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UQ19 Ada Semantic Interface Specification (ASIS) Version 0.4 – Vendor Independent ASIS (VIA)

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The Ada Semantic Interface Specification is layered vendor-independent open architecture. ASIS queries and services provide a consistent interface to information within the Ada Program Library. Clients of ASIS are shielded and free from the implementation details of each Ada vendor's proprietary library and intermediate representations.

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For The

SOFTWARE TECHNOLOGY FOR ADAPTABLE, RELIABLE SYSTEMS (STARS)

Ada Semantic Interface Specification (ASIS)
Version 0.4
Vendor Independent ASIS (VIA)

STARS-RC-251901/003/00
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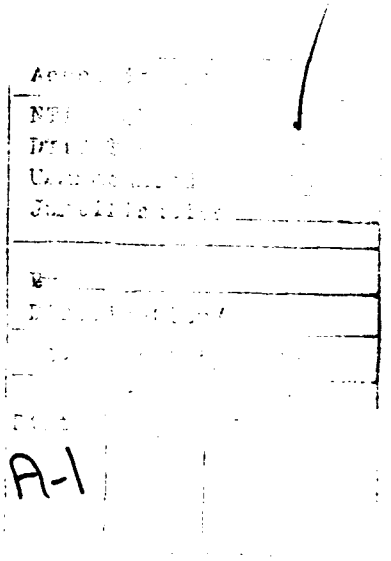

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12010 Sunrise Valley Drive
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21 October 1991

INFORMAL TECHNICAL REPORT

For The

SOFTWARE TECHNOLOGY FOR ADAPTABLE, RELIABLE SYSTEMS
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Ada Semantic Interface Specification (ASIS)
Version 0.4
Vendor Independent ASIS (VIA)

STARS-RC-251901/003/00
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TASK: UQ19
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INFORMAL TECHNICAL REPORT
Ada Semantic Interface Specification (ASIS)
Version 0.4
Vendor Independent ASIS (VIA)

Principal Author(s):

Steve Blake, TeleSoft *Date*

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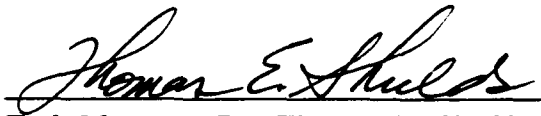

10/8/91

Task Manager *Dr. Thomas E. Shields* *Date*

(Signatures on File)

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INFORMAL TECHNICAL REPORT
Ada Semantic Interface Specification (ASIS)
Version 0.4
Vendor Independent ASIS (VIA)

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STARS-RC-251901/001/00	Original Issue	11 February 1991	*on file*

Contents

1 SPECIFICATION LISTING

```
--|
--|Item: Ada Semantic Interface Specification (ASIS)
--|$Revision:"0.4"$
--|$State: Prototype $
--|
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--|$Log:"ASIS_spec.ps,v"$"--|Revision"0.4""1991/11/08""21:24:04""cm"--|Based"on"ASIS"WG"meeting"Ju
--|Revision 0.4  1991/11/08  20:56:33  cm
--|Based on ASIS WG meeting June 6, 1991
--|
--|Revision 0.4  1991/10/21  17:01:39  cm
--|Based on ASIS WG meeting June 6, 1991.
--|
--|Revision 0.3  1991/05/30  15:16:14  guy
--|Integrates Rational's LRM interface, eliminating dependencies on the
--|Rational environment.
--|
--|Revision 0.2  1991/01/17  08:58:49  cm
--|Initial submittal.
--|



------------------ASIS-PROLOGUE--------------------------------
--
-- System       : ADA SEMANTIC INTERFACE SPECIFICATION (ASIS)
-- Version      : 0.4
--              :
-- Components   : Specifications are in the following order:
--              :
--              :
--              :   ASIS_Ada_Program
--              :   ASIS_Environment
--              :   ASIS_Libraries
--              :   ASIS_Compilation_Units
--              :   ASIS_Elements
--              :   ASIS_Declarations
--              :   ASIS_Type_Definitions
--              :   ASIS_Names_And_Expressions
--              :   ASIS_Statements
--              :   ASIS_Representation_Clauses
--              :   ASIS_Text
```

```
--              :
--              :
-- Release date : Sept 27, 1991
-- Last update  : July 10, 1991
-- Date created : June 01, 1990
-- Machine/System Compiled/Run on : Sun 4, SunOS Release 4.1.1
--
------------------------------------------------------------------
--
-- Abstract     :
--
-- The Ada Semantic Interface Specification is a layered
-- vendor-independent open architecture. ASIS queries and
-- services provide a consistent interface to information
-- within the Ada Program Library.  Clients of ASIS are shielded
-- and free from the implementation details of each Ada vendor's
-- proprietary library and intermediate representations.
--



------------------ Revision history --------------------------
--
-- DATE         VERSION AUTHOR          HISTORY
-- 12/28/90     0.1     Steve Blake     Initial Release
-- 01/11/91     0.2     Steve Blake     Unisys/STARS Phase I deliverable
-- 05/13/91     0.3     Steve Blake     Unisys/STARS Phase II deliverable
-- 07/10/91     0.4*    Steve Blake     Internal reveiw release
-- 09/27/91     0.4     Steve Blake     Unisys/STARS Phase II deliverable
--
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-- until it has been approved for wider release by the ESD STARS
-- program office.
--
-- Version 0.4 of the ASIS specification is being distributed to
-- STARS contractors with the intention that they review the
-- specification for its applicability to Ada tools, its completeness,
-- and its relevance.  The ASIS working group has been established to
-- review comments and account for them in future versions of ASIS.
```

```
-- Please forward all comments to the members of the working group at
-- the following e-mail addresses:
--
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--
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-------------------END-PROLOGUE--------------------------------




-----------------------------------------------------------------------
-- ASIS PRELIMINARY REVIEW VERSION 0.4
-- Sept 27, 1991
-----------------------------------------------------------------------


package ASIS_Ada_Program is

  ---------------------------------------------------------------------
  -- ASIS_Ada_Program encapsulates declarations that are made
  -- available to ASIS and its clients in a vendor-independent manner.


  ---------------------------------------------------------------------
  -- LIBRARY
```

```
subtype Library is implementation_defined_limited_private_type;

-- The Ada Program Library abstraction (a limited private type).
--
-- A logical library handle is associated with name and parameters values
-- which are used by the implementation to identify and connect to the
-- physical information in the "library file".
--
-- The term "library file" refers to the information on the compilation
-- units that must be maintained by the compiler or compiling environment.
-- It does not assume the method a vendor chooses to implement or maintain
-- the information.
--
-- Some environments may not need name and parameters values to identify
-- their library file.  Other environments may choose to implement the
-- library as a single external file in which case the name and parameters
-- values would supply the name and form values needed to open such a file.


-------------------------------------------------------------------------
-- COMPILATION UNITS

subtype Compilation_Unit is implementation_defined_private_type;

-- The Ada Compilation Unit abstraction (a private type).
--
-- The text of a program can be submitted to the compiler in one or
-- more compilations.  Each compilation is a succession of compilation
-- units.
--
-- Compilation units are composed of two distinct parts:
--  1) A context clause
--  2) The declaration of a library unit or a secondary unit.
--
-- The context clause contains zero or more with clauses and use clauses.
--
-- ASIS treats Pragmas that appear immediately after the context clause
-- and before the subsequent declaration part as belonging to the context
-- clause part.
--
-- The declaration associated with a compilation unit can either
-- be a package, procedure, function, generic, or subunit.
--
-- The abstract type Compilation_Unit is is a handle to compilation units
-- as a whole.  An object of the type Compilation_Unit deals with the
```

```
-- external view of compilation units such as their relationships with other
-- units or their compilation attributes.
--

Nil_Compilation_Unit: Compilation_Unit renames
   implementation_defined_constant;

-- A constant Ada Compilation Unit with a void or null value.


-------------------------------------------------------------------------
-- ELEMENTS

subtype Element is implementation_defined_private_type;

-- The Ada program element abstraction (a private type).
--
-- The type Element is a distinct abstract type representing handles to the
-- lexical elements that form the text of compilation units.  Elements deal
-- with the internal or "textual" view of compilation units.
--
-- Operations are provided to split a Compilation_Unit object into two
-- component Elements:
--  1) A context clause represented by an Element_List containing
--     with clauses, use clauses, and pragmas.
--  2) An Element associated with the declaration.
--
-- Use the context clause operations in this package to decompose
-- with clauses and use clauses.
--
-- Use the ASIS_ELEMENTS pragma operations to decompose pragmas.
--

Nil_Element: Element renames
   implementation_defined_constant;

-- A constant Ada program element with a void or null value.


-------------------------------------------------------------------------
-- ELEMENT SUBTYPES

subtype Declaration is ASIS_Ada_Program.Element;
-- Use ASIS_Declarations operations.
```

```
subtype Type_Definition is ASIS_Ada_Program.Element;
-- Use ASIS_Type_Definitions operations.

subtype Identifier_Definition is ASIS_Ada_Program.Element;

subtype Identifier_Reference is ASIS_Ada_Program.Element;

subtype Expression is ASIS_Ada_Program.Element;
-- Use ASIS_Names_And_Expression operations.

subtype Name_Expression is ASIS_Ada_Program.Element;
-- Use ASIS_Names_And_Expression operations.

subtype Statement is ASIS_Ada_Program.Element;
-- Use ASIS_Statements operations.



-------------------------------------------------------------------------
-- TIME

subtype ASIS_Time is Calendar.Time;

-- A private type from the predefined library package Calendar.
-- Operations on ASIS_Time are provided by Calendar.


Nil_Time : constant Calendar.Time :=
  Calendar.Time_Of ( Year => 1901, Month=> 1, Day  => 1, Seconds  => 0.0 );


-------------------------------------------------------------------------
-- ASIS_INTEGER

subtype ASIS_Integer is Integer range
  implementation_defined .. implementation_defined;

-- A subtype of the predefined type Integer that allows each ASIS
-- implementation to place constraints on the lower and upper bounds.

-------------------------------------------------------------------------
-- ASIS_POSITIVE

subtype ASIS_Positive is ASIS_Integer range 0 .. implementation_defined;
```

```
-- A subtype of the predefined type Integer that allows each ASIS
-- implementation to place a constraint on the upper bound.

-------------------------------------------------------------------------
-- ASIS_LIST_INDEX

subtype ASIS_List_Index is ASIS_Integer range 1 .. implementation_defined;

-- A subtype of the predefined type Integer that allows each ASIS
-- implementation to place a constraint on the upper bound on the number
-- of components allowed in lists.
--
-- Used as a subtype for the array index subtype definition of the various
-- lists in ASIS.


-------------------------------------------------------------------------
-- COMPILATION_UNIT_LIST

subtype Compilation_Unit_List is implementation_defined_array;

-- Defines a list of Ada compilation units.  For some operations that
-- return a Compilation_Unit_List value, the order of components may vary
-- across implementations of ASIS.  Variances are noted in the commentary
-- of individual operations.
--
-- Implemented as an unconstrained array:
-- array ( ASIS_List_Index range <> ) of Compilation_Unit;


Nil_Compilation_Unit_List : Compilation_Unit_List  renames
   implementation_defined_constant;

-- A constant Ada Compilation Unit List with a void or null value.


package Compilation_Unit_List_Operations is

  function "&" (Left  : in Compilation_Unit_List;
                Right : in Compilation_Unit_List)
    return Compilation_Unit_List renames implementation_defined;

  function "&" (Left  : in Compilation_Unit_List;
                Right : in Compilation_Unit)
    return Compilation_Unit_List renames implementation_defined;
```

```
  function "&" (Left  : in Compilation_Unit;
                Right : in Compilation_Unit_List)
    return Compilation_Unit_List renames implementation_defined;

  function "&" (Left  : in Compilation_Unit;
                Right : in Compilation_Unit)
    return Compilation_Unit_List renames implementation_defined;

end Compilation_Unit_List_Operations;


------------------------------------------------------------------------
-- ELEMENT_LIST

subtype Element_List is implementation_defined_array;

-- Defines a list of Ada program elements.  For some operations that
-- return Element_List values, the order of components may vary
-- across implementations of ASIS.  Variances are noted in the commentary
-- of individual operations.
--
-- Implemented as an unconstrained array:
-- array ( ASIS_List_Index range <> ) of Element;


Nil_Element_List : Element_List  renames
   implementation_defined_constant;

-- A constant Element List with a void or null value.


package Element_List_Operations is

  function "&" (Left  : in Element_List;
                Right : in Element_List)
    return Element_List renames implementation_defined;

  function "&" (Left  : in Element_List;
                Right : in Element)
    return Element_List renames implementation_defined;

  function "&" (Left  : in Element;
                Right : in Element_List)
    return Element_List renames implementation_defined;
```

```
  function "&" (Left  : in Element;
                Right : in Element)
    return Element_List renames implementation_defined;

end Element_List_Operations;


-----------------------------------------------------------------------
-- ASIS_CHARACTER


subtype ASIS_Character is implementation_defined_enumeration_type;

-- An enumeration type.

package ASIS_Character_Operations is

  function "="  (Left, Right : in ASIS_Character) return Boolean
    renames implementation_defined;

  function "<"  (Left, Right : in ASIS_Character) return Boolean
    renames implementation_defined;

  function "<=" (Left, Right : in ASIS_Character) return Boolean
    renames implementation_defined;

  function ">"  (Left, Right : in ASIS_Character) return Boolean
    renames implementation_defined;

  function ">=" (Left, Right : in ASIS_Character) return Boolean
    renames implementation_defined;

  function To_ASIS_Character (Value : in Standard.Character)
    return ASIS_Character renames implementation_defined;

  function To_Standard_Character (Value : in ASIS_Character)
    return Standard.Character renames implementation_defined;

end ASIS_Character_Operations;


-----------------------------------------------------------------------
-- ASIS_STRING
```

```
subtype ASIS_String is implementation_defined_array;

-- packed array ( Positive range <> ) of ASIS_Character;

Nil_String : constant ASIS_String (1..0) := "";

package ASIS_String_Operations is

  function "="  (Left, Right : in ASIS_String) return Boolean
  renames implementation_defined;

  function "<"  (Left, Right : in ASIS_String) return Boolean
    renames implementation_defined;

  function "<=" (Left, Right : in ASIS_String) return Boolean
    renames implementation_defined;

  function ">"  (Left, Right : in ASIS_String) return Boolean
    renames implementation_defined;

  function ">=" (Left, Right : in ASIS_String) return Boolean
    renames implementation_defined;

  function "&" (Left : in ASIS_String; Right : in ASIS_String)
    return ASIS_String renames implementation_defined;

  function "&" (Left : in ASIS_String; Right : in ASIS_Character)
    return ASIS_String renames implementation_defined;

  function "&" (Left : in ASIS_Character; Right : in ASIS_String)
    return ASIS_String renames implementation_defined;

  function "&" (Left : in ASIS_Character; Right : in ASIS_Character)
    return ASIS_String renames implementation_defined;

  function To_ASIS_String (Value : in Standard.String)
    return ASIS_String renames implementation_defined;

  function To_Standard_String (Value : in ASIS_String)
    return Standard.String renames implementation_defined;

end ASIS_String_Operations;
```

```
-------------------------------------------------------------------------
-- ASIS_TEXT


Maximum_Line_Length : ASIS_Integer renames implementation_defined_constant;
-- The maximum allowed length of a line of text in an Ada program.


Maximum_Line_Number : ASIS_Integer renames implementation_defined_constant;
-- The maximum allowed number of lines of text in an Ada program.


subtype Line_Number is ASIS_Integer range 0..Maximum_line_Number;
-- The range of line numbers within the text of programs.
-- The value 0 is used to indicate an invalid line number.


subtype Line is implementation_defined_private_type;

 -- An Ada text line abstraction (a private type).


-------------------------------------------------------------------------
-- ASIS_TEXT LINE_LIST


subtype Line_List is implementation_defined_array;

-- List of Lines
-- Implemented as an unconstrained array:
-- array ( Line_Number range <> ) of Line;


Nil_Line_List : Line_List  renames
   implementation_defined_constant;

-- A constant Line List with a void or null value.


package Line_List_Operations is

  function "&" (Left  : in Line_List;
                Right : in Line_List)
    return Line_List renames implementation_defined;
```

```
   function "&" (Left  : in Line_List;
                 Right : in Line)
     return Line_List renames implementation_defined;

   function "&" (Left  : in Line;
                 Right : in Line_List)
     return Line_List renames implementation_defined;

   function "&" (Left  : in Line;
                 Right : in Line)
     return Line_List renames implementation_defined;

end Line_List_Operations;


------------------------------------------------------------------------
-- EXCEPTIONS


Inappropriate_Library : exception;

-- Raised when an operation is given a Library value that is
-- not appropriate for the operation.


Inappropriate_Compilation_Unit : exception;

-- Raised when an operation is given a Compilation_Unit value that is
-- not appropriate.


Inappropriate_Program_Element : exception;

-- Raised when an operation is given an Element value that is
-- not appropriate.


Failed : exception;

-- All operations may raise Failed whenever they cannot normally complete
-- their operation.
-- This is a catch-all exception that may be raised for different reasons
-- in different ASIS implementations.
--
-- The Diagnosis and Status functions are provided in ASIS_Libraries,
```

```
   -- ASIS_Compilation_Units, and ASIS_Elements packages so more information
   -- about the failure can be retrieved.


end ASIS_Ada_Program;
```

```
-------------------------------------------------------------------------
-- ASIS PRELIMINARY REVIEW VERSION 0.4
-- Sept 27, 1991
-------------------------------------------------------------------------


with ASIS_Ada_Program;
package ASIS_Environment is

   ----------------------------------------------------------------------
   -- This package provides operations to initialize and finalize the
   -- ASIS environment.

   ----------------------------------------------------------------------

   subtype ASIS_String is ASIS_Ada_Program.ASIS_String;


   Nil_String : ASIS_String renames ASIS_Ada_Program.Nil_String;


   ----------------------------------------------------------------------
   -- EXCEPTIONS

   Failed : exception renames ASIS_Ada_Program.Failed;

   -- Raised when the environment failed to initialize or finalize.
   -- Raised when invalid parameters are given to initialize or finalize.


   ----------------------------------------------------------------------
   -- ENVIRONMENT VERSION
```

```
function Version return ASIS_String;

-- Returns a ASIS_String that identifies the current ASIS version.


-------------------------------------------------------------------
-- ENVIRONMENT INITIALIZATION


function Is_Initialized return Boolean;

-- Returns True if the the environment is initialized.


procedure Initialize(Parameters: in ASIS_String := Nil_String);

-- Performs any necessary initialization activities.
-- This must be invoked once before any other ASIS
-- Services.  Parameter values are vendor dependent.
--
-- Preconditions:
--     The environment is not already initialized,
--     otherwise the call is ignored.
--
-- Raises:
--     Failed if the environment failed to initialize.
--
-- Postconditions:  (if no exception is raised)
--     ASIS services are ready for use.


-------------------------------------------------------------------
-- ENVIRONMENT FINALIZATION


function Is_Finalized return Boolean;

-- Returns True if the environment is finalized.


procedure Finalize(Parameters: in ASIS_String := Nil_String);

-- Performs any necessary termination activities.
-- This must be invoked once following all other ASIS
```

```
   -- Services.  Parameter values are vendor dependent.
   --
   -- Preconditions:
   --     The environment must be initialized, otherwise the
   --     call is ignored.
   --
   -- Raises:
   --     Failed if the environment failed to finalize.
   --
   -- Postconditions:  (if no exception is raised)
   --     Subsequent calls to ASIS services are erroneous.


   ------------------------------------------------------------------------
   -- ERROR INFORMATION

   type ASIS_Environment_Error_Kinds is

          (Not_An_Error,

           Environment_Error,      -- The environment failed to
   -- initialize or finalize.

           Parameter_Error,        -- Invalid parameters were given
   -- to initialize or finalize.

           TBD);


   -- Whenever an error condition is detected and the exception Failed
   -- is raised, an ASIS_Environment_Error_Kinds value is stored.  That value
   -- can be retrieved using the Status function.  The Diagnosis function will
   -- retrieve the ASIS_String diagnostic message describing the failure.
   --
   -- Error information is only kept when the catch-all exception Failed
   -- is raised, and refers to the most recent failure.
   --
   -- Note that Status and Diagnosis values are vendor dependent and will
   -- vary among ASIS implementations.


   function Status return ASIS_Environment_Error_Kinds;

   -- Returns the ASIS_Environment_Error_Kinds value for the the most recent
   -- failure.
```

```
  -- Returns Not_An_Error if the most recent initialize or finalize
  -- operations were successful.


  function Diagnosis return ASIS_Ada_Program.ASIS_String;

  -- Returns an ASIS_String value describing the most recent failure.

  -- Returns a Nil_String if the most recent initialize or finalize
  -- operations were successful.



end ASIS_Environment;
```

```
-------------------------------------------------------------------------
-- ASIS PRELIMINARY REVIEW VERSION 0.4
-- Sept 27, 1991
-------------------------------------------------------------------------


with ASIS_Ada_Program;
package ASIS_Libraries is

  -- LRM Section 10.4

  -- ASIS_Libraries encapsulates a set of operations that implement
  -- the ASIS Ada Program Library abstraction.
  -- It assumes only knowledge of the program library that is
  -- specified in section 10.4 of the Ada LRM.

  subtype Library is ASIS_Ada_Program.Library;

  subtype ASIS_String is ASIS_Ada_Program.ASIS_String;

  Nil_String : ASIS_String renames ASIS_Ada_Program.Nil_String;
```

```
-------------------------------------------------------------------------
-- EXCEPTIONS


Failed : exception renames ASIS_Ada_Program.Failed;

-- All operations may raise Failed whenever they cannot normally complete
-- their operation.
-- This is a catch-all exception that may be raised for different reasons
-- in different ASIS implementations.
--
-- The Diagnostic and Status functions are provided so more information
-- about the failure can be retrieved.


-------------------------------------------------------------------------
-- LIBRARY CONSTRUCTORS


function Default_Name return ASIS_String;

-- Returns the default library name.
-- If there is no default library, a Nil_String is returned.


function Default_Parameters return ASIS_String;

-- Returns the default library parameters.
-- If there are no default parameters, a Nil_String is returned.


procedure Associate
   (Program_Library : in out Library;
    Name            : in     ASIS_String;
    Parameters      : in     ASIS_String := Default_Parameters);

-- Associates Library with the given Name and Parameters values.
-- A library can have at most one set of values associated with
-- it at any time.  Name and Parameters values previously
-- associated are replaced.
--
-- Preconditions:
-- Is_Open( Program_Library ) = False
--
-- Postconditions:
```

```
-- Name( Program_Library ) = Name
-- Parameters( Program_Library ) = Parameters
-- Has_Associations( Program_Library ) = True
-- Is_Open( Program_Library ) = False


procedure Open (Program_Library : in out Library);

-- Opens the Ada Library using the associated Name and
-- Parameters values.
--
-- Preconditions:
-- Has_Associations( Program_Library ) = True
-- Is_Open( Program_Library ) = False
--
-- Postconditions:
-- Is_Open( Program_Library ) = True


procedure Close (Program_Library : in out Library);

-- Closes the Ada Library.
-- Any previous associations to Library are retained, therefore
-- allowing Library to be re-opened.
--
-- Preconditions:
--     Is_Open( Program_Library ) = True
--
-- Postconditions:
-- Is_Open( Program_Library ) = False
-- Has_Associations( Program_Library ) = True
--
--    Any value obtained from a library becomes invalid when that
--    library is closed.
-- Subsequent calls to ASIS services using Compilation_Unit
--    and Element handles obtained from the library are erroneous.

-------------------------------------------------------------------------
-- LIBRARY HANDLE DESTRUCTOR


procedure Dissociate (Program_Library : in out Library);

-- Severs all previous associations to Program_Library.
-- A given library with no associations is returned unchanged.
```

```
--
-- Note that this operation has no affect on the physical Ada Library.
--
-- Preconditions:
-- Is_Open( Program_Library ) = False
--
-- Postconditions:
-- Any storage for Library is deallocated.
-- Has_Associations( Program_Library ) = False


-------------------------------------------------------------------
-- LIBRARY ATTRIBUTES

function Is_Equal (Left, Right : in Library) return Boolean;

-- Returns True if Left and Right designate the same library file.


function Exists (Program_Library : in Library) return Boolean;

-- Returns True if Program_Library designates a library file that exists.


function Is_Open (Program_Library : in Library) return Boolean;

-- Returns True if Program_Library is open.


function Has_Associations ( Program_Library : in Library)
  return Boolean;

-- Returns True if name and parameters values have been
-- associated to Program_Library.


function Name (Program_Library : in Library) return ASIS_String;

-- Returns the name associated with Program_Library.
-- if not Has_Associations( Program_Library ), a Nil_String is returned.


function Parameters (Program_Library : in Library) return ASIS_String;

-- Returns the parameters associated with Program_Library.
```

```
-- if not Has_Associations( Program_Library ), a Nil_String is returned.


-------------------------------------------------------------------------
-- ERROR INFORMATION

type ASIS_Library_Error_Kinds is

  (Not_An_Error,              -- The library has no error condition.

   Capacity_Error,            -- The implementation cannot support a
     -- request to open an additional library.

   Data_Error,                -- The library file specified by Name(Library)
     -- does not contain a valid Ada library.
     -- ie. The contents of the library are the
     -- wrong version or format.

   Initialization_Error,      -- The underlying components have not been
     -- initialized by calling
     -- ASIS_System_Services.Initialize.

   Name_Error,                -- The Name(Library) does not specify a
     -- library file.
     -- ie. The named library does not exist.

   Status_Error,              -- The Library is not in valid state (either
     -- open or closed) to perform a given operation.

   Storage_Error,             -- The system can not perform new allocations.

   Use_Error,                 -- Characteristics of the library file specified
     -- by Name(Library) or Parameters(Library) do
     -- not permit performance of a given operation.

   TBD);


-- Whenever an error condition is detected and the exception Failed
-- is raised, an ASIS_Library_Error_Kinds value is stored for the Library
-- involved in the failure.   That value can be retrieved using the Status
-- function.  The Diagnosis function will retrieve the ASIS_String
-- diagnostic message for the Library_Error_Kinds value.
--
-- Status information is only kept when the catch-all exception Failed
```

```
   -- is raised.
   --
   -- Note that Status and Diagnosis values are vendor dependent and will
   -- vary among ASIS implementations.


   function Status (Program_Library : in Library)
     return ASIS_Library_Error_Kinds;

   -- Returns the ASIS_Library_Error_Kinds value associated with
   -- Program_Library.

   -- Returns Not_An_Error if Program_Library has no error kind associated
   -- with it, or if not Has_Associations(Program_Library).
   -- EG. It has not been involved in a failed operation.


   function Diagnosis (Program_Library : in Library) return ASIS_String;

   -- Returns an ASIS_String value associated with Program_Library.


   procedure Dissociate_Library_Error_Information;

   -- Removes the association of status and diagnosis error information with
   -- all Library handles that have been involved in a failed operation.
   --
   -- This operation does not affect Library handles in any other way.


   ------------------------------------------------------------------------
   -- DEBUGGING

   function Debug_Image (Program_Library : in Library) return ASIS_String;

   -- Returns an ASIS_String value containing implementation defined debug
   -- information associated with Program_Library.


private


end ASIS_Libraries;
```

```
-------------------------------------------------------------------------
-- ASIS PRELIMINARY REVIEW VERSION 0.4
-- Sept 27, 1991
-------------------------------------------------------------------------


with ASIS_Ada_Program;
package ASIS_Compilation_Units is

  -- LRM Chapter 10

  subtype Library is ASIS_Ada_Program.Library;


  subtype Compilation_Unit is ASIS_Ada_Program.Compilation_Unit;

  Nil_Compilation_Unit : Compilation_Unit renames
                           ASIS_Ada_Program.Nil_Compilation_Unit;

  -- A constant Ada Compilation Unit with a void or null value.


  subtype Element is ASIS_Ada_Program.Element;

  subtype Compilation_Unit_List is ASIS_Ada_Program.Compilation_Unit_List;

  Nil_Compilation_Unit_List : Compilation_Unit_List  renames
                                ASIS_Ada_Program.Nil_Compilation_Unit_List;

  -- A constant Ada Compilation Unit List with a void or null value.


  subtype ASIS_String is ASIS_Ada_Program.ASIS_String;

  Nil_String : ASIS_String renames ASIS_Ada_Program.Nil_String;

  subtype ASIS_Time is ASIS_Ada_Program.ASIS_Time;
```

```
-----------------------------------------------------------------------
-- EXCEPTIONS


Inappropriate_Library : exception renames
                        ASIS_Ada_Program.Inappropriate_Library;

-- Raised when an operation is given a Library value that is
-- not appropriate for the operation.
--
-- All ASIS_Compilation_Units operations that take a library parameter
-- will raise this exception when given a library that is not open.


Inappropriate_Compilation_Unit : exception renames
                        ASIS_Ada_Program.Inappropriate_Compilation_Unit;

-- Raised when an operation is given a Compilation_Unit value that is
-- not appropriate.


Failed : exception renames ASIS_Ada_Program.Failed;

-- All operations may raise Failed whenever they are given appropriate
-- input but cannot normally complete their operation.
-- This is a catch-all exception that may be raised for different reasons
-- in different ASIS implementations.
--
-- The Diagnosis and Status functions are provided so more information
-- about the failure can be retrieved.


-----------------------------------------------------------------------
-- 10.1 COMPILATION UNITS - KINDS


type Compilation_Unit_Kinds is

-- The kinds of Ada Program Library compilation units.

   (A_Subprogram_Declaration,
    A_Package_Declaration,
    A_Generic_Declaration,
    A_Generic_Instantiation,
    A_Subprogram_Body,
```

```
    A_Package_Body,
    A_Subunit,

    A_Nonexistent_Library_Unit,   -- A unit that no longer exists but is
  -- mentioned in a with clause of another
  -- unit or is the specification of a
  -- library unit body.

    A_Nonexistent_Secondary_Unit, -- A unit that does not exist but is
  -- mentioned in a body stub of another
  -- unit or is the proper body of a
  -- library unit.

    Unknown,      -- The unit kind is not known.

    Not_A_Compilation_Unit        -- A void compilation unit kind value.
    );


function Kind (A_Compilation_Unit : in Compilation_Unit)
  return Compilation_Unit_Kinds;

-- Returns the kind of the compilation unit.
--
-- Returns Not_A_Compilation_Unit for any inappropriate compilation unit
-- such as a Nil_Compilation_Unit.


------------------------------------------------------------------------
-- COMPILATION_UNIT ASSIGNMENT


procedure Assign (Target : in out Compilation_Unit;
                  Source : in     Compilation_Unit);

-- Assigns the source compilation unit to the target compilation unit.
--
-- Postconditions:  (if no exception is raised)
--   Depending on the ASIS implementation, the target compilation unit
--    may be dissociated before performing the assignment.
--   Is_Equal(Target, Source)


------------------------------------------------------------------------
-- 10.1 COMPILATION UNITS - BELONGING TO A LIBRARY
```

```
-- Compilation units are said to belong to a program library.
-- These queries search a given library for compilation units.
-- Successful searches have the affect of associating the logical
-- compilation unit handles with the corresponding physical compilation
-- unit values within the library.
--
-- Exists(A_Compilation_Unit) = True when a Compilation_Unit is successfully
-- obtained from these queries.
--
--
-- Eligible Compilation Units
--
-- Some ASIS implementation may allow more than one version of a library
-- unit to exist within a library.  If so, then only one of those library
-- units is "eligible" to be used in an executable program.  Other versions
-- of the library unit are "ineligible".  The search rules used to determine
-- library unit eligibility are defined by each ASIS implementation.


function Library_Unit (Name : in String; Program_Library : in Library)
  return Compilation_Unit;

-- Returns an eligible library unit with the distinct name belonging
-- to the library.  See LRM 10.1(3).
--
-- If no such library unit exists, a Nil_Compilation_Unit is returned.
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


function Secondary_Unit (Name : in String; Program_Library : in Library)
  return Compilation_Unit;

-- Returns an eligible secondary unit with the distinct name belonging
-- to the library.  See LRM 10.1(3).
--
-- If no such secondary unit exists, a Nil_Compilation_Unit is returned.
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).
```

```
subtype Library_Unit_List is Compilation_Unit_List;

function All_Library_Units (Program_Library : in Library)
  return Library_Unit_List;

-- Returns the complete list of all versions of library units in the
-- library.
--
-- The occurrence and order of units in the list is implementation defined.
--
-- If no library units exist within the library,
-- a Nil_Compilation_Unit_List is returned.
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


function Library_Units (Program_Library : in Library)
  return Library_Unit_List;

-- Returns a list of eligible and distinctly named library units
-- belonging to the library.  See LRM 10.1(3).
--
-- The order of units in the list is implementation defined.
--
-- If no library units exist within the library,
-- a Nil_Compilation_Unit_List is returned.
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


subtype Secondary_Unit_List is Compilation_Unit_List;


function All_Secondary_Units (Program_Library : in Library)
  return Secondary_Unit_List;

-- Returns the complete list of all versions of secondary units in the
-- library.
--
-- The occurrence and order of units in the list is implementation defined.
--
-- If no secondary units exist within the library,
-- a Nil_Compilation_Unit_List is returned.
```

```
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


function Secondary_Units (Program_Library : in Library)
  return Secondary_Unit_List;

-- Returns a list of eligible and distinctly named secondary units
-- belonging to the library.  See LRM 10.1(3).
--
-- The order of units in the list is implementation defined.
--
-- If no secondary units exist within the library,
-- a Nil_Compilation_Unit_List is returned.
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).



function All_Compilation_Units (Program_Library : in Library)
  return Compilation_Unit_List;

-- Returns the complete list of all versions of compilation units in the
-- Library.
--
-- If no compilation units exist within the Library, an empty list is
-- returned.
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


function Compilation_Units (Program_Library : in Library)
  return Compilation_Unit_List;

-- Returns a list of eligible and distinct compilation units belonging to
-- the given Library.  See LRM 10.1(3).
--
-- The order of units in the list is implementation defined.
--
-- If no compilation units exist within the Library, an empty list is
-- returned.
--
```

```
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


-------------------------------------------------------------------------
-- 10.1 ENCLOSING LIBRARY


function Enclosing_Library (A_Compilation_Unit : in Compilation_Unit)
  return Library;

-- Returns the library to which the compilation unit belongs.
-- Compilation units retrieved through any of the search operations
-- keep track of the library in which they were found.
--
-- Since the type Library is a limited private, this function is only
-- intended to be used to supply the library parameter to other operations.
-- This conveniently eliminates the need to make the original library
-- visible at the place of each call where a library parameter is required.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(A_Compilation_Unit)


-------------------------------------------------------------------------
-- 10.1 CORRESPONDING COMPILATION UNITS


function Corresponding_Library_Unit
   (Secondary_Unit  : in Compilation_Unit)
  return Compilation_Unit;

function Corresponding_Library_Unit
   (Secondary_Unit  : in Compilation_Unit;
    Program_Library : in Library)
  return Compilation_Unit;

-- Returns the compilation unit that is the semantically correct
-- corresponding library unit of the given Secondary_Unit.  The library
-- unit returned is the library unit for which the secondary unit is
-- the proper body.
--
-- Returns a Nil_Compilation_Unit for all given Secondary_Unit
-- values that do not have an existing corresponding library unit.
-- The corresponding library unit would have to have existed when the
```

```
-- secondary unit was compiled, however, some ASIS implementations allow
-- compilation units to be removed without affecting other dependent
-- compilation units.
--
-- If a Program_Library is given, that library is used to search for the
-- corresponding compilation unit.
--
-- If a library unit is given, the same compilation unit is returned.
-- If no corresponding library unit exists, a Nil_Compilation_Unit is
-- returned.
--
-- LRM 10.1(6).  A subprogram body given in a compilation unit is
-- interpreted as a secondary unit if the program library already
-- contains a library unit that is a subprogram with the same name;
-- it is otherwise interpreted both as a library unit and as the
-- corresponding library unit body (that is, as a secondary unit).
-- In this case, given a secondary unit handle whose Kind is
-- A_Subprogram_Body, this operation returns the library unit handle
-- whose Kind is A_Subprogram_Declaration.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(Secondary_Unit) or Is_Subunit(Secondary_Unit)
--   or Kind(Secondary_Unit) = Unknown
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


function Corresponding_Secondary_Unit
   (Library_Unit    : in Compilation_Unit)
  return Compilation_Unit;

function Corresponding_Secondary_Unit
   (Library_Unit    : in Compilation_Unit;
    Program_Library : in Library)
  return Compilation_Unit;

-- Returns the compilation unit that is the semantically correct
-- corresponding library unit body (the secondary unit) of the given
-- Library_Unit.
--
-- Returns a Nil_Compilation_Unit for all given Library_Unit
-- values that do not have an existing corresponding secondary unit,
-- for example, the library unit is a package declaration whose body is
-- not required or has not yet been compiled.
```

```
--
-- If a secondary unit is given, the same compilation unit is returned.
-- If no corresponding secondary unit exists, a Nil_Compilation_Unit is
-- returned.
--
-- If a Program_Library is given, that library is used to search for the
-- corresponding compilation unit.
--
-- LRM 10.1(6).  A subprogram body given in a compilation unit is
-- interpreted as a secondary unit if the program library already
-- contains a library unit that is a subprogram with the same name;
-- it is otherwise interpreted both as a library unit and as the
-- corresponding library unit body (that is, as a secondary unit).
-- In this case, given a library unit handle whose Kind is
-- A_Subprogram_Declaration, this operation returns the secondary
-- unit handle whose Kind is A_Subprogram_Body.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(Library_Unit) or Is_Subunit(Library_Unit)
--   or Kind(Library_Unit) = Unknown
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


-------------------------------------------------------------------------
-- 10.1(7) COMPILATION PRAGMAS


subtype Pragma_List is ASIS_Ada_Program.Element_List;

function Compilation_Pragmas
   (A_Compilation_Unit : in Compilation_Unit)
  return Pragma_List;

-- Returns a list of pragmas that apply to the whole of the compilation
-- of the compilation unit.
--
-- Pragmas returned in this list must appear before the first compilation
-- unit of the compilation that contained the given compilation unit.
--
-- Use the Pragmas operation in ASIS_Elements to obtain a list of
-- pragmas in a given context within a compilation unit.
--
-- A Nil_Element_List is returned if the compilation unit has no such
```

```
-- applicable pragmas or if the Kind(A_Compilation_Unit) = Unknown.
--
-- Further analysis:
--   Use ASIS_Elements pragma operations to decompose pragmas.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(A_Compilation_Unit)


-------------------------------------------------------------------------
-- 10.1 COMPILATION UNIT ATTRIBUTES


function Is_Nil (A_Compilation_Unit : in Compilation_Unit) return Boolean;

-- Returns True if the compilation unit has a void or null value.
--
-- All Compilation_Unit kinds are appropriate.


function Is_Equal (Left, Right : in Compilation_Unit) return Boolean;

-- Returns True if Left and Right represent the same compilation unit.
--
-- All Compilation_Unit kinds are appropriate.


function Name (A_Compilation_Unit : in Compilation_Unit) return String;

-- Returns the Name associated with the given compilation unit.
-- Then name is the Ada identifier that names the compilation unit.
--
-- If a Nil_Compilation_Unit is given then a null string is returned.
--
-- All Compilation_Unit kinds are appropriate.


function Unique_Name (A_Compilation_Unit : in Compilation_Unit)
  return ASIS_String;

-- Returns an ASIS_String that uniquely identifies the given compilation unit.
-- The result may vary depending on the ASIS implementation.  The unique
-- name may include the name of the library, file system paths, sublibrary
-- files, version numbers, kind, or any other information that a vendor
-- may use to uniquely identify the compilation unit.
```

```
--
-- If a Nil_Compilation_Unit is given then a Nil_String is returned.
--
-- All Compilation_Unit kinds are appropriate.


function Exists (A_Compilation_Unit : in Compilation_Unit) return Boolean;

-- Returns True if Compilation_Unit has been successfully compiled into
-- a program library.
--
-- Returns False when given a Nil_Compilation_Unit.
--
-- All Compilation_Unit kinds are appropriate.


function Can_Be_Main_Program (A_Compilation_Unit : in Compilation_Unit)
  return Boolean;

-- Returns True if Compilation_Unit exists and is a subprogram
-- that is a library unit that can be used as a main program.
-- See LRM 10.1(8)
--
-- Results of this function may vary according to the requirements
-- an Ada implementation may impose on a main program.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(A_Compilation_Unit) or Kind(A_Compilation_Unit) = Unknown


function Body_Is_Optional (A_Compilation_Unit : in Compilation_Unit)
  return Boolean;

-- Returns True if Compilation_Unit's body is not required.
-- See LRM 7.1(5)
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(A_Compilation_Unit) or Kind(A_Compilation_Unit) = Unknown


function Text_File_Name (A_Compilation_Unit : in Compilation_Unit)
  return ASIS_String;

-- Returns the text file name for Compilation_Unit.
-- The text file name identifies the file or other structure that
```

```
-- contained the text for the given compilation unit when it was
-- submitted to the compiler.
--
-- If not Exists(A_Compilation_Unit) or Kind(A_Compilation_Unit) = Unknown
-- or if the text file name is not available, a Nil_String is returned.


function Text_File_Form (A_Compilation_Unit : in Compilation_Unit)
  return ASIS_String;

-- Returns the text file form for Compilation_Unit.
--
-- If not Exists(A_Compilation_Unit) or Kind(A_Compilation_Unit) = Unknown
-- or if the text file form is not available, a Nil_String is returned.


function Object_File_Name (A_Compilation_Unit : in Compilation_Unit)
  return ASIS_String;

-- Returns the object file name created for Compilation_Unit.
--
-- If not Exists(A_Compilation_Unit) or Kind(A_Compilation_Unit) = Unknown
-- or if the object file name is not available, a Nil_String is returned.


function Object_File_Form (A_Compilation_Unit : in Compilation_Unit)
  return ASIS_String;

-- Returns the object file Form created for Compilation_Unit.
--
-- If not Exists(A_Compilation_Unit) or Kind(A_Compilation_Unit) = Unknown
-- or if the object file form is not available, a Nil_String is returned.


function Compilation_Command_Line_Options
   (A_Compilation_Unit : in Compilation_Unit)
  return ASIS_String;

-- Returns the command line options used to compile Compilation_Unit.
--
-- If not Exists(A_Compilation_Unit) or Kind(A_Compilation_Unit) = Unknown
-- or if compilation command line options are not available,
-- a Nil_String is returned.
```

```
function Time_Of_Last_Update (A_Compilation_Unit : in Compilation_Unit)
  return ASIS_Time;

-- Returns the time that Compilation_Unit was most recently
-- updated in its library.
--
-- If not Exists(A_Compilation_Unit) or Kind(A_Compilation_Unit) = Unknown
-- or if the time is not available, a Nil_time value is returned.


function Compilation_Cpu_Time (A_Compilation_Unit : in Compilation_Unit)
  return ASIS_Time;

-- Returns the CPU time used to compile Compilation_Unit.
--
-- The value is relative to Nil_time as defined below.
--
-- For example:
--
--   A value where Year = 1901, Month = 1, Day = 1, and Seconds = 10.0
--   means the compilation took 10.0 seconds.
--   A value where Year = 1902, Month = 4, Day = 6, and Seconds = 23.0
--   means the compilation took 1 year, 3 months, 5 days, 23.0 seconds.
--
-- If not Exists(A_Compilation_Unit) or Kind(A_Compilation_Unit) = Unknown
-- or if compilation CPU time is not available, a Nil_time value is returned.


------------------------------------------------------------------------
-- 10.1 COMPILATION UNIT ATTRIBUTES - GENERAL OR IMPLEMENTATION DEFINED


function Has_Attribute
   (A_Compilation_Unit : in Compilation_Unit;
    Attribute          : in ASIS_String)
  return Boolean;

-- Returns True if the compilation unit has the given attribute.
--
-- Results of this operation may vary across ASIS implementations.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(A_Compilation_Unit) or Kind(A_Compilation_Unit) = Unknown
```

```
function Attribute_Value_Delimiter return ASIS_String;

-- Returns the ASIS_String used as a delimiter separating
-- individual values within the ASIS_String Attribute_Values of
-- a compilation unit.
--
-- Results of this operation may vary across ASIS implementations.


function Attribute_Values
   (A_Compilation_Unit : in Compilation_Unit;
    Attribute          : in ASIS_String)
  return ASIS_String;

-- Returns the ASIS_String containing zero or more images of values that
-- may be associated with the given attribute.  The Attribute_Value_Delimiter
-- separates individual values in the ASIS_String when more than one value
-- is returned.
--
-- Results of this operation may vary across ASIS implementations.
--
-- If not Exists(A_Compilation_Unit) or Kind(A_Compilation_Unit) = Unknown
-- or the compilation unit does not have the attribute or associated values,
-- a Nil_String is returned.



function Attribute_Time
     (A_Compilation_Unit : in Compilation_Unit;
      Attribute          : in ASIS_String)
  return ASIS_Time;

-- Returns the ASIS_Time value associated with the given attribute.
--
-- Results of this operation may vary across ASIS implementations.
--
-- If not Exists(A_Compilation_Unit) or Kind(A_Compilation_Unit) = Unknown
-- or the compilation unit does not have the attribute or associated value,
-- Nil_Time is returned.



------------------------------------------------------------------------
-- 10.1 COMPILATION UNITS - ELEMENT GATEWAY
```

```
function Enclosing_Compilation_Unit (Program_Element : in Element)
  return Compilation_Unit;


-- Returns the Compilation_Unit that contains the given Element.
--
-- This is a gateway from Element handles to Compilation_Unit handles.
--
-- Raises Inappropriate_Program_Element
-- if ASIS_Elements.Is_Nil(Program_Element).


subtype Declaration is ASIS_Ada_Program.Element;

function Unit_Declaration (A_Compilation_Unit : in Compilation_Unit)
  return Declaration;

-- Returns the declaration of the library unit or secondary unit.
--
-- This is a gateway from Compilation_Unit handles to Element handles.
--
-- If Kind(A_Compilation_Unit) = Unknown an ASIS_Ada_Program.Nil_Element
-- is returned.
--
-- Use ASIS_Declarations operations to further decompose these elements.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(A_Compilation_Unit)


-------------------------------------------------------------------------
-- 10.1.1 CONTEXT CLAUSES - ELEMENT GATEWAY

subtype Context_Clause_Element is ASIS_Ada_Program.Element;

subtype Context_Clause_Element_List is ASIS_Ada_Program.Element_List;

function Context_Clause_Elements
   (A_Compilation_Unit : in Compilation_Unit)
  return Context_Clause_Element_List;

-- Returns a list of with clauses, use clauses, and pragmas that
-- explicitly reside in the context clause of the compilation unit.
--
```

```
-- With clause and use clauses that implicitly apply to a given secondary
-- unit are not returned in this list.  See LRM 10.1.1(4).  Use the
-- compilation unit relationship operations and Relation_Kinds Supporters
-- and Direct_Supporters to find all the supporting library units.
--
-- Pragmas returned in this list must occur immediately after the context
-- clause of a compilation unit before the subsequent library unit or
-- secondary unit.  See LRM Appendix B. Pragma ELABORATE.
--
-- Results of this operation may vary across ASIS implementations.
-- Some implementations normalize all with clauses and use clauses
-- containing multiple names of library units into an equivalent sequence
-- of corresponding single with or use clauses.  Similarly, an
-- implementation may keep a name only once even though that name may appear
-- more than once in the with clauses or use clauses of a compilation unit.
-- See LRM 8.4(9) and LRM 10.1.1(8).
--
-- If not Exists(A_Compilation_Unit) or Kind(A_Compilation_Unit) = Unknown
-- or if the compilation unit has no context clause, a Nil_Element_List is
-- returned
--
-- Further analysis:
--   Use ASIS_Elements.Major_Element_Kind to analyze the kind of elements
--   in a context clause.
--   Use ASIS_Elements pragma operations to decompose pragmas.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(A_Compilation_Unit)


subtype Identifier_Reference_List is ASIS_Ada_Program.Element_List;

function Referenced_Units
   (With_Clause_Or_Use_Clause : in Context_Clause_Element)
  return Identifier_Reference_List;

-- Returns a list of elements of the subtype Identifier_Reference that are
-- mentioned in the with clause or the use clause.
--
-- Results of this operation may vary across ASIS implementations.
-- Depending on the behavior of the function Context_Clause_Elements,
-- this operation will either return a list containing one or more
-- identifiers or will always return a list containing a single identifier.
--
-- Appropriate ASIS_Elements.Major_Element_Kinds:
```

```
--   A_With_Clause
--   A_Use_Clause occurring within a context clause of a compilation unit
--
-- A_Use_Clause that is a declarative item is inappropriate.
-- Use ASIS_Names_And_Expressions.Named_Packages to analyze use clauses that
-- are declarative items.


-------------------------------------------------------------------------
-- 10.2 SUBUNITS OF COMPILATION UNITS


function Is_Subunit
   (A_Compilation_Unit : in Compilation_Unit)
  return Boolean;

-- Returns True if the given Compilation_Unit is a subunit.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(A_Compilation_Unit) or Kind(A_Compilation_Unit) = Unknown


function Subunits
   (Parent_Unit     : in Compilation_Unit)
  return Secondary_Unit_List;

function Subunits
   (Parent_Unit     : in Compilation_Unit;
    Program_Library : in Library)
  return Secondary_Unit_List;

-- Returns a list of subunits corresponding to the
-- the body stubs that appear in the given Parent_Unit.
--
-- Returns a Nil_Compilation_Unit_List if the parent unit does not
-- contain any body stubs.
--
-- The list includes subunits existing in the given library and subunits
-- that do not exist but whose name can be deduced from the body stub and
-- the name of the parent unit.  These nonexistent units are known to be
-- secondary units so their Kind will be A_Nonexistent_Secondary_Unit.
--
-- Subunits can also be obtained through the query
-- Related_Compilation_Units using the Family relation.
--
```

```
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(Parent_Unit) or Kind(Parent_Unit) = Unknown
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


function Subunit_Parent
   (Subunit         : in Compilation_Unit)
  return Compilation_Unit;

function Subunit_Parent
   (Subunit         : in Compilation_Unit;
    Program_Library : in Library)
  return Compilation_Unit;

-- Returns the Compilation_Unit that contains the body stub
-- of the given Subunit.
--
-- Returns a Nil_Compilation_Unit if the subunit parent cannot be
-- found within the library.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Is_Subunit(Subunit)
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).



function Subunit_Ancestor
   (Subunit         : in Compilation_Unit)
  return Compilation_Unit;

function Subunit_Ancestor
   (Subunit         : in Compilation_Unit;
    Program_Library : in Library)
  return Compilation_Unit;

-- Returns the Compilation_Unit that is the ancestor library unit
-- of the given Subunit.  The ancestor unit is a parent unit that
-- is not itself a subunit.  See LRM 10.2(5).
--
-- Returns a Nil_Compilation_Unit if the subunit ancestor cannot be
-- found within the library.
```

```
--
-- Raises Inappropriate_Compilation_Unit
-- if not Is_Subunit(Subunit)
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


-------------------------------------------------------------------------
-- 10.3 ORDER OF COMPILATION

-- Compilation Unit Relationships
--
-- Relationship queries provide handles to compilation units that are
-- related in a given manner to one or more given compilation units.
-- Compilation units located by the queries are returned in an ordered
-- list.
--
-- The following describes the semantics of the list of units returned
-- by these queries:
--   Related_Compilation_Units
--   Compilation_Order
--   Recompilation_Order
--   Elaboration_Order
--
-- The list contains four possible sublists:
--
--   1) A sublist of existing ordered units
--   2) A sublist of units that are inconsistent due to the
--      recompilation of one or more related units.
--   3) A sublist of units that have missing (nonexistent) related units.
--   4) A sublist of circularities among the related units.
--
-- Each of the four sublists is delimited by a Nil_Compilation_Unit.
--
--
-- 1) THE ORDERED UNITS SUBLIST
--
-- The semantics of the ordering of units in the first sublist are
-- defined by each of the individual operations.
--
--
-- 2) THE INCONSISTENT UNITS SUBLIST
--
-- The second sublist contains pairs of units; Each pairing contains the
```

```
-- inconsistent unit followed by the unit causing the inconsistency.
-- An inconsistent unit is a Compilation_Unit that exists but is obsolete
-- due to recompilation of any supporters within the given Library.
-- See LRM 10.3
--
-- For example:
--
-- Given a sublist containing the units:  A B A C D E
--
-- It can be determined that:
--   A is inconsistent since its supporter B has been recompiled.
--   A is inconsistent since its supporter C has been recompiled.
--   D is inconsistent since its supporter E has been recompiled.
--
--
--
-- 3) THE MISSING UNITS SUBLIST
--
-- The third sublist contains pairs of units; Each pairing contains the
-- existing unit followed by the missing related unit.
-- A missing unit is a Compilation_Unit that has a valid name, but its
-- Kind is either A_Nonexistent_Library_Unit or A_Nonexistent_Secondary_Unit.
--
-- For example:
--
-- Given a sublist containing the units:  A B A C
--
-- If Kind(B) = A_Nonexistent_Library_Unit
-- and Kind(C) = A_Nonexistent_Secondary_Unit
--
-- It can be determined that:
--   A is missing its supporter B.
--   A is missing a related secondary unit C.
--
--
-- 4) THE CIRCULAR DEPENDENCIES SUBLIST
--
-- Circular dependencies between compilation units are provided in the
-- fourth sublist.  There may be more than one set of circular
-- dependencies.  The ordering of distinct sets in the sublist is
-- implementation defined.
--
-- The semantics of set of units in the circular sublist structures are the
-- same for each operation:
--
```

```
-- The sublist contains pairs of units; Each pairing contains a unit
-- followed by its supporter unit.  A circularity is established when
-- a following supporter unit is equal to the first unit in the sublist
-- (See the unit A in the example below).  The next set of circular
-- dependent units, if any, starts with the next unit in the sublist
-- (the unit D below).
--
-- For example:
--
-- Given a list containing the units:  A B B C C A D E E F F G G D
--
-- It can be determined that there are two sets of circularly dependent
-- units:
--   {A, B, C} and {D, E, F, G}
--
-- The dependencies are:  A depends on B, B depends on C, C depends on A.
--        D depends on E, E depends on F, F depends on G, G depends on D.
--
--
-- IMPORTANT NOTE:
--
-- For each operation that returns inconsistent, missing, or circular units,
-- the appearance of any of these units in those sublists means that the
-- first sublist containing ordered or related units cannot be guaranteed
-- valid or complete.
--
-- Programs that do not first check for inconsistent, missing, or circular
-- units may be ERRONEOUS.
--
-------------------------------------------------------------------------


type Relation_Kinds is

   -- Defines the kinds of relations between compilation units

 (Direct_Supporters,

  Supporters,

  ---------------------------------------------------------------------
  -- Definition:  SUPPORTERS of a unit
  --
  -- Supporters of a compilation unit are units that must be compiled
  -- before that compilation unit can be compiled.  A compilation unit
```

```
-- cannot be successfully compiled if one or more supporters are
-- missing or obsolete.
--
-- Library units mentioned in with clauses of other compilation
-- units are direct supporters of those compilation units.
-- The property is transitive; Units that support library units withed
-- by other compilation units are indirect supporters of those
-- compilation units.
--
-- The package Standard is a supporter of every unit, but is not
-- considered to be a direct supporter unless it is mentioned in a with
-- clause.
--
-- For example:
-- If A withs B and B withs C.
-- Then C directly supports B,
--      C indirectly supports A, and
--      both B and C are supporters of A.
--
-- A library unit is a direct supporter of its corresponding
-- secondary unit.
-- The parent unit of a subunit is a direct supporter of the subunit.
-------------------------------------------------------------------------

Direct_Dependents,

Dependents,

-------------------------------------------------------------------------
-- Definition:  DEPENDENTS of a unit
--
-- A compilation unit that mentions other library units in its with
-- clauses directly depends on those library units.  The property is
-- transitive;  A unit that depends on a given unit also indirectly
-- depends on the given unit's supporters.
--
-- For example:
-- If A withs B and B withs C
--     then B directly depends on C,
--      A indirectly depends on C, and
--      both A and B are dependents of C.
--
-- Dependents are all the units that must be recompiled if the unit
-- is recompiled.  A secondary unit is a direct dependent of its
-- corresponding library unit.
```

```
--
-- Dependencies between compilation units may also be introduced
-- by inline inclusions, for certain compiler optimizations, and
-- for certain implementations of generic program units.
-- See LRM 10.3(6-9)
-------------------------------------------------------------------

Family,

-------------------------------------------------------------------
-- Definition:  FAMILY of a unit
--
-- The family of a given unit is defined as the set of
-- compilation units that comprise the given unit's spec, body,
-- and subunits (and subunits of subunits).
-------------------------------------------------------------------

Extended_Family

-------------------------------------------------------------------
-- Definition:  EXTENDED FAMILY of a unit
--
-- The extended family of a given unit is defined as the set of
-- compilation units that comprise the given unit's spec, body,
-- subunits and transitive supporters, and the extended family of
-- each transitive supporting unit.
-- The extended family of a unit that is a main program includes
-- all the Ada units ultimately required to form the program.
--
-- The term closure is commonly used to with similar meaning.
--
-- For example:
--  Assume the body of A has a subunit A.S.
-- If A withs B and B withs C and C does not with a library unit.
-- Then the extended family of A is:
--    library unit C
--    secondary unit C    (if required)
--    library unit B
--    secondary unit B    (if required)
--    library unit A
--    secondary unit A
--    secondary unit A.S  (subunit)
--
-------------------------------------------------------------------
```

```
   );


function Related_Compilation_Units
   (Compilation_Units : in Compilation_Unit_List;
    Dependent_Units   : in Compilation_Unit_List;
    Program_Library   : in Library;
    Relation          : in Relation_Kinds )
  return Compilation_Unit_List;

-- Produces the list of compilation units related to
-- the given compilation units by the specified relation.
--
-- Dependent units are only required when the relation is:
--   Direct_Dependents or Dependents.
--
-- The extended families of the dependent units provide a context for
-- the operation to select dependents of the given compilation units.
--
-- The return list contains the sublists described above for the
-- operations on Compilation Unit Relationships
--
-- Raises Inappropriate_Compilation_Unit
-- if any of the given compilation units or dependent units do not exist.
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


function Compilation_Order
   (Compilation_Units : in Compilation_Unit_List;
    Dependent_Units   : in Compilation_Unit_List;
    Program_Library   : in Library;
    Relation          : in Relation_Kinds )
  return Compilation_Unit_List;

-- Produces, in compilation order, the list of compilation units
-- related to the given compilation units by the specified relation.
-- The given compilation units are returned as part of the list.
--
-- Dependent units are only required when the relation is:
--   Direct_Dependents or Dependents.
--
-- The extended families of the dependent units provide a context for
-- the operation to select dependents of the given compilation units.
```

```
--
-- The return list contains the sublists described above for the
-- operations on Compilation Unit Relationships
--
-- Raises Inappropriate_Compilation_Unit
-- if any of the given compilation units or dependent units do not exist.
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


function Recompilation_Order
   (Compilation_Units : in Compilation_Unit_List;
    Dependent_Units   : in Compilation_Unit_List;
    Program_Library   : in Library;
    Relation          : in Relation_Kinds )
  return Compilation_Unit_List;

-- Produces, in compilation order, the list of compilation units
-- related to the given compilation units by the specified relation
-- and which are in need of recompilation.
--
-- The effects of obsolete units are reflected, transitively, in
-- the Ordered_Compilation_Units list produced.
--
-- Dependent units are only required when the relation is:
--   Direct_Dependents or Dependents.
--
-- The extended families of the dependent units provide a context for
-- the operation to select dependents of the given compilation units.
--
-- The return list contains the sublists described above for the
-- operations on Compilation Unit Relationships
--
-- Raises Inappropriate_Compilation_Unit
-- if any of the given compilation units or dependent units do not exist.
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


function Direct_Supporters
   (A_Compilation_Unit : in Compilation_Unit;
    Compilation_Units  : in Compilation_Unit_List)
  return Compilation_Unit_List;
```

```
function Direct_Supporters
   (Program_Library    : in Library;
    A_Compilation_Unit : in Compilation_Unit;
    Compilation_Units  : in Compilation_Unit_List)
  return Compilation_Unit_List;

-- Returns a list of units from the given Compilation_Unit_List
-- that are compiled direct supporters of Compilation_Unit.
-- Indirect (or transitive) supporters are not returned.
--
-- A compilation unit is not a direct supporter of itself.
-- Direct supporters duplicated in the given list are duplicated in
-- the returned list.
--
-- Only compilation units existing in the given library are
-- included in the return list.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(A_Compilation_Unit)
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


function Supporters
   (A_Compilation_Unit : in Compilation_Unit;
    Compilation_Units  : in Compilation_Unit_List)
  return Compilation_Unit_List;

function Supporters
   (Program_Library    : in Library;
    A_Compilation_Unit : in Compilation_Unit;
    Compilation_Units  : in Compilation_Unit_List)
  return Compilation_Unit_List;

-- Returns a list of units from the given Compilation_Unit_List
-- that are compiled supporters of Compilation_Unit.
-- Direct and indirect (or transitive) supporters are included.
--
-- A compilation unit is not a supporter of itself.
-- Supporters duplicated in the given list are duplicated in
-- the returned list.
--
-- Only compilation units existing in the given library are
```

```
-- included in the return list.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(A_Compilation_Unit)
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


function Direct_Dependents
   (A_Compilation_Unit : in Compilation_Unit;
    Compilation_Units  : in Compilation_Unit_List)
  return Compilation_Unit_List;

function Direct_Dependents
   (Program_Library    : in Library;
    A_Compilation_Unit : in Compilation_Unit;
    Compilation_Units  : in Compilation_Unit_List)
  return Compilation_Unit_List;

-- Returns a list of units from the given Compilation_Unit_List
-- that are compiled direct dependents of Compilation_Unit.
-- Indirect (or transitive) dependents are not returned.
--
-- A compilation unit is not a direct dependent of itself.
-- Direct dependents duplicated in the given list are duplicated in
-- the returned list.
--
-- Only compilation units existing in the given library are
-- included in the return list.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(A_Compilation_Unit)
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


function Dependents
   (A_Compilation_Unit : in Compilation_Unit;
    Compilation_Units  : in Compilation_Unit_List)
  return Compilation_Unit_List;

function Dependents
   (Program_Library    : in Library;
```

```
    A_Compilation_Unit : in Compilation_Unit;
    Compilation_Units  : in Compilation_Unit_List)
  return Compilation_Unit_List;

-- Returns a list of units from the given Compilation_Unit_List
-- that are compiled dependents of Compilation_Unit.
-- Direct and indirect (or transitive) dependents are included.
--
-- A compilation unit is not a dependent of itself.
-- Dependents duplicated in the given list are duplicated in
-- the returned list.
--
-- Only existing compilation units are included in the return list.
-- Only compilation units existing in the given library are
-- included in the return list.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(A_Compilation_Unit)
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


-------------------------------------------------------------------------
-- 10.4 THE PROGRAM LIBRARY - COMPILATION UNIT STATUS


function Is_Obsolete
   (A_Compilation_Unit : in Compilation_Unit)
  return Boolean;

function Is_Obsolete
   (A_Compilation_Unit : in Compilation_Unit;
    Program_Library    : in Library)
  return Boolean;

-- Returns True if Compilation_Unit exists but is obsolete due
-- to recompilation or removal of any supporters within the
-- given Library.  See LRM 10.3
--
-- It is always true that within the same library context,
-- a compilation unit is either obsolete or current, but not both.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(A_Compilation_Unit)
```

```
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


function Is_Consistent
   (A_Compilation_Unit : in Compilation_Unit)
  return Boolean;

function Is_Consistent
   (A_Compilation_Unit : in Compilation_Unit;
    Program_Library    : in Library)
  return Boolean;

-- Returns True if Compilation_Unit exists and is not obsolete.
-- See LRM 10.3
--
-- It is always true that within the same library context,
-- a compilation unit is either obsolete or consistent, but not both.
--
-- Raises Inappropriate_Compilation_Unit
-- if not Exists(A_Compilation_Unit)
--
-- Raises Inappropriate_Library
-- if not ASIS_Libraries.Is_Open(Program_Library).


-----------------------------------------------------------------------
-- 10.4 THE PROGRAM LIBRARY - COMPILATION UNIT STATUS

-- The package ASIS_LIBRARY contains the operations for
-- naming and interrogating the Ada Program Library.


-----------------------------------------------------------------------
-- 10.5 ELABORATION OF LIBRARY UNITS


function Elaboration_Order
    (Compilation_Units : in Compilation_Unit_List;
     Program_Library   : in Library)
  return Compilation_Unit_List;

-- Produces, in elaboration order, the list of compilation units
-- required to elaborate the given compilation units.
```

```
   --
   -- The return list contains the sublists described above for the
   -- operations on Compilation Unit Relationships
   --
   -- Use context clause elements to get pragma elaborate elements
   -- for a compilation unit.
   --
   -- Raises Inappropriate_Compilation_Unit
   -- if any of the given compilation units do not exist.
   --
   -- Raises Inappropriate_Library
   -- if not ASIS_Libraries.Is_Open(Program_Library).


   ------------------------------------------------------------------------
   -- COMPILATION UNIT DESTRUCTOR


   procedure Dissociate
      (A_Compilation_Unit : in out Compilation_Unit);

   -- Severs associations made to the Compilation_Unit.
   -- A Nil_Compilation_Unit value is returned.
   --
   -- Postconditions:  (if no exception is raised)
   --   Depending on the ASIS implementation, storage for Compilation_Unit
   --    may be deallocated.


   procedure Dissociate
      (A_Compilation_Unit_List : in out Compilation_Unit_List);

   -- Severs associations made to the Compilation_Unit_List.
   -- A Nil_Compilation_Unit_List value is returned.
   --
   -- Postconditions:  (if no exception is raised)
   --   Depending on the ASIS implementation, storage for each Compilation_Unit
   --    may be deallocated.


   ------------------------------------------------------------------------
   -- ERROR INFORMATION

   type ASIS_Compilation_Unit_Error_Kinds is
```

```
   (Not_An_Error,

    Status_Error,              -- A operation that takes a library parameter
                               -- was given a library that was not open.

    TBD);

  -- Additional Error Kind literals are yet TO BE DETERMINED

  -- Whenever an error condition is detected and the exception Failed
  -- is raised, an ASIS_Compilation_Unit_Error_Kinds value is stored for the
  -- Compilation_Unit involved in the failure.   That value can be retrieved
  -- using the Status function.  The Diagnosis function will retrieve the
  -- ASIS_String diagnostic message for the Compilation_Unit_Error_Kinds value.
  --
  -- Error information is only kept when the catch-all exception Failed
  -- is raised.
  --
  -- Note that Status and Diagnosis values are vendor dependent and will
  -- vary among ASIS implementations.


  function Status (A_Compilation_Unit : in Compilation_Unit)
    return ASIS_Compilation_Unit_Error_Kinds;

  -- Returns the ASIS_Compilation_Unit_Error_Kinds value associated with
  -- the compilation unit.
  --
  -- Returns Not_An_Error if the compilation unit has no error kind associated
  -- with it, or if Is_Nil(A_Compilation_Unit).
  -- EG. It has not been involved in a failed operation.


  function Diagnosis (A_Compilation_Unit : in Compilation_Unit)
    return ASIS_String;

  -- Returns an ASIS_String value containing implementation defined error
  -- information associated with the compilation unit.


  procedure Dissociate_Compilation_Unit_Error_Information;

  -- Removes the association of status and diagnosis error information with
  -- all Compilation_Unit handles that have been involved in a failed
  -- operation.
```

```
  --
  -- This operation does not affect Compilation_Unit handles in any other way.


  ------------------------------------------------------------------------
  -- DEBUGGING

  function Debug_Image (A_Compilation_Unit : in Compilation_Unit)
    return ASIS_String;

  -- Returns an ASIS_String value containing implementation defined debug
  -- information associated with the compilation unit.


private


end ASIS_Compilation_Units;
```

```
------------------------------------------------------------------------
-- ASIS PRELIMINARY REVIEW VERSION 0.4
-- Sept 27, 1991
------------------------------------------------------------------------


with ASIS_Ada_Program;
package ASIS_Elements is

  -- LRM Chapter 2

  subtype Element is ASIS_Ada_Program.Element;

  subtype Element_List is ASIS_Ada_Program.Element_List;

  -- ASIS Elements are handles to the lexical elements that form the text
```

```
-- of compilation units.
--
-- ASIS Elements are either terminal elements or composite elements made
-- up of component elements.  For example, a simple name is a terminal element
-- while a selected component is a composite element consisting of three
-- components: a prefix, a dot, and a selector.  A lexical element must fit
-- on one line of text but a composite element could span many lines.
--
-- ASIS defines a variety of element subtypes that identify classes of
-- elements.  These subtypes classify elements into declarations, statements,
-- expressions, type definitions, and several other classes.
--
-- For each element class, ASIS provides enumeration types that describe the
-- kinds of elements.  For example, statements can be if statements, loop
-- statements, raise statements, or any other kind of statement.
-- Operations are defined to determine the kind for elements of a
-- particular class.
--
-- ASIS offers many operations to decompose the various classes of composite
-- elements into constituent component elements.
--
-- Other ASIS operations return semantically related elements such as the
-- type of a given object or the specification of a given body.
--
-- Each ASIS Element may also have attributes that provide information
-- about that element.  For example, all declaration elements will
-- have a name (identifier) associated with them.  Certain static
-- expressions may have a value associated with them.  Operations
-- are defined to provide this information for specific kinds of
-- elements.
--
-- Some elements "make reference to" other elements.  Declarations,
-- for example, define named elements of the class Identifier_Definition.
-- Other elements such as statements and expressions may make
-- reference to named elements.  These references are handled with
-- elements of the class Identifier_Reference.
--
-- Each ASIS Element has a text image whose value is a series of characters
-- that forms the text span of the Element.  The text span covers all the
-- characters from the first character of the Element through the last
-- character of the Element over the range of lines.
--

------------------------------------------------------------------------

-- EXCEPTIONS
```

```
Inappropriate_Program_Element : exception renames
    ASIS_Ada_Program.Inappropriate_Program_Element;

-- All operations may raise Inappropriate_Program_Element whenever they
-- are given input that is not valid.  It is generally inappropriate to
-- mix elements of distinct subtypes.  EG. Passing a statement to an
-- operation expecting a declaration is inappropriate.
-- It is also inappropriate to mix kinds of elements within a subtype when
-- an operation is expecting a specific kind.  EG. Passing a type
-- declaration to an operation looking for a procedure declaration is
-- inappropriate.


Failed : exception renames ASIS_Ada_Program.Failed;

-- All operations may raise Failed whenever they cannot normally complete
-- their operation.
-- This is a catch-all exception that may be raised for different reasons
-- in different ASIS implementations.
--
-- The Diagnostic and Status functions are provided so more information
-- about the failure can be retrieved.


-------------------------------------------------------------------------
-- ELEMENT ASSIGNMENT

procedure Assign (Target : in out Element; Source : in Element);

-- Assigns the source element to the target element.
--
-- Postconditions:  (if no exception is raised)
--   Depending on the ASIS implementation, the target element
--    may be dissociated before performing the assignment.
--   Is_Equal(Target, Source)


-------------------------------------------------------------------
-- ELEMENT ATTRIBUTES

function Is_Nil (Program_Element : in Element) return Boolean;

-- Returns True if the program element has a void or null value.
--
```

```
-- All element kinds are appropriate.


function Is_Equal (Left, Right : in Element)
  return Boolean;

-- Returns True if Left and Right represent the same element.
--
-- All element kinds are appropriate.


------------------------------------------------------------------
-- MAJOR ELEMENT KINDS

type Major_Element_Kinds is (

  An_Identifier,                -- LRM 2.3     ASIS_Names_And_Expressions
  A_Pragma,                     -- LRM 2.8     ASIS_Elements
  An_Argument_Association,      -- LRM 2.8     ASIS_Statements
  A_Declaration,                -- LRM 3       ASIS_Declarations
  A_Type_Definition,            -- LRM 3.3.1   ASIS_Type_Definitions
  A_Subtype_Indication,         -- LRM 3.3.2   ASIS_Type_Definitions
  A_Constraint,                 -- LRM 3.3.2   ASIS_Type_Definitions
  A_Discrete_Range,             -- LRM 3.6     ASIS_Type_Definitions
  A_Discriminant_Association,   -- LRM 3.7.2   ASIS_Type_Definitions
  A_Variant_Part,               -- LRM 3.7.3   ASIS_Type_Definitions
  A_Null_Component,             -- LRM 3.7.3   ASIS_Type_Definitions
  A_Variant,                    -- LRM 3.7.3   ASIS_Type_Definitions
  A_Choice,                     -- LRM 3.7.3   ASIS_Type_Definitions
  A_Name_Expression,            -- LRM 4.1     ASIS_Names_And_Expressions
  A_Component_Association,      -- LRM 4.3     ASIS_Names_And_Expressions
  An_Expression,                -- LRM 4.4     ASIS_Names_And_Expressions
  A_Statement,                  -- LRM 5.1     ASIS_Statements
  An_If_Statement_Arm,          -- LRM 5.3     ASIS_Statements
  A_Case_Statement_Alternative, -- LRM 5.4     ASIS_Statements
  A_Parameter_Association,      -- LRM 6.4     ASIS_Statements
  A_Use_Clause,                 -- LRM 8.4     ASIS_Compilation_Units
  A_Select_Statement_Arm,       -- LRM 9.7     ASIS_Statements
  A_Select_Alternative,         -- LRM 9.7.1   ASIS_Statements
  A_With_Clause,                -- LRM 10.1.1  ASIS_Compilation_Units
  An_Exception_Handler,         -- LRM 11.2    ASIS_Statements
  A_Representation_Clause,      -- LRM 13.1    ASIS_Representation_Clauses
  A_Component_Clause,           -- LRM 13.4    ASIS_Representation_Clauses

  Not_A_Major_Element);
```

```
function Major_Element_Kind (Program_Element : in Element)
  return Major_Element_Kinds;

-- Returns the Major_Element_Kind of the element.
-- Returns Not_A_Major_Element for a Nil_Element.
--
-- All element kinds are appropriate.
--
-- Once the Major_Element_Kind of an element is determined,
-- further decomposition or analysis can be done by calling functions
-- in the ASIS package that deals with a specific element kind.


-------------------------------------------------------------------
-- MAJOR ELEMENTS

type Parse_Control is (Continue,
Abandon_Children,
Abandon_Siblings,
Terminate_Immediately);

generic

  with procedure Pre_Operation
   (Ada_Element       : in ASIS_Ada_Program.Element;
    Control           : in out Parse_Control) is <>;

  with procedure Post_Operation
   (Ada_Element       : in ASIS_Ada_Program.Element;
    Control           : in out Parse_Control) is <>;

procedure Parse_Major_Element
 (Ada_Element       : in ASIS_Ada_Program.Element;
  Control           : in out Parse_Control);

-- Parses the element and all its component elements.  For each element,
-- the formal procedure Pre_Operation is called when first visiting the
-- element.  All component elements are then visited and finally the formal
-- procedure Post_Operation is called when returning from visiting all
-- component elements.
--
-- Parsing can be controlled with the Control parameter.
-- The Abandon_Children control prevents parsing of the current element's
```

```
-- child components, but picks up with the next sibling element.
-- The Abandon_Siblings control abandons parsing of the remaining siblings
-- but continues parsing at the parent.
-- The Terminate_Immediately control does just that.
--
-- Abandon_Children in a Post_Operation is the same as Continue as all the
-- children have been parsed.
-- Abandon_Siblings in a Pre_Operation skips the associated
-- Post_Operation.
--
-- Raises Inappropriate_Program_Element
-- if Major_Element_Kind(Ada_Element) = Not_A_Major_Element

-------------------------------------------------------------------
-- ENCLOSING MAJOR ELEMENTS

function Enclosing_Major_Element (Program_Element : in Element)
  return Element;

function Enclosing_Major_Element
   (Program_Element : in Element; Context : in Element)
  return Element;

-- Returns the Major Element that immediately encloses the given element.
-- Some elements know what their enclosing major element is regardless of
-- a given context.  For other elements, the enclosing major element may
-- have to be determined by performing a search.  The context parameter
-- provides the element that is searched and thus can be used to make this
-- operation more efficient.  However, if the Program_Element is not a
-- component element of the Context element and the enclosing element
-- cannot be determined without a search, then a Nil_Element is returned.
--
-- A nil element is also returned if the element is the declaration part
-- of a compilation unit. (EG. The ASIS_Compilation_Units.Unit_Declaration
-- of the compilation unit).
--
-- Use ASIS_Compilation_Units.Enclosing_Compilation_Unit to get the
-- enclosing compilation unit for an element.
--
-- Raises Inappropriate_Program_Element if Is_Nil(Program_Element)
--
-- Examples:
--
--   Given a type declaration in a declare block, returns the block
--   statement element that encloses the type declaration.
```

```
--
--   Given a statement within the sequence of statements of a loop
--   statement, returns the enclosing loop statement.
--
--   Given an Identifier_Reference as the selector in an expanded name,
--   returns the Name_Expression representing the prefix, the dot, and
--   the selector.


------------------------------------------------------------------------
-- PRAGMAS - LRM 2.8

subtype Pragma_List is ASIS_Ada_Program.Element_List;

function Pragmas (Context : in Element) return Pragma_List;

-- Returns the list of pragmas appearing within the given context.
--
-- A Nil_Element_List is returned if there are no pragmas.
--
-- Raises Inappropriate_Program_Element
-- if Major_Element_Kind(Context) = Not_A_Major_Element


subtype Pragma_Element is ASIS_Ada_Program.Element;

function Is_Predefined (A_Pragma : in Pragma_Element) return Boolean;

-- Returns True if the pragma is one of the predefined language pragmas.
-- See the LRM Appendix B.
--
-- Raises Inappropriate_Program_Element
-- if Major_Element_Kind(A_Pragma) /= A_Pragma


function Name (A_Pragma : in Pragma_Element) return String;

-- Returns the identifier name of any pragma.
--
-- Raises Inappropriate_Program_Element
-- if Major_Element_Kind(A_Pragma) /= A_Pragma


subtype Argument_Association_List is ASIS_Ada_Program.Element_List;
```

```
function Argument_Associations (A_Pragma : in Pragma_Element)
  return Argument_Association_List;

-- Returns a list of the argument associations of the pragma.
--
-- Raises Inappropriate_Program_Element
-- if Major_Element_Kind(A_Pragma ) /= A_Pragma
--
-- Further Analysis:
--   Pragma argument associations take the same form as actual parameter
--   associations of a procedure call.
--   The ASIS_Statements operation Formal_Parameter will extract the
--   argument identifier.
--   The ASIS_Statements operation Actual_Parameter will extract the
--   name or expression.



-------------------------------------------------------------------------
-- ELEMENT DESTRUCTOR

procedure Dissociate (Program_Element: in out Element);

-- A Nil_Element value is returned.
--
-- Postconditions:  (if no exception is raised)
--   Depending on the ASIS implementation, storage for the element
--    may be deallocated.
--   Program_Element = Nil_Element



procedure Dissociate
   (Program_Element_List : in out Element_List);

-- Severs associations made to the Element_List.
-- A Nil_Element_List value is returned.
--
-- Postconditions:  (if no exception is raised)
--   Depending on the ASIS implementation, storage for each Element
--    may be deallocated.


-------------------------------------------------------------------
-- ERROR INFORMATION
```

```
type ASIS_Element_Error_Kinds is (Not_An_Error, TBD);
-- Additional Error Kind literals are yet TO BE DETERMINED


-- Whenever an error condition is detected and the exception Failed
-- is raised, an ASIS_Element_Error_Kinds value is stored for the Element
-- involved in the failure.   That value can be retrieved using the Status
-- function.  The Diagnosis function will retrieve the ASIS_String
-- diagnostic message for the Element_Error_Kinds value.
--
-- Error information is only kept when the catch-all exception Failed
-- is raised.
--
-- Note that Status and Diagnosis values are vendor dependent and will
-- vary among ASIS implementations.


function Status (Program_Element : in Element)
  return ASIS_Element_Error_Kinds;

-- Returns the ASIS_Element_Unit_Error_Kinds value associated with
-- the element.
--
-- Returns Not_An_Error if the element has no error kind associated
-- with it, or if Is_Nil(Program_Element)
-- EG. It has not been involved in a failed operation.


function Diagnosis (Program_Element : in Element)
  return ASIS_Ada_Program.ASIS_String;

-- Returns an ASIS_String value containing implementation defined error
-- information associated with the element.


procedure Dissociate_Element_Error_Information;

-- Removes the association of status and diagnosis error information with
-- all Element handles that have been involved in a failed operation.
--
-- This operation does not affect Element handles in any other way.


-------------------------------------------------------------------------
```

```
  -- DEBUGGING

  function Debug_Image (Program_Element : in Element)
    return ASIS_Ada_Program.ASIS_String;

  -- Returns an ASIS_String value containing implementation defined debug
  -- information associated with the element.


end ASIS_Elements;
```

```
-------------------------------------------------------------------------
-- ASIS PRELIMINARY REVIEW VERSION 0.4
-- Sept 27, 1991
-------------------------------------------------------------------------


with ASIS_Ada_Program;
package ASIS_Declarations is

  -- LRM Chapters 3, 6, 7, 8, 9, 11, 12

  subtype Element is ASIS_Ada_Program.Element;
    -- Use ASIS_Elements operations.

  subtype Declaration is ASIS_Ada_Program.Declaration;
    -- Use ASIS_Declarations operations.

  subtype Expression is ASIS_Ada_Program.Expression;
    -- Use ASIS_Names_And_Expression operations.

  subtype Name_Expression is ASIS_Ada_Program.Name_Expression;
    -- Use ASIS_Names_And_Expression operations.

  subtype Statement is ASIS_Ada_Program.Statement;
    -- Use ASIS_Statements operations.

  subtype Type_Definition is ASIS_Ada_Program.Type_Definition;
```

```
  -- Use ASIS_Type_Definitions operations.

subtype Task_Specification is Type_Definition;
  -- Use operations in this package and in ASIS_Type_Definitions.


subtype Library is ASIS_Ada_Program.Library;

-------------------------------------------------------------
-- DECLARATION KINDS


type Declaration_Kinds is

-- Declaration_Kinds include all declarations and specifications that
-- declare named entities.

--   Declarations with identifier lists can
--   declare one or more identifiers:

   (A_Variable_Declaration,
    A_Component_Declaration,

    A_Constant_Declaration,
    A_Deferred_Constant_Declaration,

    A_Generic_Formal_Object_Declaration,

    A_Discriminant_Specification,

    A_Parameter_Specification,

    An_Integer_Number_Declaration,
    A_Real_Number_Declaration,

    An_Exception_Declaration,


--   Declarations with a single identifier or designator:

    An_Enumeration_Literal_Specification,
    A_Loop_Parameter_Specification,

    A_Full_Type_Declaration,
    An_Incomplete_Type_Declaration,
```

```
A_Private_Type_Declaration,

A_Subtype_Declaration,

A_Package_Declaration,
A_Package_Body_Declaration,

A_Procedure_Declaration,
A_Procedure_Body_Declaration,

A_Function_Declaration,
A_Function_Body_Declaration,

An_Object_Rename_Declaration,
An_Exception_Rename_Declaration,
A_Package_Rename_Declaration,
A_Procedure_Rename_Declaration,
A_Function_Rename_Declaration,

A_Generic_Package_Declaration,
A_Generic_Procedure_Declaration,
A_Generic_Function_Declaration,

A_Package_Instantiation,
A_Procedure_Instantiation,
A_Function_Instantiation,

A_Task_Declaration,
A_Task_Body_Declaration,
A_Task_Type_Declaration,

An_Entry_Declaration,

A_Procedure_Body_Stub,
A_Function_Body_Stub,
A_Package_Body_Stub,
A_Task_Body_Stub,

A_Generic_Formal_Type_Declaration,
A_Generic_Formal_Private_Type_Declaration,
A_Generic_Formal_Procedure_Declaration,
A_Generic_Formal_Function_Declaration,

Not_A_Declaration);
```

```
function Kind (A_Declaration : in Declaration) return Declaration_Kinds;

-- Returns the kind of the given declaration.
--
-- Returns Not_A_Declaration for any inappropriate element such as
-- a Statement, Expression, or Nil_Element.


-------------------------------------------------------------------
-- IDENTIFIER 2.3
--
-- IDENTIFIER LIST 3.2
--   IN A COMPONENT DECLARATION 3.7
--   IN A DEFERRED CONSTANT DECLARATION 7.4
--   IN A DISCRIMINANT SPECIFICATION 3.7.1
--   IN A GENERIC PARAMETER DECLARATION FOR GENERIC FORMAL OBJECTS 3.7.1
--   IN AN OBJECT DECLARATION 3.2
--   IN A NUMBER DECLARATION 3.2
--   IN A PARAMETER SPECIFICATION 6.1


subtype Identifier_Definition_List is ASIS_Ada_Program.Element_List;

function Identifiers (A_Declaration : in Declaration)
  return Identifier_Definition_List;

-- Returns a list of each Identifier_Definition defined by the declaration.
-- For declarations that define a single identifier, the list returned
-- always has a length of one.
--
-- Examples:
--   type Foo is new Integer;
--        --- Returns a list containing one Identifier_Definition Foo.
--
--   One, Uno : constant Foo := 1;
--   ---  --- Returns a list of two Identifier_Definitions One and Uno.
--
-- Results of this operation may vary across ASIS implementations.
-- Some implementations normalize all multiple object declarations into
-- an equivalent sequence of corresponding single object declarations.
-- See LRM 3.2(10).  If this is the case, then this operation will
-- return a list containing a single identifier.
--
-- Raises Inappropriate_Program_Element
```

```
-- if Kind(A_Declaration) = Not_A_Declaration


------------------------------------------------------------
-- OBJECT DECLARATIONS - LRM 3.2.1

function Is_Initialized (Object_Declaration : in Declaration)
  return Boolean;

-- Returns True if the declaration has an explicit initialization.
--
-- Appropriate Declaration Kinds:
--   A_Variable_Declaration,
--   A_Component_Declaration,
--   A_Constant_Declaration,
--   A_Discriminant_Specification,
--   A_Parameter_Specification,
--   An_Integer_Number_Declaration,
--   A_Real_Number_Declaration,
--   A_Generic_Formal_Object_Declaration


function Initial_Value (Object_Declaration : in Declaration)
  return Expression;

-- If Is_Initialized(Object_Decl) then
--   Returns the expression that initializes the declaration.
-- else returns Nil_Element.
--
-- Appropriate Declaration Kinds:
--   All kinds appropriate for Is_Initialized.


function Is_Variable (Object_Declaration : in Declaration) return Boolean;
function Is_Constant (Object_Declaration : in Declaration) return Boolean;

-- Variable, discriminant, and component declarations are always variables.
-- Constants and deferred constants are always constant.
-- A renamed object is a constant if the renamed entity is a constant.
-- A loop parameter specification is always a constant during each
--   iteration of the loop.
-- A number declaration is always a constant.
-- A subprogram formal parameter or a generic formal object is constant
--   if it is mode in.
--
```

```
-- Appropriate Declaration Kinds:
--   A_Variable_Declaration,
--   A_Discriminant_Specification,
--   A_Component_Declaration,
--   A_Constant_Declaration,
--   A_Deferred_Constant_Declaration,
--   An_Object_Rename_Declaration,
--   An_Integer_Number_Declaration,
--   A_Real_Number_Declaration,
--   A_Parameter_Specification,
--   A_Generic_Formal_Object_Declaration



function Object_Declaration_Definition (Object_Declaration : in Declaration)
 return Type_Definition;

-- Returns the subtype indication or the constrained array definition
-- following the colon in the object declaration.
--
-- Appropriate Declaration Kinds:
--   A_Variable_Declaration,
--   A_Component_Declaration,
--   A_Constant_Declaration,


function Corresponding_Constant_Declaration
   (Constant_Declaration : in Declaration)
 return Declaration;

-- Returns the corresponding full constant declaration when given
-- a deferred constant declaration, or;
-- Returns the corresponding deferred constant declaration when given
-- a full constant declaration.
--
-- A Nil_Element is returned when a full constant declaration that has no
-- corresponding deferred constant declaration is given.
--
-- Appropriate Declaration Kinds:
--   A_Constant_Declaration,
--   A_Deferred_Constant_Declaration,


------------------------------------------------------------------
-- TYPE DECLARATIONS - LRM 3.3
```

```
function Is_Type_Declaration (A_Declaration : in Declaration)
  return Boolean;

-- Returns True for declarations that are type or subtype declarations.
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Declaration) = Not_A_Declaration


function Is_Private (Type_Declaration : in Declaration) return Boolean;

-- Returns True if the type declaration is:
--   A_Private_Type_Declaration,
--   A_Generic_Formal_Private_Type_Declaration,
--   A_Full_Type_Declaration of a type derived from a private type,
--   A_Full_Type_Declaration of a composite type with subcomponents
--     of a private type.
--
-- Raises Inappropriate_Program_Element
-- if not Is_Type_Declaration(Type_Declaration)


function Is_Limited (Type_Declaration : in Declaration) return Boolean;

-- Returns True if the type declaration is:
--   A_Full_Type_Declaration of a type derived from a limited type,
--   A_Full_Type_Declaration of a composite type with subcomponents
--     of a limited type,
--   A_Task_Type_Declaration,
--   A_Private_Type_Declaration that includes the reserved word limited,
--   A_Generic_Formal_Private_Type_Declaration, that includes the
--     reserved word limited.
--
-- Raises Inappropriate_Program_Element
-- if not Is_Type_Declaration(Type_Declaration)


function Is_Discriminated (Type_Declaration : in Declaration)
  return Boolean;

-- Returns True if the type declaration has discriminants.
--
-- Raises Inappropriate_Program_Element
-- if not Is_Type_Declaration(Type_Declaration)
```

```
subtype Discriminant_Specification_List is ASIS_Ada_Program.Element_List;

function Discriminants (Type_Declaration : in Declaration)
  return Discriminant_Specification_List;

-- Returns a list of discriminant specifications in their order of
-- appearance.
--
-- Results of this operation may vary across ASIS implementations.
-- Some implementations normalize all multiple discriminant specifications
-- into an equivalent sequence of corresponding single discriminant
-- specifications.  See LRM 3.7.1(4).
--
-- Further Analysis:
--   Use Identifiers to obtain the identifier list.
--   Use Type_Mark to obtain the parameter type mark.
--   Use Is_Initialized and Initial_Value to query the information
--     related to the presence of the default parameter initialization.
--
-- Appropriate Declaration Kinds:
--   A_Full_Type_Declaration
--   An_Incomplete_Type_Declaration
--   A_Private_Type_Declaration
--   A_Generic_Formal_Private_Type_Declaration


function Type_Declaration_Definition (Type_Declaration : in Declaration)
  return Type_Definition;

-- Returns the type definition following the reserved word is in the
-- type or subtype declaration.
--
-- Returns a Nil_Element if given An_Incomplete_Type_Declaration.
--
-- Appropriate Declaration Kinds:
--   A_Subtype_Declaration
--   A_Full_Type_Declaration
--   An_Incomplete_Type_Declaration
--   A_Private_Type_Declaration
--   A_Task_Type_Declaration
--   A_Generic_Formal_Type_Declaration
--   A_Generic_Formal_Private_Type_Declaration,
```

```
function Corresponding_Type_Declaration
   ( Type_Declaration : in Declaration) return Declaration;

function Corresponding_Type_Declaration
   ( Type_Declaration : in Declaration;
     Program_Library  : in Library)
 return Declaration;

-- Returns the corresponding full type declaration when given a private
-- or incomplete type declaration, or;
-- Returns the corresponding private or incomplete type declaration when
-- given a full type declaration.
--
-- A Nil_Element is returned when a full type declaration that has no
-- corresponding private or incomplete type declaration is given.
--
-- A Nil_Element is returned when a corresponding type declaration
-- does not exist within the given context.
--
-- The Library parameter is necessary whenever the corresponding full
-- type of an incomplete type is in a corresponding package body.
-- See LRM 3.8.1(3).
--
-- Appropriate Declaration Kinds:
--   A_Full_Type_Declaration
--   An_Incomplete_Type_Declaration
--   A_Private_Type_Declaration
--   A_Task_Type_Declaration


------------------------------------------------------------------
-- ENUMERATION LITERALS - LRM 3.5.1

-- Use ASIS_Type_Definitions.Enumeration_Literals to analyze the list of
-- enumeration literals in the type definition part of an enumeration type
-- declaration.

function Is_Character_Literal
   (Enumeration_Literal_Specification : in Declaration)
  return Boolean;

-- Returns True if the enumeration literal is a character literal.
--
-- Appropriate Declaration Kinds:
```

```
--    An_Enumeration_Literal_Specification


-------------------------------------------------------------
-- PROGRAM UNIT DECLARATIONS
-- LRM Chapters 6, 7, 9

-- Program units are package, subprogram, and task specifications
-- and bodies.


function Is_Spec (A_Declaration : in Declaration) return Boolean;

-- Determines whether a package, procedure, function, or task is a
-- specification.
--
-- Returns True if the declaration is:
--    A_Package_Declaration,
--    A_Procedure_Declaration,
--    A_Function_Declaration,
--    A_Package_Rename_Declaration,
--    A_Procedure_Rename_Declaration,
--    A_Function_Rename_Declaration,
--    A_Generic_Package_Declaration,
--    A_Generic_Procedure_Declaration,
--    A_Generic_Function_Declaration,
--    A_Package_Instantiation,
--    A_Procedure_Instantiation,
--    A_Function_Instantiation,
--    A_Task_Declaration,
--    A_Task_Type_Declaration,
--    An_Entry_Declaration,
--    A_Generic_Formal_Procedure_Declaration
--    A_Generic_Formal_Function_Declaration
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Declaration) = Not_A_Declaration


function Is_Package (A_Declaration : in Declaration) return Boolean;

-- Returns True if the declaration is:
--    A_Package_Declaration,
--    A_Package_Body_Declaration,
--    A_Package_Rename_Declaration,
```

```
--   A_Generic_Package_Declaration,
--   A_Package_Instantiation,
--   A_Package_Body_Stub,
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Declaration) = Not_A_Declaration


function Is_Task (A_Declaration : in Declaration) return Boolean;

-- Returns True if the declaration is:
--   A_Task_Body_Stub,
--   A_Task_Declaration,
--   A_Task_Body_Declaration,
--   A_Task_Type_Declaration,
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Declaration) = Not_A_Declaration


function Is_Procedure (A_Declaration : in Declaration) return Boolean;

-- Returns True if the declaration is:
--   A_Procedure_Declaration,
--   A_Procedure_Body_Declaration,
--   A_Procedure_Rename_Declaration,
--   A_Generic_Procedure_Declaration,
--   A_Procedure_Instantiation,
--   A_Procedure_Body_Stub,
--   A_Generic_Formal_Procedure_Declaration
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Declaration) = Not_A_Declaration


function Is_Function (A_Declaration : in Declaration) return Boolean;

-- Returns True if the declaration is:
--   A_Function_Declaration,
--   A_Function_Body_Declaration,
--   A_Function_Rename_Declaration,
--   A_Generic_Function_Declaration,
--   A_Function_Instantiation,
--   A_Function_Body_Stub,
--   A_Generic_Formal_Function_Declaration
```

```
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Declaration) = Not_A_Declaration


function Is_Subprogram (A_Declaration : in Declaration) return Boolean;

-- Determines if a declaration is a subprogram declaration regardless
-- if it is generic, an instantiation, rename, spec or body.
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Declaration) = Not_A_Declaration


function Unit_Specification (Program_Unit_Declaration : in Declaration)
  return Declaration;

-- Returns the corresponding specification of a program unit declaration.
--
-- If a specification declaration is given, the same element is returned.
-- If no explicit specification exists, or the declaration is the proper
-- body of a subunit, a nil element is returned.
--
-- If a generic instantiation is given, the same element is returned.
--
-- Appropriate Declaration Kinds returning a specification:
--   A_Package_Body_Declaration,
--   A_Procedure_Body_Declaration,
--   A_Function_Body_Declaration,
--   A_Task_Body_Declaration,
--   A_Procedure_Body_Stub,
--   A_Function_Body_Stub,
--   A_Package_Body_Stub,
--   A_Task_Body_Stub,
--
-- Appropriate Declaration Kinds returning the same element:
--   Package_Declaration,
--   A_Procedure_Declaration,
--   A_Function_Declaration,
--   A_Package_Rename_Declaration,
--   A_Procedure_Rename_Declaration,
--   A_Function_Rename_Declaration,
--   A_Generic_Package_Declaration,
--   A_Generic_Procedure_Declaration,
--   A_Generic_Function_Declaration,
```

```
--   A_Package_Instantiation,
--   A_Procedure_Instantiation,
--   A_Function_Instantiation,
--   A_Task_Declaration,
--   A_Task_Type_Declaration,



function Unit_Body (Program_Unit_Declaration : in Declaration)
  return Declaration;

function Unit_Body (Program_Unit_Declaration : in Declaration;
                    Program_Library          : in Library)
  return Declaration;

-- Returns the corresponding body for a given program unit declaration.
--
-- If a body declaration is given, the same element is returned.
-- If no body exists, a nil element is returned.
--
-- If a generic instantiation is given, the same element is returned.
--
-- The Library parameter is necessary whenever the unit body is located
-- in a different compilation unit than the declaration of the
-- specification.
--
-- Appropriate Declaration Kinds returning a body:
--   Package_Declaration,
--   A_Procedure_Declaration,
--   A_Function_Declaration,
--   A_Generic_Package_Declaration,
--   A_Generic_Procedure_Declaration,
--   A_Generic_Function_Declaration,
--   A_Task_Declaration,
--   A_Task_Type_Declaration,
--
-- Appropriate Declaration Kinds returning the same element:
--   A_Package_Body_Declaration,
--   A_Procedure_Body_Declaration,
--   A_Function_Body_Declaration,
--   A_Package_Rename_Declaration,
--   A_Procedure_Rename_Declaration,
--   A_Function_Rename_Declaration,
--   A_Package_Instantiation,
--   A_Procedure_Instantiation,
```

```
--    A_Function_Instantiation,
--    A_Task_Body_Declaration,
--    A_Procedure_Body_Stub,
--    A_Function_Body_Stub,
--    A_Package_Body_Stub,
--    A_Task_Body_Stub,



------------------------------------------------------------
-- SUBPROGRAMS
-- LRM Chapter 6

-- PARAMETER_SPECIFICATION - LRM 6.1


subtype Parameter_Specification is Declaration;

type Parameter_Kinds is

   (A_Default_In_Parameter,
    An_In_Parameter,
    An_Out_Parameter,
    An_In_Out_Parameter,
    Not_A_Parameter);

function Parameter_Kind (Parameter : in Parameter_Specification)
            return Parameter_Kinds;

-- Returns the kind of the given parameter specification.
-- This operation also returns the mode for generic formal object
-- declarations.
--
-- Returns Not_A_Parameter for any inappropriate element such as
-- a Statement, Expression, or Nil_Element.
--
-- Results of this operation may vary across ASIS implementations.
-- Some implementations will not differentiate between An_In_Parameter
-- and A_Default_In_Parameter.


subtype Parameter_Specification_List is ASIS_Ada_Program.Element_List;

function Parameters (Subprogram_Or_Entry : in Declaration)
  return Parameter_Specification_List;
```

```
-- Returns a list of parameter specifications in the formal part
-- of the subprogram or entry declaration in the order of appearance.
--
-- A Nil_Element_List is returned if the subprogram or entry has no
-- parameters.
--
-- Results of this operation may vary across ASIS implementations.
-- Some implementations normalize all multiple parameter specifications into
-- an equivalent sequence of corresponding single parameter specifications.
-- See LRM 6.1(4).
--
-- Further Analysis:
--   Use Identifiers to obtain the identifier list.
--   Use Type_Mark to obtain the parameter type mark.
--   Use Is_Initialized and Initial_Value to query the information
--     related to the presence of the default parameter initialization.
--
-- Appropriate Declaration Kinds:
--   Any declaration for which Is_Subprogram returns True, or
--   An_Entry_Declaration,


function Return_Type (Function_Declaration : in Declaration)
  return Name_Expression;

-- Returns the Name_Expression of the return type.
--
-- Appropriate Declaration Kinds:
--   Any declaration for which Is_Function returns True


function Is_Operator_Definition (Function_Declaration : in Declaration)
 return Boolean;

-- Returns True if the function designator is an operator symbol.
--
-- Appropriate Declaration Kinds:
--   Any declaration for which Is_Function returns True


function Subprogram_Body_Block (Subprogram_Body : in Declaration)
  return Statement;

-- Returns the block statement for the body including the declarative
```

```
-- part, sequence of statements, and exception handlers, if any.
-- A Nil_Element is returned if the body is a body stub.
--
-- Appropriate Declaration Kinds:
--   A_Procedure_Body_Declaration,
--   A_Function_Body_Declaration,
--   A_Procedure_Instantiation,
--   A_Function_Instantiation,
--   A_Procedure_Body_Stub,
--   A_Function_Body_Stub,


-------------------------------------------------------------------
-- TYPE_MARK
--   IN A PARAMETER SPECIFICATION 6.1
--   IN A DEFERRED CONSTANT DECLARATIONS 7.4
--   IN A RENAMING_DECLARATION 8.5
--   IN A DISCRIMINANT SPECIFICATION 3.7.1
--   IN A GENERIC PARAMETER DECLARATION 12.1


function Type_Mark (A_Declaration : in Declaration)
  return Name_Expression;

-- Returns the type mark associated with the declaration.
--
-- Appropriate Declaration Kinds:
--   A_Parameter_Specification
--   A_Deferred_Constant_Declaration
--   A_Discriminant_Specification
--   An_Object_Rename_Declaration
--   A_Generic_Formal_Object_Declaration


-----------------------------------------------------------
-- PACKAGES
-- L.M Chapter 7


function Is_Visible (A_Declaration : in Declaration) return Boolean;

-- Returns True for units that are library level package or subprogram
-- specs, and for visible declarative items inside library level package
-- specs.
--
```

```
-- Raises Inappropriate_Program_Element
-- if Kind(A_Declaration) = Not_A_Declaration


function Is_Library_Unit_Declaration (A_Declaration : in Declaration)
  return Boolean;

-- Returns True for declarations that are library units and
-- for declarations of secondary units that are interpreted as
-- library units.  LRM 10.1(6).
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Declaration) = Not_A_Declaration


function Is_In_Visible_Part (A_Declaration : in Declaration) return Boolean;

-- Returns true if the declaration is a declarative item in the visible
-- part of a library package.
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Declaration) = Not_A_Declaration


function Is_In_Private_Part (A_Declaration : in Declaration) return Boolean;

-- Returns true if the declaration is a declarative item in the private
-- part of a library package.
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Declaration) = Not_A_Declaration


subtype Declarative_Item_List is ASIS_Ada_Program.Element_List;

function Visible_Part_Declarative_Items
   (Package_Specification : in Declaration)
  return Declarative_Item_List;

-- Returns a list of all basic declarations, representation specifications,
-- and use clauses in the visible part of a package in the order of
-- appearance.
--
-- Results of this operation may vary across ASIS implementations.
-- Some implementations normalize all multiple object declarations into
```

```
   -- an equivalent sequence of corresponding single object declarations.
   -- See LRM 3.2(10).
   --
   -- Appropriate Declaration Kinds:
   --   A_Package_Declaration,
   --   A_Generic_Package_Declaration,
   --   A_Package_Instantiation,


   function Private_Part_Declarative_Items
      (Package_Specification : in Declaration)
     return Declarative_Item_List;

   -- Returns a list of all basic declarations, representation specifications,
   -- and use clauses in the private part of a package in the order of
   -- appearance.
   --
   -- Results of this operation may vary across ASIS implementations.
   -- Some implementations normalize all multiple object declarations into
   -- an equivalent sequence of corresponding single object declarations.
   -- See LRM 3.2(10).
   --
   -- Appropriate Declaration Kinds:
   --   A_Package_Declaration,
   --   A_Generic_Package_Declaration,
   --   A_Package_Instantiation,


   function Package_Body_Block (Package_Body : in Declaration)
     return Statement;

   -- Returns the block statement for the body including the declarative
   -- part, sequence of statements, and exception handlers, if any.
   --
   -- A Nil_Element is returned if the body is a body stub, or
   -- if the body of a package instantiation does not exist.
   --
   -- Appropriate Declaration Kinds:
   --   A_Package_Body_Declaration,
   --   A_Package_Instantiation,
   --   A_Package_Body_Stub,


   ------------------------------------------------------------------
   -- RENAMING DECLARATIONS
```

```
-- LRM Section 8.5


function Is_Renaming_Declaration (A_Declaration : in Declaration)
  return Boolean;

-- Returns True for declarations that are one of the forms of renaming
-- declarations.
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Declaration) = Not_A_Declaration


function Renamed_Entity (Renaming_Declaration : in Declaration)
  return Name_Expression;

-- Returns the Name_expression that follows the reserved word renames
-- in the Renaming_Declaration.
--
-- Raises Inappropriate_Program_Element
-- if not Is_Renaming_Declaration(Renaming_Declaration)


function Renamed_Base_Entity (Renaming_Declaration : in Declaration)
  return Name_Expression;

-- Unwinds recursive renamings to return the Name_expression that is
-- not itself a renamed entity.
--
-- Raises Inappropriate_Program_Element
-- if not Is_Renaming_Declaration(Renaming_Declaration)



------------------------------------------------------------
-- TASK DECLARATIONS
-- LRM Chapter 9


function Task_Declaration_Declarative_Items
   (Task_Declaration : in Declaration)
  return Declarative_Item_List;

-- Returns a list of entry declarations, and representation clauses
-- in the task declaration in order of appearance.
```

```
--
-- Further Analysis:
--   Use ASIS_Declarations operations for subprogram declarations to
--   decompose task entries.
--   Use ASIS_Representation_Clauses operations to analyze representation
--   clauses that apply to the entries.
--
-- Appropriate Declaration Kinds:
--   A_Task_Declaration
--   A_Task_Type_Declaration
--
-- Task type declarations can also be analyzed by getting the type_definition
-- part and then calling ASIS_Type_Definitions.Task_Type_Declarative_Items.


function Task_Body_Block (Task_Body : in Declaration) return Statement;

-- Returns the block statement for the body including the declarative part,
-- any elaboration statements, and exception handler if any.
--
-- A Nil_Element is returned if the body is a body stub.
--
-- Appropriate Declaration Kinds:
--   A_Task_Body_Declaration,
--   A_Task_Body_Stub,


-------------------------------------------------------------------
-- ENTRY DECLARATIONS
-- LRM Section 9.5


subtype Entry_Declaration_List is ASIS_Ada_Program.Element_List;

function Entry_Declarations (Task_Declaration : in Declaration)
  return Entry_Declaration_List;

-- Returns a list of entry declarations associated with a task declaration.
--
-- The operations available for decomposing subprogram specifications
-- will also work for entry declarations.
--
-- Appropriate Declaration Kinds:
--   A_Task_Declaration,
--   A_Task_Type_Declaration,
```

```
subtype Discrete_Range is ASIS_Ada_Program.Element;
  -- Use ASIS_Type_Definitions operations to analyze discrete ranges.

function Family_Index (Entry_Family : in Declaration)
  return Discrete_Range;

-- Returns the index discrete range for the entry family.
--
-- If the entry is not a family, a nil element is returned.
--
-- Appropriate Declaration Kinds:
--   An_Entry_Declaration


-------------------------------------------------------------
-- SUBUNITS AND BODY STUBS - LRM 10.2

-- Use ASIS_COMPILATION_UNTIS operations to examine subunits as
-- compilation units.


function Is_Subunit (A_Declaration : in Declaration) return Boolean;

-- Returns True if the declaration is the declaration part of a subunit.
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Declaration) = Not_A_Declaration


function Subunit (Body_Stub        : in Declaration)
  return Declaration;

function Subunit (Body_Stub        : in Declaration;
                  Program_Library  : in Library)
  return Declaration;

-- Returns the Subunit Declaration corresponding to the body stub.
--
-- A Nil_Element is returned if the subunit does not exist.
--
-- Appropriate Declaration Kinds:
--   Any declaration for which Is_Body_Stub(Body_Stub) = True.
```

```
function Is_Body_Stub (A_Declaration : in Declaration) return Boolean;

-- Returns true if the Declaration is:
--   A_Package_Body_Stub,
--   A_Function_Body_Stub,
--   A_Procedure_Body_Stub,
--   A_Task_Body_Stub,
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Declaration) = Not_A_Declaration


function Body_Stub (Subunit : in Declaration) return Declaration;

-- Returns the body stub declaration in the subunit's parent unit.
--
-- A Nil_Element is returned if not the body stub does not exist.
--
-- Appropriate Declaration Kinds:
--   Any declaration for which Is_Subunit(Subunit) = True.


------------------------------------------------------------------
-- EXCEPTION DECLARATIONS
-- LRM Chapter 11

-- Use Identifiers to get a list of identifier definitions introduced
-- by an exception declaration.


------------------------------------------------------------------
-- GENERIC PACKAGE and SUBPROGRAM SPECIFICATIONS
-- LRM Chapter 12


function Is_Generic (Package_Or_Subprogram_Declaration : in Declaration)
  return Boolean;

-- Determines if the declaration is a generic specification or body.
--
-- Returns True if the declaration returned by a call to
-- Specification(Package_Or_Subprogram_Decl) is:
--   A_Generic_Package_Declaration,
--   A_Generic_Procedure_Declaration,
```

```
--   A_Generic_Function_Declaration,
--
-- Appropriate Declaration Kinds:
--   Any declaration for which Is_Subprogram returns True
--   Any declaration for which Is_Package returns True


subtype Generic_Formal_Parameter is Declaration;

subtype Generic_Formal_Parameter_List is ASIS_Ada_Program.Element_List;


function Generic_Formal_Parameters (Generic_Declaration : in Declaration)
  return Generic_Formal_Parameter_List;

-- Returns a list of generic formal parameter declarations in order of
-- appearance.
--
-- Results of this operation may vary across ASIS implementations.
-- Some implementations normalize all multiple object declarations into
-- an equivalent sequence of corresponding single object declarations.
-- See LRM 3.2(10).
--
-- Further Analysis:
--   Object parameters can be decomposed with formal parameter
--     and object declaration operations.
--   The mode of a generic formal object can be determined using the
--     Parameter_Kind operation.
--   Array and access type declarations can be decomposed with the
--     operations corresponding to their types.
--   Subprogram parameters can be queried by the following operations and
--     can be further decomposed with subprogram declaration operations.
--
-- Appropriate Declaration Kinds:
--   A_Generic_Package_Declaration,
--   A_Generic_Procedure_Declaration,
--   A_Generic_Function_Declaration,


function Is_Generic_Formal (Program_Element : in Element) return Boolean;

-- Returns true if a subprogram, type or object declaration is a generic
-- formal parameter.
--
-- Raises Inappropriate_Program_Element if the element is a Nil_Element.
```

```
type Generic_Formal_Subprogram_Default_Kinds is

   (A_Box,
    A_Name,
    None,
    Not_A_Generic_Formal_Subprogram_Default);

function Generic_Formal_Subprogram_Default_Kind
   (A_Generic_Formal_Subprogram : in Generic_Formal_Parameter)
  return Generic_Formal_Subprogram_Default_Kinds;

-- Returns the kind of the given generic formal subprogram default.
-- Returns Not_A_Generic_Formal_Subprogram_Default for any inappropriate
-- element such as a Statement, Expression, or Nil_Element.


function Generic_Formal_Subprogram_Default
   (A_Generic_Formal_Subprogram : in Generic_Formal_Parameter)
  return Name_Expression;

-- Returns the name appearing after the reserved word is in the given
-- generic formal subprogram declaration.
--
-- Raises Inappropriate_Program_Element if
-- Generic_Formal_Subprogram_Default_Kind(A_Generic_Formal_Subprogram)
--  /= A_Name


-------------------------------------------------------------
-- GENERIC INSTANTIATION
-- LRM Section 12.3

-- Instantiations can be analyzed in terms of the generic actual parameters
-- supplied with the instantiation.  An instance is a copy of the generic
-- unit, and while there is no explicit specification in the program text,
-- an implicit specification and body, if there is one, with the generic
-- actual parameters is implied.
--
-- To analyze the template specification or body of a generic instantiation:
--   Use Generic_Unit_Name to obtain the name of the generic unit.
--   Then use ASIS_Names_And_Expressions.Named_Declaration to get to the
--     generic declaration.
--   Then use Unit_Body to get to the body of the generic declaration.
```

```
function Is_Generic_Instantiation
   (Package_Or_Subprogram_Declaration : in Declaration)
  return Boolean;

-- Returns True if the declaration is:
--   A_Package_Instantiation,
--   A_Procedure_Instantiation,
--   A_Function_Instantiation,
--
-- Raises Inappropriate_Program_Element
-- if Kind(Package_Or_Subprogram_Declaration) = Not_A_Declaration


function Generic_Unit_Name (Generic_Instantiation : in Declaration)
  return Name_Expression;

-- Returns the name expression following the reserved word new in the
-- generic instantiation.  The name denotes the generic package, generic
-- procedure, or generic function that is the template for the instance.
--
-- Appropriate Declaration Kinds:
--   A_Package_Instantiation,
--   A_Procedure_Instantiation,
--   A_Function_Instantiation,



subtype Generic_Association_List is ASIS_Ada_Program.Element_List;

function Generic_Associations
   (Generic_Instantiation : in Declaration;
    Include_Defaults      : in Boolean := False)
  return Generic_Association_List;

-- Returns an ordered list of generic associations from the generic
-- actual part of an instantiation.
--
-- If Include_Defaults is True:
--   The (unspecified) default associations will also be included and,
--   the list will be ordered to match the declaration order of the
--   corresponding generic formal parameters.
--
-- If Include_Defaults is False:
```

```
   --    Only explicit actual parameters will be included in the order they
   --    appeared in the program text.
   --
   -- An ASIS implementation may choose to always "Include Defaults" its
   -- internal representation.  If that is the case, the operation will
   -- always behave as if Include_Defaults is True.
   --
   -- Appropriate Declaration Kinds:
   --    A_Package_Instantiation,
   --    A_Procedure_Instantiation,
   --    A_Function_Instantiation,
   --
   -- To map generic actual parameters to corresponding generic formal
   -- parameters:
   --
   --    Create an actual parameter list by applying the function
   --    ASIS_Statements.Actual_Parameter to each generic association
   --    returned by Generic_Actual_Parameters with Include_Defaults = True.
   --
   --    Create a formal parameter list by applying the function
   --    ASIS_Declarations.Identifiers to each formal parameter
   --    declaration returned by Generic_Formal_Parameters.
   --
   --    The Expression elements in the actual parameters list will have a
   --    one to one correspondence with the Identifier_Definition elements
   --    in the formal parameter list.


   function Generic_Associations_Include_Defaults return Boolean;

   -- Returns True if this implementation will always "Include Defaults".
   -- If that is the case, the Generic_Associations operation will always
   -- behave as if its parameter Include_Defaults is True.


end ASIS_Declarations;
```

```
-------------------------------------------------------------------------
-- ASIS PRELIMINARY REVIEW VERSION 0.4
-- Sept 27, 1991
-------------------------------------------------------------------------


with ASIS_Ada_Program;
package ASIS_Type_Definitions is

  -- LRM Chapter 3

  subtype Element is ASIS_Ada_Program.Element;
    -- Use ASIS_Elements operations.

  subtype Type_Definition is ASIS_Ada_Program.Type_Definition;
    -- Use ASIS_Type_Definitions operations.

  subtype Declaration is ASIS_Ada_Program.Declaration;
    -- Use ASIS_Declarations operations.

  subtype Expression is ASIS_Ada_Program.Expression;
    -- Use ASIS_Names_And_Expression operations.

  subtype Name_Expression is ASIS_Ada_Program.Name_Expression;
    -- Use ASIS_Names_And_Expression operations.

  subtype Statement is ASIS_Ada_Program.Statement;
    -- Use ASIS_Statements operations.

  subtype Identifier_Reference is ASIS_Ada_Program.Identifier_Reference;
    -- Use ASIS_Names_And_Expression operations.

  subtype Subtype_Indication is Type_Definition;
    -- Use operations in this package and in ASIS_Names_And_Expressions.

  ---------------------------------------------------------------
  -- TYPE DEFINITION KINDS


  type Type_Definition_Kinds is

     (A_Subtype_Definition,    -- Though not an Ada term, this kind is
                               -- distinct from a subtype indication which
      -- is a component of several other
      -- Type_Definition_Kinds
```

```
    An_Enumeration_Type_Definition,
    An_Integer_Type_Definition,
    A_Float_Type_Definition,
    A_Fixed_Type_Definition,
    An_Array_Type_Definition,
    A_Record_Type_Definition,
    An_Access_Type_Definition,
    A_Derived_Type_Definition,
    A_Task_Type_Definition,
    A_Private_Type_Definition,
    A_Limited_Private_Type_Definition,

    A_Generic_Discrete_Subtype_Definition,
    A_Generic_Integer_Subtype_Definition,
    A_Generic_Float_Subtype_Definition,
    A_Generic_Fixed_Subtype_Definition,
    A_Generic_Array_Type_Definition,
    A_Generic_Access_Type_Definition,
    A_Generic_Private_Type_Definition,
    A_Generic_Limited_Private_Type_Definition,

    Not_A_Type_Definition);


function Kind (A_Type_Definition : in Type_Definition)
  return Type_Definition_Kinds;

-- Returns the kind of the Type_Definition.
--
-- Returns Not_A_Type_Definition for any inappropriate element such as
-- a Statement, Declaration, or Nil_Element.


------------------------------------------------------------------

function Type_Definition_Declaration (A_Type_Definition : in Type_Definition)
  return Declaration;

-- Returns the type declaration or the object declaration associated
-- with the type definition.
-- A Nil_Element is returned when the type declaration is anonymous.
-- EG. the type_definition is An_Array_Type_Definition from an object
-- declaration.
--
```

```
-- Raises Inappropriate_Program_Element
-- if Kind(A_Type_Definition) = Not_A_Type_Definition


------------------------------------------------------------
-- TYPES AND SUBTYPES - LRM 3.3


function Base_Type (A_Type_Definition : in Type_Definition)
  return Type_Definition;

-- Returns the base type of the specified type definition as per LRM 3.3.
-- All subtypes are constraints applied to some base type.  This function
-- returns that base type.
--
-- This is an identity function if the type definition of a base type
-- is given.
--
-- A Nil_Element is returned when the type definition is from an
-- anonymous type or from a predefined type.

-- Raises Inappropriate_Program_Element
-- if Kind(A_Type_Definition) = Not_A_Type_Definition


function Last_Constraint (A_Type_Definition : in Type_Definition)
  return Type_Definition;

-- This function recursively unwinds subtyping to arrive at a type
-- definition which is either the base_type or a subtype that imposes
-- an explicit constraint.
--
-- This is an identity function if the type definition is not
-- A_Subtype_Definition.
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Type_Definition) = Not_A_Type_Definition


function Last_Subtype (A_Type_Definition : in Type_Definition)
  return Type_Definition;

-- This function unwinds subtyping one step at a time to return a type
-- definition which is either the base_type or a subtype that imposes
-- constraints (the case where the constraint imposes no restriction is
```

```
-- also included).  LRM 3.3(4).
--
-- This is an identity function if the type definition is not
-- A_Subtype_Definition.
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Type_Definition) = Not_A_Type_Definition


function Subtype_Definition_Subtype_Indication
   (Subtype_Definition : in Type_Definition)
  return Subtype_Indication;

-- Returns the subtype indication associated with the subtype definition.
--
-- Raises Inappropriate_Program_Element
-- if Kind(Subtype_Definition) /= A_Subtype_Definition.


------------------------------------------------------------
-- DERIVED TYPES - LRM 3.4

function Parent_Subtype (Derived_Type : in Type_Definition)
  return Subtype_Indication;

-- Returns the subtype indication associated with the derived type.
-- The subtype indication after the reserved word new defines the
-- parent subtype.
--
-- Raises Inappropriate_Program_Element
-- if Kind(Derived_Type) /= A_Derived_Type_Definition.


function Parent_Type (Derived_Type : in Type_Definition)
  return Type_Definition;

-- Returns the parent type of the specified derived type definition as
-- per LRM 3.4.
-- The parent type is the base type of the parent subtype.
--
-- Appropriate Type_Definition Kinds:
--   A_Derived_Type_Definition
```

```
------------------------------------------------------------

function Ground_Type (A_Type_Definition : in Type_Definition)
  return Type_Definition;

-- This function recursively unwinds all type derivations and subtyping
-- to arrive at a type definition which is neither a derived type or a
-- subtype.
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Type_Definition) = Not_A_Type_Definition



------------------------------------------------------------
--
-- Examples of base type, parent type, and ground type.
--
-- type Number is new Integer range 0 .. 100;
--   A derived type definition defines a new base type whose
--   characteristics are derived from those of a parent type.
--
--   The base type of Number is Number.
--   The parent type of Number is Integer.
--   The ground type of Number is Integer.
--
--
-- subtype Day_Number is Number range 1 .. 31;
--
--   A subtype indication defines a subtype of the base type of the
--   type mark.
--
--   The base type of Day_Number is Number.
--   The parent type of Day_Number is Integer.
--   The ground type of Day_Number is Integer.
--
--
-- type Week_Day is new Day_Number range 1 .. 7;
--
--   The subtype indication after the reserved word new defines the
--   parent subtype. The parent type is the base type of the parent subtype.
--
--   The base type of Week_Day is Number.
--   The parent type of Week_Day is Number.
--   The ground type of Week_Day is Integer.
```

```
--
-------------------------------------------------------------


function Type_Structure (A_Type_Definition : in Type_Definition)
  return Type_Definition;

-- Returns the type structure from which the specified type definition has
-- been derived.  This function will unwind recursive derivations until the
-- type definition derives a new representation or is no longer derived.
-- This function is different from GROUND_TYPE only for enumeration types or
-- record types that have derivations with rep specs.
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Type_Definition) = Not_A_Type_Definition


function Is_Predefined (A_Type_Definition : in Type_Definition)
  return Boolean;

-- Returns true if the base type of the type definition is one of:
-- Boolean, Character, String, Integer, Natural, Positive, Float, Duration,
-- or any other type declared in the predefined package Standard.
--
-- TRUE  if given type definition of:
--   subtype Weight is Natural range 0..50;
-- FALSE if given type definition of:
--   type Weight is new Natural is range 1..10;
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Type_Definition) = Not_A_Type_Definition


-------------------------------------------------------------
-- CONSTRAINTS


subtype Constraint is ASIS_Ada_Program.Element;

type Constraint_Kinds is

   (A_Simple_Range,
    A_Range_Attribute,
    A_Floating_Point_Constraint,
    A_Fixed_Point_Constraint,
```

```
    An_Index_Constraint,
    A_Discriminant_Constraint,
    Not_A_Constraint);

function Constraint_Kind (A_Constraint : in Constraint)
  return Constraint_Kinds;

-- Returns the kind of the Constraint.
--
-- Returns Not_A_Constraint for any inappropriate element such as
-- a Statement, Declaration, or Nil_Element.


subtype Discriminant_Association_List is ASIS_Ada_Program.Element_List;

function Discriminant_Associations
   (Discriminant_Constraint : in Constraint;
    Include_Defaults        : in Boolean := False)
  return Discriminant_Association_List;

-- Returns the list of discriminant associations of a discriminant
-- constraint.
--
-- If Include_Defaults is True:
--   The (unspecified) default associations will also be included and,
--   The list will be ordered to match the declaration order of the
--   identifiers in the corresponding discriminant specifications.
--
-- If Include_Defaults is False:
--   Only explicit discriminant associations will be included in the
--   order they appeared in the program text.
--
-- An ASIS implementation may choose to always "Include Defaults" its
-- internal representation.  If that is the case, the operation will
-- always behave as if Include_Defaults is True.
--
-- Raises Inappropriate_Program_Element
-- if Constraint_Kind(Discriminant_Constraint)
--   /= A_Discriminant_Constraint


function Discriminant_Associations_Include_Defaults return Boolean;

-- Returns True if this implementation will always "Include Defaults".
-- If that is the case, the Discriminant_Associations operation will
```

```
-- always behave as if its parameter Include_Defaults is True.


subtype Discriminant_Association is ASIS_Ada_Program.Element;

subtype Identifier_Reference_List is ASIS_Ada_Program.Element_List;

function Discriminant_Simple_Names
   (A_Discriminant_Association : in Discriminant_Association)
  return Identifier_Reference_List;

-- Returns the list of simple names in the discriminant association.
-- Will be a nil list if positional notation is used.
--
-- Raises Inappropriate_Program_Element
-- if ASIS_Elements.Major_Element_Kind(A_Discriminant_Association) /=
-- A_Discriminant_Association


function Discriminant_Expression
   (A_Discriminant_Association : in Discriminant_Association)
  return Expression;

-- Returns the expression for the discriminant association.
--
-- Raises Inappropriate_Program_Element
-- if ASIS_Elements.Major_Element_Kind(A_Discriminant_Association) /=
-- A_Discriminant_Association



-------------------------------------------------------------------
-- DISCRETE RANGES


subtype Discrete_Range is ASIS_Ada_Program.Element;  -- LRM 3.6

type Discrete_Range_Kinds is

   (A_Simple_Range,
    A_Range_Attribute,
    A_Discrete_Subtype_Indication,
    Not_A_Discrete_Range);

function Discrete_Range_Kind (A_Discrete_Range : in Discrete_Range)
```

```
   return Discrete_Range_Kinds;

-- Returns the kind of the Discrete_Range.
--
-- Returns Not_A_Discrete_Range for any inappropriate element such as
-- a Statement, Declaration, or Nil_Element.


-------------------------------------------------------------------
-- RANGE CONSTRAINT


subtype Range_Constraint is ASIS_Ada_Program.Element;

function Lower_Bound
   (Simple_Range_Constraint : in Range_Constraint)
  return Expression;

-- Returns the simple expression for the lower bound of a simple range.
--
-- Appropriate elements of the subtypes constraint or discrete range:
-- Appropriate Constraint Kinds:
--   A_Simple_Range
-- Appropriate Discrete_Range Kinds:
--   A_Simple_Range


function Upper_Bound
   (Simple_Range_Constraint : in Range_Constraint)
  return Expression;

-- Returns the simple expression for the upper bound of a simple range.
--
-- Appropriate elements of the subtypes constraint or discrete range:
-- Appropriate Constraint Kinds:
--   A_Simple_Range
-- Appropriate Discrete_Range Kinds:
--   A_Simple_Range


function Range_Attribute
   (Range_Attribute_Constraint : in Range_Constraint)
  return Expression;

-- Returns the range attribute expression supplying the range.
```

```
-- Accepts elements of the subtypes constraint or discrete range.
--
-- Further Analysis:
--   Range attributes are expressions and can be analyzed by using
--   the attribute operations in ASIS_Names_And_Expressions.
--
-- Appropriate Constraint Kinds:
--   A_Range_Attribute
-- Appropriate Discrete_Range Kinds:
--   A_Range_Attribute


-------------------------------------------------------------
-- CHOICES


subtype Choice is ASIS_Ada_Program.Element;

type Choice_Kinds is

   (A_Simple_Expression,
    A_Discrete_Range,
    An_Others_Choice,
    A_Simple_Name,
    An_Exception_Name,
    Not_A_Choice);

function Choice_Kind (A_Choice : in Choice) return Choice_Kinds;

-- Returns the kind of the choice.
-- Returns Not_A_Choice for any inappropriate element such as
-- a Statement, Declaration, or Nil_Element.


function Choice_Simple_Expression (A_Choice : in Choice) return Expression;

-- Returns the expression associated with the choice.
--
-- Appropriate Choice Kinds:
--   A_Simple_Expression


function Choice_Discrete_Range (A_Choice : in Choice) return Discrete_Range;

-- Returns the discrete range associated with the choice.
```

```
--
-- Appropriate Choice Kinds:
--   A_Discrete_Range


function Choice_Name (A_Choice : in Choice) return Name_Expression;

-- Returns the simple name or exception name associated with the choice.
--
-- Appropriate Choice Kinds:
--   A_Simple_Name
--   An_Exception_Name


------------------------------------------------------------------
-- SUBTYPE_INDICATIONS AND TYPE_MARKS - LRM 3.3.2


function Type_Mark (A_Subtype_Indication : in Subtype_Indication)
  return Name_Expression;

-- Returns the type mark of a subtype indication or a discrete subtype
-- indication.
--
-- Appropriate Type_Definition Kinds:
--   A_Subtype_Indication
--
-- Appropriate Discrete_Range Kinds:
--   A_Discrete_Subtype_Indication
--
-- Use Index_Subtype_Definitions query to get the type mark(s) from
-- unconstrained array Index_Subtype_Definition(s).


function Subtype_Constraint (A_Subtype_Indication : in Subtype_Indication)
  return Constraint;

-- Returns the constraint applied to the subtype indication.
-- A Nil_Element is returned if no constraint is present.
--
-- Appropriate Type_Definition Kinds:
--   A_Subtype_Indication
--
-- Appropriate Discrete_Range Kinds:
--   A_Discrete_Subtype_Indication
```

```
------------------------------------------------------------
-- ENUMERATION TYPES - LRM 3.5.1

subtype Declaration_List is ASIS_Ada_Program.Element_List;

function Enumeration_Literal_Declarations
   (Enumeration_Type : in Type_Definition)
  return Declaration_List;

-- Returns a list of the literals declared in an enumeration type
-- declaration.  Each of these elements is a Declaration.
--
-- Appropriate Type_Definition Kinds:
--   An_Enumeration_Type_Definition


subtype Identifier_Definition_List is ASIS_Ada_Program.Element_List;

function Enumeration_Literal_Identifiers
   (Enumeration_Type : in Type_Definition)
  return Identifier_Definition_List;

-- Returns a list of the literals declared in an enumeration type
-- declaration.  Each of these elements is an Identifier_Definition.
--
-- Appropriate Type_Definition Kinds:
--   An_Enumeration_Type_Definition


------------------------------------------------------------
-- INTEGER TYPES - LRM 3.5.4


function Integer_Constraint (Integer_Type : in Type_Definition)
  return Range_Constraint;

-- Returns the range constraint on the integer type definition.
--
-- A Nil_Element may be returned by some ASIS implementations if the
-- integer type is a predefined type.
--
-- Appropriate Type_Definition Kinds:
--   An_Integer_Type_Definition
```

```
------------------------------------------------------------
-- REAL TYPES - LRM 3.5.6


function Real_Type_Constraint (Real_Type : in Type_Definition)
  return Constraint;

-- Returns the floating point constraint from a A_Float_Type_Definition
-- or the fixed point constraint from A_Fixed_Type_Definition.
--
-- A Nil_Element may be returned by some ASIS implementations if the
-- real type is a predefined type.
--
-- Appropriate Type_Definition Kinds:
--   A_Float_Type_Definition
--   A_Fixed_Type_Definition

-- Primary

function Floating_Accuracy_Definition
   (Floating_Point_Constraint : in Constraint)
  return Expression;

-- Returns the static simple expression following the reserved word digits
-- in the floating accuracy definition of a floating point constraint.
--
-- Appropriate Constraint Kinds:
--   A_Floating_Point_Constraint


function Floating_Point_Range_Constraint
   (Floating_Point_Constraint : in Constraint)
  return Range_Constraint;

-- Returns the optional range constraint of a floating point constraint.
--
-- A Nil_Element is returned if there is no range constraint.
--
-- Appropriate Constraint Kinds:
--   A_Floating_Point_Constraint


function Fixed_Accuracy_Definition
```

```
   (Fixed_Point_Constraint : in Constraint)
  return Expression;

-- Returns the static simple expression following the reserved word delta
-- in the fixed accuracy definition of a fixed point constraint.
--
-- Appropriate Constraint Kinds:
--   A_Fixed_Point_Constraint


function Fixed_Point_Range_Constraint
   (Fixed_Point_Constraint : in Constraint)
  return Range_Constraint;

-- Returns the optional range constraint of the fixed point type definition.
--
-- A Nil_Element is returned if there is no range constraint.
--
-- Appropriate Constraint Kinds:
--   A_Fixed_Point_Constraint


------------------------------------------------------------
-- ARRAY TYPES - LRM 3.6


function Is_Constrained_Array (Array_Type : in Type_Definition)
  return Boolean;

-- Returns True if the array type definition denotes a constrained array.
--
-- Appropriate Type_Definition Kinds:
--   An_Array_Type_Definition
--   A_Generic_Array_Type_Definition



function Index_Constraint (Constrained_Array_Type : in Type_Definition)
  return Constraint;

-- Returns the index constraint for a constrained array type declaration.
--
-- A constrained array definition has one index constraint which defines
-- one or more discrete ranges.
--
```

```
-- Use the Discrete_Ranges operation to decompose the index constraint.
--
-- Raises Inappropriate_Program_Element
-- if not Is_Constrained_Array(Constrained_Array_Type) = True


subtype Discrete_Range_List is ASIS_Ada_Program.Element_List;

function Discrete_Ranges (Index_Constraint : in Constraint)
  return Discrete_Range_List;

-- Returns the list of Discrete_Range components of an Index_Constraint
--
-- Raises Inappropriate_Program_Element
-- if Constraint_Kind(Index_Constraint) /= An_Index_Constraint


subtype Name_Expression_List is ASIS_Ada_Program.Element_List;

function Index_Subtype_Definitions
   (Unconstrained_Array_Type : in Type_Definition)
  return Name_Expression_List;

-- Returns a list of the Index_Subtype_Definition (Type_Mark range <>)
-- for an unconstrained array type definition.
--
-- The list contains elements of the subtype Name_Expression
-- representing the Type_Mark(s).
--
-- Raises Inappropriate_Program_Element
-- if Is_Constrained_Array(Unconstrained_Array_Type) = True


function Component_Subtype_Indication (Array_Type : in Type_Definition)
  return Subtype_Indication;

-- Returns the component subtype indication of the array type.
--
-- A Nil_Element may be returned by some ASIS implementations if the
-- array type is a predefined type.
--
-- Appropriate Type_Definition Kinds:
--   An_Array_Type_Definition
--   A_Generic_Array_Type_Definition
```

```
-------------------------------------------------------------
-- RECORD TYPES - LRM 3.7


subtype Record_Component is ASIS_Ada_Program.Element;

subtype Variant is ASIS_Ada_Program.Element;


function Is_Discriminated (Record_Type : in Type_Definition) return Boolean;

-- Returns True if the record type definition has discriminants.
--
-- Appropriate Type_Definition Kinds:
--   A_Record_Type_Definition


subtype Discriminant_Specification_List is ASIS_Ada_Program.Element_List;

function Discriminants (Record_Type : in Type_Definition)
  return Discriminant_Specification_List;

-- Returns a list of discriminant specification declarations
-- in their order of appearance.
--
-- A Nil list is returned if the record type definition has no
-- discriminants.
--
-- Further Analysis:
--   Use ASIS_DECLARATIONS operations to decompose discriminant
--   specifications.
--
-- Appropriate Type_Definition Kinds:
--   A_Record_Type_Definition


subtype Record_Component_List is ASIS_Ada_Program.Element_List;

function Record_Components (Record_Type : in Type_Definition)
  return Record_Component_List;

-- Returns a list of the components of the record definition.
--
-- Appropriate Type_Definition Kinds:
```

```
--   A_Record_Type_Definition


type Component_Kinds is

   (A_Null_Component,
    A_Component_Declaration,
    A_Variant_Part,
    Not_A_Component);

function Component_Kind (Component : in Record_Component)
  return Component_Kinds;

-- Returns the kind of the component.
--
-- Returns Not_A_Component for any inappropriate element such as
-- a Statement, Expression, or Nil_Element.

-- Component declarations can be analyzed using the ASIS_DECLARATIONS
-- operations.


function Corresponding_Discriminant_Simple_Name
   (Variant_Part : in Record_Component)
  return Identifier_Reference;

-- Returns the discriminant simple name in the variant part.
--
-- Raises Inappropriate_Program_Element
-- if Component_Kind(Variant_Part) /= A_Variant_Part.


subtype Variant_List is ASIS_Ada_Program.Element_List;

function Variants (Variant_Part : in Record_Component) return Variant_List;

-- Returns a list of variants that make up the record component.
--
-- Raises Inappropriate_Program_Element
-- if Component_Kind(Variant_Part) /= A_Variant_Part.


subtype Choice_List is ASIS_Ada_Program.Element_List;

function Variant_Choices (A_Variant : in Variant) return Choice_List;
```

```
-- Returns a list of the 'WHEN <choice> | <choice>' choices.
-- Use the CHOICES operations to extract further information.
--
-- Raises Inappropriate_Program_Element
-- if ASIS_Elements.Major_Element_Kind(A_Variant) /= A_Variant


subtype Variant_Component_List is ASIS_Ada_Program.Element_List;

function Variant_Components (A_Variant: in Variant)
  return Variant_Component_List;

-- Returns a list of the record components of the variant.
--
-- Further Analysis:
-- Use the Component_Kind operation to analyze the variant components.
--
-- Raises Inappropriate_Program_Element
-- if ASIS_Elements.Major_Element_Kind(A_Variant) /= A_Variant


-------------------------------------------------------------
-- ACCESS TYPES - LRM 3.8

function Access_To (Access_Type : in Type_Definition)
  return Subtype_Indication;

-- Returns the subtype indication following the reserved word access
-- in the access type definition.
--
-- Appropriate Type_Definition Kinds:
--   An_Access_Type_Definition.
--   A_Generic_Access_Type_Definition.


-------------------------------------------------------------
-- TASK SPECIFICATIONS
-- LRM Chapter 9

subtype Declarative_Item_List is ASIS_Ada_Program.Element_List;

function Task_Type_Declarative_Items (Task_Type : in Type_Definition)
  return Declarative_Item_List;
```

```
   -- Returns a list of entry declarations and representation clauses
   -- in the specification of a task type in order of appearance.
   --
   -- Further Analysis:
   --   Use ASIS_Declarations operations for subprogram declarations to
   --   decompose task entries.
   --   Use ASIS_Representation_Clauses operations to analyze representation
   --   clauses that apply to the entries.
   --
   -- Appropriate Type_Definition Kinds:
   --   A_Task_Type_Definition



end ASIS_Type_Definitions;
```

```
-------------------------------------------------------------------------
-- ASIS PRELIMINARY REVIEW VERSION 0.4
-- Sept 27, 1991
-------------------------------------------------------------------------


with ASIS_Ada_Program;
package ASIS_Names_And_Expressions is

   -- LRM Chapter 4

   subtype Element is ASIS_Ada_Program.Element;
     -- Use ASIS_Elements operations.

   subtype Expression is ASIS_Ada_Program.Element;
     -- Use ASIS_Names_And_Expression operations.

   subtype Name_Expression is ASIS_Ada_Program.Element;
     -- Use ASIS_Names_And_Expression operations.

   subtype Declaration is ASIS_Ada_Program.Element;
     -- Use ASIS_Declarations operations.
```

```
subtype Statement is ASIS_Ada_Program.Element;
  -- Use ASIS_Statements operations.

subtype Type_Definition is ASIS_Ada_Program.Element;
  -- Use ASIS_Type_Definitions operations.


-----------------------------------------------------------------
-- NAME AND EXPRESSION KINDS


type Name_And_Expression_Kinds is

   (A_Simple_Name,                          -- LRM 4.1
    An_Operator_Symbol,                     -- LRM 4.1
    A_Character_Literal,                    -- LRM 4.2
    An_Enumeration_Literal,                 -- LRM 4.2

    An_Indexed_Component,                   -- LRM 4.1.1
    A_Slice,                                -- LRM 4.1.2
    A_Selected_Component,                   -- LRM 4.1.3
    An_Attribute,                           -- LRM 4.1.4
    A_Type_Conversion,                      -- LRM 4.6
    A_Qualified_Expression,                 -- LRM 4.7
    A_Function_Call,                        -- LRM 6.4

    A_Null_Literal,                         -- LRM 4.2
    A_String_Literal,                       -- LRM 4.2
    An_Integer_Literal,                     -- LRM 4.2
    A_Real_Literal,                         -- LRM 4.2
    An_Aggregate,                           -- LRM 4.3
    A_Parenthesized_Expression,             -- LRM 4.4
    A_Special_Operation,                    -- LRM 4.4
    An_Allocation_From_Subtype,             -- LRM 4.8
    An_Allocation_From_Qualified_Expression, -- LRM 4.8

    Not_An_Expression);


function Kind (An_Expression : in Expression)
  return Name_And_Expression_Kinds;

-- Returns the kind of the Expression, Name_Expression,
-- Identifier_Definition, or Identifier_Reference.
```

```
--
-- Returns Not_An_Expression for any inappropriate element such as
-- a Statement, Declaration, or Nil_Element.


-------------------------------------------------------------------
-- THE TYPE OF AN EXPRESSION


function Expression_Type (An_Expression : in Expression)
  return Type_Definition;

-- Returns the type definition for the expression.
-- This operation does not "unwind" subtypes or derived types to get to
-- the base type or parent type definitions.  That can be accomplished
-- using ASIS_Type_Definitions operations Parent_Type and Base_Type.
--
-- Raises Inappropriate_Program_Element
-- if Kind(An_Expression) = Not_An_Expression


function Is_Universal (An_Expression : in Expression) return Boolean;

-- Returns True if the expression is of the type Universal_Integer or
-- the type Universal_Real.
--
-- Raises Inappropriate_Program_Element
-- if Kind(An_Expression) = Not_An_Expression


-------------------------------------------------------------------
-- IDENTIFIERS - LRM 2.3


subtype Identifier_Definition is ASIS_Ada_Program.Element;
subtype Identifier_Reference is ASIS_Ada_Program.Element;


type Id_Kinds is

   (An_Identifier_Definition,
    An_Identifier_Reference,
    Not_An_Identifier);

function Id_Kind (An_Identifier : in Element) return Id_Kinds;
```

```
-- Returns the kind of the Identifier_Definition or Identifier_Reference.
--
-- Returns Not_An_Identifier for any inappropriate element such as
-- a Statement, Declaration, or Nil_Element.


function String_Name (An_Identifier : in Element) return String;

-- Returns the name of the identifier.
--
-- Appropriate Id_Kinds:
--   An_Identifier_Definition,
--   An_Identifier_Reference


function Enclosing_Declaration (An_Identifier : in Identifier_Definition)
  return Declaration;

-- Returns the enclosing declaration for the identifier_definition.
--
-- This operations acts as the inverse of the ASIS_Declarations.Identifiers
-- operation when given an Identifier_Defintion.
--
-- Appropriate Kinds:
--   Any element where:
--     Id_Kind(element) = An_Identifier_Definition


-------------------------------------------------------------------
-- REFERENCES OF NAMED ENTITIES


subtype Identifier_List is ASIS_Ada_Program.Element_List;

function References
   ( Named_Entity : in Element;
     Context      : in Element )
  return Identifier_List;

-- Returns all direct references of the given Element within the given
-- context.
--
-- Appropriate Elements:
--   An Identifier_Definition, Identifier_Reference, Name_Expression, or
```

```
--   expression whose ASIS_Names_And_Expressions.Kind is:
--     A_Simple_Name,
--     An_Operator_Symbol,
--     A_Character_Literal,
--     An_Enumeration_Literal,


function Is_Referenced
   (Named_Entity : in Element;
    Context      : in Element )
  return Boolean;

-- Returns true if the Named_Entity is referenced within the given
-- context.
--
-- The search is discontinued after first reference is found.
--
-- Appropriate Elements:
--   An Identifier_Definition, Identifier_Reference, or Name_Expression
--   whose Name_And_Expression_Kind is:
--     A_Simple_Name,
--     An_Operator_Symbol,
--     A_Character_Literal,
--     An_Enumeration_Literal,


subtype Expression_List is ASIS_Ada_Program.Element_List;

function Used_Names (An_Expression : in Expression) return Expression_List;

-- Returns a list of names of objects/types, operators, and literals
-- in an expression.
-- EG. the expression (A + B.D (Q'(4))) would return the list :
--      A   : A_SIMPLE_NAME
--      +   : AN_OPERATOR_SYMBOL
--      B.D : A_SELECTED_COMPONENT
--      Q   : A_SIMPLE_NAME
--      4   : AN_INTEGER_LITERAL
--
-- The list may vary from one ASIS implementation to another
-- due to constant folding or other vendor dependent normalizations.
-- However, the lists are always semantically equivalent.
--
-- Raises Inappropriate_Program_Element
-- if Kind(An_Expression) = Not_An_Expression
```

```
-----------------------------------------------------------------------
-- DEFINITION OF REFERENCED NAME


function Definition (A_Reference : in Element) return Identifier_Definition;

-- Returns the first definition of the given reference.
--
-- A Nil_Element is returned if the element references a declaration that
-- is either predefined or implicit.
--
-- If given an Identifier_Definition, the same element is returned.
--
-- Appropriate Expression Kinds:
--   A_Simple_Name,
--   An_Operator_Symbol,
--   A_Character_Literal,
--   An_Enumeration_Literal,
--   An_Indexed_Component,
--   A_Slice,
--   A_Selected_Component,
--   An_Attribute,


function Enclosing_Name_Expression (An_Identifier : in Identifier_Reference)
  return Name_Expression;

-- Returns the outermost name_expression that contains the
-- identifier_reference.
--
-- Appropriate Kinds:
--   Any element where:
--     Id_Kind(element) = An_Identifier_Reference


-----------------------------------------------------------------------
-- DECLARATIONS OF NAMED ENTITIES

function Is_Predefined (Named_Entity : in Name_Expression)
  return Boolean;

-- Returns true if the named entity denotes an element that is
-- predefined. (EG. STANDARD."+")
```

```
--
-- Appropriate Expression Kinds:
--   A_Simple_Name,
--   An_Operator_Symbol,
--   A_Character_Literal,
--   An_Enumeration_Literal,
--   An_Indexed_Component,
--   A_Slice,
--   An_Selected_Component,
--   An_Attribute
--   A_Type_Conversion
--   A_Qualified_Expression
--   A_Function_Call


function Is_Implicitly_Declared
   (Named_Entity : in Name_Expression)
  return Boolean;

-- Returns true if the named entity has no explicit
-- declaration associated with it. (EG. An implicit declaration of
-- a derived subprogram).
--
-- Appropriate Expression Kinds:
--   A_Simple_Name,
--   An_Operator_Symbol,
--   A_Character_Literal,
--   An_Enumeration_Literal,
--   An_Indexed_Component,
--   A_Slice,
--   An_Selected_Component,
--   An_Attribute
--   A_Type_Conversion
--   A_Qualified_Expression
--   A_Function_Call


function Named_Declaration
   (Named_Entity : in Name_Expression)
  return Declaration;

-- Returns the declaration of the entity denoted by the name.
--
-- A Nil_Element is returned if the element references a declaration that
-- is either predefined or implicit.
```

```
--
-- Appropriate Name_Expression Kinds:
--   A_Simple_Name,
--   An_Operator_Symbol,
--   A_Character_Literal,
--   An_Enumeration_Literal,
--   An_Indexed_Component,
--   An_Selected_Component,
--   A_Slice,
--   An_Attribute


-------------------------------------------------------------------
-- NAMES - LRM 4.1
--
-- Simple_Names and operator symbols are instances of identifier references


function Prefix (Name : in Name_Expression) return Name_Expression;

-- Returns the prefix (the construct to the left of the rightmost
-- left parenthesis in indexed or sliced objects, the rightmost 'dot' for
-- selected components, or the rightmost tick for attributes).
--
-- Appropriate Name_Expression Kinds:
--   An_Indexed_Component,
--   A_Slice,
--   A_Selected_Component,
--   An_Attribute,
--   A_Function_Call


-------------------------------------------------------------------
-- INDEXED COMPONENTS - LRM 4.1.1

function Index_Expressions (Indexed_Component : in Name_Expression)
  return Expression_List;

-- Returns a list of expressions (possibly only one) within the parenthesis.
--
-- Appropriate Name_Expression Kinds:
--   An_Indexed_Component,


-------------------------------------------------------------------
```

```
-- SLICES - LRM 4.1.2

subtype Discrete_Range is ASIS_Ada_Program.Element;
  -- Use ASIS_Type_Definitions operations to analyze discrete ranges.

function Slice_Range (Slice : in Name_Expression) return Discrete_Range;

-- Returns the discrete range of the slice.
--
-- Appropriate Name_Expression Kinds:
--   A_Slice,


-------------------------------------------------------------------- ---
-- SELECTED COMPONENTS - LRM 4.1.3

type Selection_Kinds is

   (A_Discriminant,          -- LRM 4.1.3 ( )
    A_Record_Component,      -- LRM 4.1.3 (b)
    A_Task_Entry,            -- LRM 4.1.3 (c)
    An_Access_Object,        -- LRM       (d)
    An_Expanded_Name,        -- LRM       (e,f)
    Not_A_Selection_Kind.

function Selection_Kind (Selected_Component : in Name_Expression)
  return Selection_Kinds;

-- Returns the selection kind of the selected component.
--
-- Returns Not_A_Selection_Kind for any inappropriate element such as
-- a Statement, Declaration, or Nil_Element.


function Selector (Selected_Component : in Name_Expression)
  return Name_Expression;

-- Returns the selector (the construct to the right of the rightmost
-- 'dot' in the selected component).
--
-- Appropriate Name_Expression Kinds:
--   A_Selected_Component whose Selection_Kind is:
--     A_Discriminant,
--     A_Record_Component,
--     A_Task_Entry,
```

```
--     An_Expanded_Name,


function Record_Object
   (Discriminant_Or_Component_Selection : in Name_Expression)
  return Declaration;

-- Returns the record object declaration for the selected object.
--
-- Appropriate Name_Expression Kinds:
--   A_Selected_Component whose Selection_Kind is:
--     A_Discriminant,
--     A_Record_Component,


function Selected_Component
   (Discriminant_Or_Component_Selection : in Name_Expression)
  return Declaration;

-- Returns the declaration of the Discriminant_Specification or
-- Component_Declaration in the record type declaration.
--
-- Operations in the package ASIS_Declarations can be used to
-- manipulate record components.
--
-- Appropriate Name_Expression Kinds:
--   A_Selected_Component whose Selection_Kind is:
--     A_Discriminant,
--     A_Record_Component,


function Selected_Task_Entry (Task_Entry_Selection : in Name_Expression)
  return Declaration;

-- Returns the entry declaration within the task type.
--
-- Appropriate Name_Expression Kinds:
--   A_Selected_Component whose Selection_Kind is:
--     A_Task_Entry,


function Selected_Designated_Subtype
   (Access_Object_Selection : in Name_Expression)
  return Declaration;
```

```
-- Returns the declaration of the designated subtype.  The base type of
-- this subtype is called the designated type.  The designated type is
-- returned in the absence of a subtype.
--
-- Appropriate Name_Expression Kinds:
--   A_Selected_Component whose Selection_Kind is:
--   An_Access_Object


subtype Name_Expression_List is ASIS_Ada_Program.Element_List;

function Named_Packages (A_Use_Clause : in Element)
  return Name_Expression_List;

-- Returns a list containing the Name_Expression of each package
-- mentioned in the use clause.
--
-- Results of this operation may vary across ASIS implementations.
-- Some implementations normalize all use clauses containing multiple
-- package names into an equivalent sequence of corresponding single use
-- clauses.  Similarly, an implementation may keep a name only once even
-- though that name may appear more than once in a use clause.
-- See LRM 8.4(9).
--
-- Appropriate Kinds:
--   Any element whose ASIS_Elements.Major_Element_Kind is A_Use_Clause.


-----------------------------------------------------------------------
-- ATTRIBUTES - LRM 4.1.4

function Attribute_Designator_Name (Attribute : in Name_Expression)
  return Name_Expression;

-- Returns the name expression of the attribute designator.  The name
-- expression may itself be an attribute if the given attribute is of the
-- form T'BASE'FIRST.
--
-- The attribute simple name returned here only has a name if its
-- kind = A_Simple_Name.  It is inappropriate in all other queries.
--
-- Appropriate Name_Expression Kinds:
--   An_Attribute
--
-- Further Analysis:
```

```
--  Use String_Name to get the name as a string.


function Attribute_Designator_Argument (Attribute : in Name_Expression)
  return Expression;

-- Returns the static expression associated with the optional argument
-- of the attribute designator if one exists, Nil_Element otherwise.
--
-- Appropriate Name_Expression Kinds:
--   An_Attribute


-------------------------------------------------------------------
-- LITERALS - LRM 4.2
--
-- The image of literals can be determined by using the Static_Value
-- operation.


function Is_Literal (An_Expression : in Expression) return Boolean;

-- Determines whether the expression is a literal.
--
-- Returns True if the expression is:
--   A_Character_Literal,
--   An_Enumeration_Literal,
--   A_Null_Literal,
--   A_String_Literal,
--   An_Integer_Literal,
--   A_Real_Literal,
--
-- Raises Inappropriate_Program_Element
-- if Kind(An_Expression) = Not_An_Expression


function Position_Number_Image
   (Enumeration_Or_Character_Literal : in Expression)
  return String;

-- Returns the image of the cardinality of the enumeration literal within
-- the base type of the enumeration type. (same as image of "'POS")
--
-- Appropriate Expression Kinds:
--   A_Character_Literal,
```

```
--   An_Enumeration_Literal,


function Representation_Value_Image
   (Enumeration_Or_Character_Literal : in Expression)
  return String;

-- Returns the image of the internal representation of the enumeration
-- literal.
-- (same as image of "'POS" if no rep spec defined for the enumeration type)
--
-- Appropriate Expression Kinds:
--   A_Character_Literal,
--   An_Enumeration_Literal,


function Enumeration_Type_Declaration
   (Enumeration_Or_Character_Literal : in Expression)
  return Declaration;

-- Returns the declaration of the type that contains the literal.
-- Since characters are enumerations, both regular enumeration and
-- character literals have enumeration base type declarations.
--
-- Returns a Nil_Element if
--   Is_Implicitly_Declared(Enumeration_Or_Character_Literal).
--
-- The operations in ASIS_Declarations can be used to further analyze
-- these declarations.
--
-- Appropriate Expression Kinds:
--   A_Character_Literal,
--   An_Enumeration_Literal,


-------------------------------------------------------------------------
-- AGGREGATES - LRM 4.3


subtype Component_Association is ASIS_Ada_Program.Element;

subtype Component_Association_List is ASIS_Ada_Program.Element_List;

function Components
   (Aggregate  : in Expression;
```

```
    Normalized : in Boolean := False)
  return Component_Association_List;

-- Returns a list of the component associations of an aggregate.
-- NOTE THAT NORMALIZED INFO IS NOT AVAILABLE FOR ARRAY AGGREGATES.
-- For record aggregates, the Normalized parameter has the following
-- affect:
--
-- If Normalized is True:
--   A normalized list containing all of the component associations
--   of an aggregate is returned in positional notation.
--
-- If Normalized is False:
--   Only explicit component associations will be included in the
--   order they appeared in the program text.
--
-- An ASIS implementation may choose to always "Normalize" its internal
-- representation.  If that is the case, the operation will always behave
-- as if Normalized is True.
--
-- Appropriate Expression Kinds:
--   An_Aggregate


function Components_Normalized return Boolean;

-- Returns True if this implementation will always "Normalize" record
-- aggregate components as described in the Components operation.
-- If that is the case, the Components operation will always behave as
-- if its parameter Normalized is True.


subtype Choice_List is ASIS_Ada_Program.Element_List;

function Component_Choices (Component : in Component_Association)
  return Choice_List;

-- Returns the list of choices in the aggregate component.
-- The list will be a nil list if positional notation is used.
--
-- Further Analysis:
--   Use the CHOICE operations in ASIS_Type_Definitions
--
-- Raises Inappropriate_Program_Element
-- if ASIS_Elements.Major_Element_Kind(Component) /= A_Component_Association
```

```
function Component_Expression (Component : in Component_Association)
  return Expression;

-- Returns the expression for the component association.
--
-- Raises Inappropriate_Program_Element
-- if ASIS_Elements.Major_Element_Kind(Component) /= A_Component_Association


-------------------------------------------------------------------------
-- PARENTHESIZED EXPRESSIONS - LRM 4.4


function Expression_Parenthesized (Parenthesized_Expression : in Expression)
  return Expression;

-- Returns the expression within the parenthesis.
--
-- Appropriate Expression Kinds:
--   A_Parenthesized_Expression


-------------------------------------------------------------------------
-- FUNCTION CALLS
--   AS A PRIMARY - LRM 4.4
--   OPERATORS    - LRM 4.5


function Is_Prefix_Call (Function_Call : in Expression) return Boolean;

-- Returns true if the function call is in prefix form.
-- EG. - Foo (A, B);   -- Returns TRUE
--       "<" (A, B);   -- Returns TRUE
--       ... A < B ... -- Returns FALSE
--
-- Appropriate Expression Kinds:
--   A_Function_Call


function Is_Prefix_Call_Supported return Boolean;

-- Returns True if the ASIS implementation has the ability to determine
-- whether calls are in prefix form.
```

```
function Called_Function (Function_Call : in Expression) return Declaration;

-- Returns the declaration of the called function.
--
-- Returns a Nil_Element if
--   Is_Implicitly_Declared(Function_Call).
--
-- Appropriate Expression Kinds:
--   A_Function_Call


subtype Parameter_Association_List is ASIS_Ada_Program.Element_List;

function Function_Call_Parameters
   (Function_Call    : in Expression;
    Include_Defaults : in Boolean := False)
  return Parameter_Association_List;

-- Returns a list of parameter associations for the call.
--
-- If Include_Defaults is True:
--   The (unspecified) default parameters will also be included and,
--   the list will be ordered to match the declaration order of the
--   corresponding formal parameter specifications.
--
-- If Include_Defaults is False:
--   Only explicit actual parameters will be included in the order they
--   appeared in the program text.
--
-- An ASIS implementation may choose to always "Include Defaults" its
-- internal representation.  If that is the case, the operation will
-- always behave as if Include_Defaults is True.
--
-- Use ASIS_Statements operations to decompose parameter associations.
--
-- To map actual parameters to corresponding formal parameters:
--
--   Create an actual parameter list by applying the function
--   ASIS_Statements.Actual_Parameter to each parameter association
--   returned by Function_Call_Parameters with Include_Defaults = True.
--
--   Create a formal parameter list by applying the function
--   ASIS_Declarations.Identifiers to each formal parameter
```

```
--   specification returned by ASIS_Declarations.Parameters.
--
--   The Expression elements in the actual parameters list will have a
--   one to one correspondence with the Identifier_Definition elements
--   in the formal parameter list.
--
-- Appropriate Expression Kinds:
--   A_Function_Call
--
-- Further Analysis:
--  Use ASIS_Statements operations Formal_Parameter and Actual_Parameter
--  to analyze the parameter associations.


function Function_Call_Parameters_Include_Defaults return Boolean;

-- Returns True if this implementation will always "Include Defaults".
-- If that is the case, the Function_Call_Parameters operation will
-- always behave as if its parameter Include_Defaults is True.


function Is_Parameter_Association (Program_Element : in Element)
  return Boolean;

-- Returns True if the element is a parameter association.
--
-- Raises Inappropriate_Program_Element if the element is a Nil_Element.


-------------------------------------------------------------------------
-- SPECIAL OPERATIONS
--   SHORT CIRCUIT CONTROL FORMS - LRM 4.5.1
--   MEMBERSHIP TESTS            - LRM 4.5.2


type Special_Operation_Kinds is

   (An_In_Range,
    A_Not_In_Range,
    An_In_Type,
    A_Not_In_Type,
    An_And_Then,
    An_Or_Else,
    Not_A_Special_Operation);
```

```
function Special_Operation_Kind (Special_Operation : in Expression)
  return Special_Operation_Kinds;

-- Returns the kind of the special operation.
--
-- Returns Not_A_Special_Operation for any inappropriate element such as
-- a Statement, Declaration, or Nil_Element.


function Special_Operation_Left_Hand_Side (Special_Operation : in Expression)
  return Expression;

-- All special operation left hand sides are expressions.
--
-- Appropriate Expression Kinds:
--   A_Special_Operation


subtype Range_Constraint is ASIS_Ada_Program.Element;

function In_Range_Operation_Right_Hand_Side
   (Special_Operation : in Expression)
  return Range_Constraint;

-- The right hand side for an IN_RANGE operation is a range
-- Further Analysis:
--   Use Constraint_Kind, Lower_Bound, and Upper_Bound operations
--   in ASIS_Type_Definitions.
--
-- Appropriate Special_Operation Kinds:
--   An_In_Range,
--   A_Not_In_Range


function In_Type_Operation_Right_Hand_Side
   (Special_Operation : in Expression)
  return Name_Expression;

-- The right hand side for an IN_TYPE operation is a type mark which is
-- a name and can be further analyzed using this package.
--
-- Appropriate Special_Operation Kinds:
--   An_In_Type,
--   A_Not_In_Type
```

```
function Short_Circuit_Operation_Right_Hand_Side
   (Special_Operation : in Expression)
  return Expression;

-- The right hand side for a short circuit operation can be any
-- expression kind which can be further analyzed using this package.
--
-- Appropriate Special_Operation Kinds:
--   An_And_Then,
--   An_Or_Else


-----------------------------------------------------------------
-- EXPRESSION EVALUATION - LRM 4.5
-- STATIC VALUES


function Is_Static (An_Expression : in Expression) return Boolean;

-- Returns True if the expression has a static value.
--
-- Raises Inappropriate_Program_Element
-- if Kind(An_Expression) = Not_An_Expression


function Static_Value (An_Expression : in Expression) return String;

-- If Is_Static(An_Expression) then
--   Returns the string image of the value of the expression.
-- else returns a null string.
--
-- Note that Static_Value for strings will not return the quotes around
-- a string literal.  However, quotes embedded in a string literal are
-- doubled, just as they appear in the program text.
--
-- Raises Inappropriate_Program_Element
-- if Kind(An_Expression) = Not_An_Expression


-----------------------------------------------------------------
-- TYPE CONVERSIONS and QUALIFIED EXPRESSIONS
-- LRM 4.6, 4.7
```

```
function Type_Mark (Type_Conversion_Or_Qualified_Expression : in Expression)
  return Name_Expression;

-- Returns the type mark of the type to which the expression is
-- being converted or qualified.
--
-- Appropriate Expression Kinds:
--   A_Type_Conversion
--   A_Qualified_Expression


function Converted_Or_Qualified_Expression
   (Type_Conversion_Or_Qualified_Expression : in Expression)
  return Expression;

-- Returns the expression being converted or qualified.
--
-- Appropriate Expression Kinds:
--   A_Type_Conversion
--   A_Qualified_Expression


------------------------------------------------------------------------
-- ALLOCATORS LRM 4.8


subtype Subtype_Indication is ASIS_Ada_Program.Element;
  -- Use operations in this package and in ASIS_Type_Definitions.

function Allocation_Type (Allocator : in Expression)
  return Subtype_Indication;

-- Returns the subtype indication for the object being allocated.
--
-- Appropriate Expression Kinds:
--   An_Allocation_From_Subtype


function Qualified_Object_Expression (Allocator : in Expression)
  return Expression;

-- Returns the qualified expression for the object being allocated.
--
-- Appropriate Expression Kinds:
--   An_Allocation_From_Qualified_Expression
```

```
end ASIS_Names_And_Expressions;
```

```
-------------------------------------------------------------------------
-- ASIS PRELIMINARY REVIEW VERSION 0.4
-- Sept 27, 1991
-------------------------------------------------------------------------

with ASIS_Ada_Program;
package ASIS_Statements is

  -- LRM Chapters 5, 6, 9, 11

  subtype Element is ASIS_Ada_Program.Element;
    -- Use ASIS_Elements operations.

  subtype Statement is ASIS_Ada_Program.Element;
    -- Use ASIS_Statements operations.

  subtype Declaration is ASIS_Ada_Program.Element;
    -- Use ASIS_Declarations operations.

  subtype Expression is ASIS_Ada_Program.Element;
    -- Use ASIS_Names_And_Expression operations.

  subtype Name_Expression is ASIS_Ada_Program.Element;
    -- Use ASIS_Names_And_Expression operations.

  subtype Type_Definition is ASIS_Ada_Program.Element;
    -- Use ASIS_Type_Definitions operations.

  subtype Identifier_Definition is ASIS_Ada_Program.Element;
    -- Use ASIS_Names_And_Expression operations.

  subtype Identifier_Reference is ASIS_Ada_Program.Element;
    -- Use ASIS_Names_And_Expression operations.
```

```
-------------------------------------------------------------------------
-- STATEMENT KINDS


type Statement_Kinds is

   -- Simple statements:

   (A_Null_Statement,
    An_Assignment_Statement,
    A_Procedure_Call_Statement,
    An_Exit_Statement,
    A_Return_Statement,
    A_Goto_Statement,
    An_Entry_Call_Statement,
    A_Delay_Statement,
    An_Abort_Statement,
    A_Raise_Statement,
    A_Code_Statement,

    -- Compound statements:

    An_If_Statement,
    A_Case_Statement,
    A_Loop_Statement,
    A_Block_Statement,
    An_Accept_Statement,
    A_Selective_Wait_Statement,
    A_Conditional_Entry_Call_Statement,
    A_Timed_Entry_Call_Statement,
    Not_A_Statement);


function Kind (A_Statement : in Statement) return Statement_Kinds;

-- Returns the kind of the statement.
--
-- Returns Not_A_Statement for any inappropriate element such as
-- a Type_Definition, Declaration, or Nil_Element.


-------------------------------------------------------------------------
-- LABELED STATEMENTS - LRM 5.1
```

```
function Is_Labeled (A_Statement : in Statement) return Boolean;

-- Returns True if the statement has a label.
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Statement) = Not_A_Statement


function Label_Names (A_Statement : in Statement) return String;

-- Returns the Label_Name(s) of the Statement.
-- The << and >> delimiters are included in the string.
-- A null string is returned if no label is present
--
-- Raises Inappropriate_Program_Element
-- if Kind(A_Statement) = Not_A_Statement


-------------------------------------------------------------------
-- ASSIGNMENT STATEMENTS - LRM 5.2


function Object_Assigned_To (Assignment_Statement : in Statement)
  return Name_Expression;

-- Returns the name of object to which the assignment is being made.
--
-- Appropriate Statement Kinds:
--   An_Assignment_Statement


function Assignment_Expression (Assignment_Statement : in Statement)
  return Expression;

-- Returns the expression on the right hand side of the assignment.
--
-- Appropriate Statement Kinds:
--   An_Assignment_Statement


-------------------------------------------------------------------
-- IF STATEMENTS - LRM 5.3
```

```
subtype If_Statement_Arm is ASIS_Ada_Program.Element;

type If_Statement_Arm_Kinds is

   (An_If_Arm,
    An_Elsif_Arm,
    An_Else_Arm,
    Not_An_If_Statement_Arm);

function If_Statement_Arm_Kind (Arm : in If_Statement_Arm)
  return If_Statement_Arm_Kinds;

-- Returns the kind of the if statement arm.
--
-- Returns Not_An_If_Statement_Arm for any inappropriate element such as
-- a Type_Definition, Declaration, or Nil_Element.


subtype If_Statement_Arm_List is ASIS_Ada_Program.Element_List;

function If_Statement_Arms (If_Statement : in Statement)
  return If_Statement_Arm_List;

-- Returns a list of the arms of the if statement in their order of
-- appearance.
--
-- Appropriate Statement Kinds:
--   An_If_Statement


function Condition_Expression (Arm : in If_Statement_Arm) return Expression;

-- Returns the condition expression for an if arm or an elsif arm.
--
-- Appropriate If_Statement_Arm Kinds:
--     An_If_Arm
--     An_Elsif_Arm


subtype Statement_List is ASIS_Ada_Program.Element_List;

function Arm_Statements (Arm : in If_Statement_Arm) return Statement_List;

-- Returns a list of the statements in an if statement arm.
```

```
--
-- Raises Inappropriate_Program_Element
-- if If_Statement_Arm_Kind(Arm) = Not_An_If_Statement_Arm


-------------------------------------------------------------------
-- CASE STATEMENTS - LRM 5.4


function Case_Expression (Case_Statement : in Statement) return Expression;

-- Returns the expression of the case statement that determines
-- which alternative will be taken.
--
-- Appropriate Statement Kinds:
--   A_Case_Statement


subtype Case_Statement_Alternative_List is ASIS_Ada_Program.Element_List;

function Case_Statement_Alternatives (Case_Statement : in Statement)
  return Case_Statement_Alternative_List;

-- Return a list of all alternatives of the case statement in their
-- order of appearance.
--
-- Appropriate Statement Kinds:
--   A_Case_Statement


subtype Case_Statement_Alternative is ASIS_Ada_Program.Element;

function Is_When_Others (Case_Alternative : in Case_Statement_Alternative)
  return Boolean;

-- Returns True if the case statement alternative is an others choice.
--
-- Appropriate Major_Element Kinds:
--   A_Case_Statement_Alternative


subtype Choice_List is ASIS_Ada_Program.Element_List;

function Case_Statement_Alternative_Choices
   (Case_Alternative : in Case_Statement_Alternative)
```

```
  return Choice_List;

-- Returns a list of the 'WHEN <choice> | <choice>' choices in their
-- order of appearance.
--
-- Further Analysis:
--   Use ASIS_Type_Definitions Choices queries to extract more information.
--
-- Appropriate Major_Element Kinds:
--   A_Case_Statement_Alternative


function Case_Statement_Alternative_Statements
   (Case_Alternative : in Case_Statement_Alternative)
  return Statement_List;

-- Returns a list of the statements in the case statement alternative.
--
-- Appropriate Major_Element Kinds:
--   A_Case_Statement_Alternative


-------------------------------------------------------------------------
-- LOOP STATEMENTS - LRM 5.5


type Loop_Kinds is

   (A_For_Loop,
    A_While_Loop,
    A_Simple_Loop,
    Not_A_Loop);

function Loop_Kind (Loop_Statement : in Statement) return Loop_Kinds;

-- Returns the kind of the if loop statement.
--
-- Returns Not_A_Loop for any inappropriate element such as
-- a Type_Definition, Declaration, or Nil_Element.


function Loop_Simple_Name (Loop_Statement : in Statement)
  return Identifier_Definition;

-- Returns the Identifier_Definition of the simple name of the loop.
```

```
   -- A Nil_Element is returned if the loop has no name.
   --
   -- Appropriate Statement Kinds:
   --   A_Loop_Statement


   function While_Condition (Loop_Statement : in Statement) return Expression;

   -- Returns the condition expression associated with the while loop.
   --
   -- Appropriate Statement Kinds:
   --   A_Loop_Statement whose Loop_Kind is A_While_Loop


   function For_Loop_Parameter_Specification (Loop_Statement : in Statement)
     return Declaration;

   -- Returns the Declaration of the Loop_Parameter_Specification.
   --
   -- Further Analysis:
   --   Use ASIS_Declarations operation Identifiers to get the
   --     Identifier_Definition of the loop parameter.
   --
   -- Appropriate Statement Kinds:
   --   A_Loop_Statement whose Loop_Kind is A_For_Loop


   subtype Discrete_Range is ASIS_Ada_Program.Element;
     -- Use ASIS_Type_Definitions operations to analyze discrete ranges.

   function Loop_Parameter_Range (Loop_Parameter_Specification : in Declaration)
     return Discrete_Range;

   -- Returns the Discrete_Range of the loop parameter.
   --
   -- Appropriate Declaration Kinds:
   --   A_Loop_Parameter_Specification


   function Is_Reverse_Loop_Parameter
      (Loop_Parameter_Specification : in Declaration)
     return Boolean;

   -- Returns True if the reserved word reverse is present.
   --
```

```
   -- Appropriate Declaration Kinds:
   --   A_Loop_Parameter_Specification


   function Loop_Statements (Loop_Statement : in Statement)
     return Statement_List;

   -- Returns a list of the statements in the loop statement.
   --
   -- Appropriate Statement Kinds:
   --   A_Loop_Statement


   ------------------------------------------------------------------------
   -- BLOCK STATEMENTS - LRM 5.6


   function Block_Simple_Name (Block_Statement : in Statement)
     return Identifier_Definition;

   -- Returns the Identifier_Definition of the simple name of the block.
   -- A Nil_Element is returned if the block has no explicit name.
   --
   -- Appropriate Statement Kinds:
   --   A_Block_Statement


   subtype Declarative_Item_List is ASIS_Ada_Program.Element_List;

   function Declarative_Items (Block_Statement : in Statement)
     return Declarative_Item_List ;

   -- Returns a list of the declarations, representation specifications,
   -- and use clauses in the declarative part of the block.
   -- A empty list indicates that there are no declarative items.
   --
   -- Appropriate Statement Kinds:
   --   A_Block_Statement


   function Block_Body_Statements (Block_Statement : in Statement)
     return Statement_List;

   -- Returns a list of the statements in the block statement.
   --
```

```
   -- Appropriate Statement Kinds:
   --   A_Block_Statement


   subtype Exception_Handler_List is ASIS_Ada_Program.Element_List;

   function Block_Exception_Handlers (Block_Statement : in Statement)
     return Exception_Handler_List;

   -- Returns a list of the exception handlers of the block.
   --
   -- Appropriate Statement Kinds:
   --   A_Block_Statement


   ------------------------------------------------------------------
   -- EXIT STATEMENTS - LRM 5.7


   function Exit_Loop_Name (Exit_Statement : in Statement)
     return Identifier_Reference;

   -- Returns the name of the exited loop.
   -- A Nil_Element is returned if no loop name is present.
   --
   -- Appropriate Statement Kinds:
   --   An_Exit_Statement


   function Exit_Condition (Exit_Statement : in Statement) return Expression;

   -- Returns the when condition of the exit statement.
   -- A Nil_Element is returned if no condition is present.
   --
   -- Appropriate Statement Kinds:
   --   An_Exit_Statement


   function Loop_Exited (Exit_Statement : in Statement) return Statement;

   -- Returns the loop statement exited by the exit statement.
   --
   -- Appropriate Statement Kinds:
   --   An_Exit_Statement
```

```
-----------  ------------------------------------------------------
-- RETURN STATEMENTS - LRM 5.8

function Return_Expression (Return_Statement : in Statement)
  return Expression;

-- Returns the expression in the return statement.
-- A Nil_Element is returned if no expression is present.
--
-- Appropriate Statement Kinds:
--   A_Return_Statement


-------------------------------------------------------------------------
-- GOTO STATEMENTS - LRM 5.9

function Goto_Label (Goto_Statement : in Statement) return String;

-- Returns the name of label specified by the goto statement.
--
-- Appropriate Statement Kinds:
--   A_Goto_Statement


function Destination_Statement (Goto_Statement : in Statement)
  return Statement;

-- Returns the named target statement specified by the goto statement.
--
-- Appropriate Statement Kinds:
--   A_Goto_Statement


-------------------------------------------------------------------------
-- PROCEDURE CALL STATEMENTS - LRM 6.4


function Called_Name (Procedure_Or_Entry_Call_Statement : in Statement)
  return Name_Expression;

-- Returns the name of the called procedure or entry.  The name of an
-- entry of a family takes the form of an indexed component.
--
-- Appropriate Statement Kinds:
```

```
--   A_Procedure_Call_Statement
--   An_Entry_Call_Statement


function Is_Implicitly_Declared
   (Procedure_Or_Entry_Call_Statement : in Statement)
  return Boolean;

-- Returns true if the procedure or entry call statement has no explicit
-- declaration associated with it. (EG. An implicit declaration of
-- a derived subprogram or an entry of a derived task type).


function Called_Procedure (Procedure_Or_Entry_Call_Statement : in Statement)
  return Declaration;

-- Returns the declaration of the called procedure or entry.
--
-- If Is_Implicitly_Declared(Procedure_Or_Entry_Call_Statement) then
-- a Nil_Element is returned.
--
-- Appropriate Statement Kinds:
--   A_Procedure_Call_Statement
--   An_Entry_Call_Statement


------------------------------------------------------------------------
-- PARAMETER ASSOCIATION - LRM 6.4

subtype Parameter_Association is ASIS_Ada_Program.Element;

subtype Parameter_Association_List is ASIS_Ada_Program.Element_List;

function Procedure_Call_Parameters
   (Procedure_Or_Entry_Call_Statement : in Statement;
    Include_Defaults                  : in Boolean := False)
  return Parameter_Association_List;

-- Returns a list of parameter associations for the call.
--
-- If Include_Defaults is True:
--   The (unspecified) default parameters will also be included and,
--   the list will be ordered to match the declaration order of the
--   corresponding formal parameter specifications.
--
```

```
-- If Include_Defaults is False:
--   Only explicit actual parameters will be included in the order they
--   appeared in the program text.
--
-- An ASIS implementation may choose to always "Include Defaults" its
-- internal representation.  If that is the case, the operation will
-- always behave as if Include_Defaults is True.
--
-- Appropriate Statement Kinds:
--   A_Procedure_Call_Statement
--   An_Entry_Call_Statement


function Procedure_Call_Parameters_Include_Defaults return Boolean;

-- Returns True if this implementation will always "Include Defaults".
-- If that is the case, the Procedure_Call_Parameters operation will
-- always behave as if its parameter Include_Defaults is True.


function Formal_Parameter (A_Parameter_Association : in Parameter_Association)
  return Identifier_Reference;

-- Returns the formal parameter simple name.
-- Accepts parameter associations and generic associations.
--
-- A Nil_Element is returned if the parameter association was given in
-- positional notation.
--
-- An ASIS implementation may choose to always normalize named notation
-- to positional notation in procedure and entry calls.
--
-- Appropriate Major_Element Kinds:
--   A_Parameter_Association
--   An_Argument_Association


function Is_Formal_Parameter_Named_Notation_Supported return Boolean;

-- Returns True if this implementation will always normalize named
-- notation to positional notation in subprogram and entry calls.
-- If that is the case, the Formal_Parameter operation will
-- always return a Nil_Element.
```

```
function Actual_Parameter (A_Parameter_Association : in Parameter_Association)
  return Expression;

-- Returns the actual parameter expression.
-- Accepts parameter associations and generic associations.
--
-- Appropriate Major_Element Kinds:
--   A_Parameter_Association
--   An_Argument_Association


-- To map actual parameters to corresponding formal parameters:
--
--   Create an actual parameter list by applying the function
--   Actual_Parameter to each parameter association returned by
--   Procedure_Call_Parameters with Include_Defaults = True.
--
--   Create a formal parameter list by applying the function
--   ASIS_Declarations.Identifiers to each formal parameter
--   specification returned by ASIS_Declarations.parameters.
--
--   The Expression elements in the actual parameters list will have a
--   one to one correspondence with the Identifier_Definition elements
--   in the formal parameter list.


-------------------------------------------------------------------------
-- ENTRY CALL STATEMENTS - LRM 9.5

-- Use PROCEDURE CALL STATEMENTS operations to analyze entry calls.


function Family_Index (Entry_Call_Or_Accept_Statement : in Statement)
  return Expression;

-- Returns the entry index in the entry call statement or accept statement.
-- If the statement has no explicit entry index, a nil element is returned.
--
-- Appropriate Statement Kinds:
--   An_Entry_Call_Statement
--   An_Accept_Statement


-------------------------------------------------------------------------
-- ACCEPT STATEMENTS - LRM 9.5
```

```
function Accepted_Entry (Accept_Statement : in Statement)
  return Declaration;

-- Returns the declaration of the entry accepted in this statement.
--
-- Appropriate Statement Kinds:
--   An_Accept_Statement


function Accept_Entry_Simple_Name (Accept_Statement : in Statement)
  return Identifier_Reference;

-- Returns the simple name of the entry following the reserved word accept.
--
-- Appropriate Statement Kinds:
--   An_Accept_Statement


subtype Parameter_Specification_List is ASIS_Ada_Program.Element_List;

function Accept_Parameters (Accept_Statement : in Statement)
  return Parameter_Specification_List;

-- Returns a list of parameter specifications in the formal part
-- of the accept statement in the order of appearance.
--
-- A Nil_Element_List is returned if the accept statement has no
-- parameters.
--
-- Results of this operation may vary across ASIS implementations.
-- Some implementations normalize all multiple parameter specifications into
-- an equivalent sequence of corresponding single parameter specifications.
-- See LRM 6.1(4).
--
-- Further Analysis:
--   Use Identifiers to obtain the identifier list.
--   Use Type_Mark to obtain the parameter type mark.
--   Use Is_Initialized and Initial_Value to query the information
--     related to the presence of the default parameter initialization.
--
-- Appropriate Statement Kinds:
--   An_Accept_Statement
```

```
function Accept_Body_Statements (Accept_Statement : in Statement)
  return Statement_List;

-- Returns a list of the statements in the accept statement.
--
-- Appropriate Statement Kinds:
--   An_Accept_Statement


------------------------------------------------------------------------
-- DELAY STATEMENTS - LRM 9.6


function Delay_Expression (Delay_Statement : in Statement)
  return Expression;

-- Returns the expression for the duration of the delay
--
-- Appropriate Statement Kinds:
--   A_Delay_Statement


------------------------------------------------------------------------
-- SELECT STATEMENTS       - LRM 9.7
-- SELECTIVE WAIT          - LRM 9.7.1
-- CONDITIONAL ENTRY CALLS - LRM 9.7.2
-- TIMED ENTRY CALLS       - LRM 9.7.3


subtype Select_Statement_Arm is ASIS_Ada_Program.Element;

type Select_Statement_Arm_Kinds is

   (A_Selective_Wait_Select_Arm,
    A_Selective_Wait_Or_Arm,
    A_Conditional_Entry_Call_Select_Arm,
    A_Timed_Entry_Call_Select_Arm,
    A_Timed_Entry_Call_Or_Arm,
    An_Else_Arm,
    Not_A_Select_Statement_Arm);

function Select_Statement_Arm_Kind (Arm : in Select_Statement_Arm)
  return Select_Statement_Arm_Kinds;
```

```
-- Returns the kind of the select statement arm.
--
-- Returns Not_A_Select_Statement_Arm for any inappropriate element such as
-- a Type_Definition, Declaration, or Nil_Element.


subtype Select_Statement_Arm_List is ASIS_Ada_Program.Element_List;

function Select_Statement_Arms (Select_Statement : in Statement)
  return Select_Statement_Arm_List;

-- Returns a list of the arms of the Select statement in their order of
-- appearance.
--
-- Appropriate Statement Kinds:
--   A_Selective_Wait_Statement
--   A_Conditional_Entry_Call_Statement
--   A_Timed_Entry_Call_Statement



subtype Select_Alternative is ASIS_Ada_Program.Element;

type Select_Alternative_Kinds is

   (An_Accept_Alternative,
    A_Delay_Alternative,
    A_Terminate_Alternative,
    Not_A_Select_Alternative);

function Select_Alternative_Kind (Alternative : in Select_Alternative)
  return Select_Alternative_Kinds;

-- Returns the kind of the select alternative.
-- Returns Not_A_Select_Alternative for any inappropriate element such as
-- a Type_Definition, Declaration, or Nil_Element.


function Arm_Select_Alternative (Arm : in Select_Statement_Arm)
  return Select_Alternative;

-- Returns the select alternative in the select statement arm.
--
-- Appropriate Select_Statement_Arm Kinds:
--   A_Selective_Wait_Select_Arm
```

```
--   A_Selective_Wait_Or_Arm


function Is_Guarded (Alternative : in Select_Alternative) return Boolean;

-- Returns true if a select alternative has a guard.
--
-- Appropriate Select_Alternative Kinds:
--   An_Accept_Alternative
--   A_Delay_Alternative
--   A_Terminate_Alternative


function Guard (Alternative : in Select_Alternative) return Expression;

-- Returns the conditional expression guarding the alternative.
-- Returns a nil element if there is no guard.
--
-- Appropriate Select_Alternative Kinds:
--   An_Accept_Alternative
--   A_Delay_Alternative
--   A_Terminate_Alternative


function Select_Alternative_Statements (Alternative : in Select_Alternative)
  return Statement_List;

-- Returns a list of the statements in the the accept or delay alternative
-- including the accept statement and delay statements themselves.
--
-- Appropriate Select_Alternative Kinds:
--   An_Accept_Alternative
--   A_Delay_Alternative


function Or_Statements (Timed_Entry_Call_Or_Arm : in Select_Statement_Arm)
  return Statement_List;

-- Returns a list of statements contained in the or arm of a time_entry_call.
--
-- Appropriate Select_Statement_Arm Kinds:
--   A_Timed_Entry_Call_Or_Arm


function Else_Statemen    Else_Arm : in Select_Statement_Arm)
```

```
  return Statement_List;

-- Returns a list of statements contained in the else arm of a
-- selective_wait or conditional_entry_call.
--
-- If no else part exists, an empty list is returned.
--
-- Appropriate Select_Statement_Arm Kinds:
--   An_Else_Arm


function Entry_Call_Statements (Arm : in Select_Statement_Arm)
  return Statement_List;

-- Returns the statements associated with the conditional or timed entry
-- call, including the actual entry call statement.
--
-- Appropriate Select_Statement_Arm Kinds:
--   A_Conditional_Entry_Call_Select_Arm
--   A_Timed_Entry_Call_Select_Arm


------------------------------------------------------------------------
-- ABORT STATEMENTS - LRM 9.10


subtype Name_Expression_List is ASIS_Ada_Program.Element_List;

function Aborted_Tasks (Abort_Statement : in Statement)
  return Name_Expression_List;

-- Returns a list of the aborted tasks.
--
-- Appropriate Statement Kinds:
--   An_Abort_Statement

------------------------------------------------------------------------
-- EXCEPTION HANDLERS - LRM 11.2


subtype Exception_Handler is ASIS_Ada_Program.Element;

function Is_Others_Handler (Handler : in Exception_Handler) return Boolean;

-- Appropriate Major_Element Kinds:
```

```
--   An_Exception_Handler


function Exception_Choices (Handler : in Exception_Handler)
  return Choice_List;

-- Returns a list of the 'WHEN <choice> | <choice>' choices in their
-- order of appearance.
--
-- Further Analysis:
--   Use the Type_Definitions package's CHOICES queries to extract
--     further information about the <choice>s.
--
-- Appropriate Major_Element Kinds:
--   An_Exception_Handler


function Handler_Statements (Handler : in Exception_Handler)
  return Statement_List;

-- Returns a list of the statements in the exception handler.
--
-- Appropriate Major_Element Kinds:
--   An_Exception_Handler


------------------------------------------------------------------------
-- RAISE STATEMENTS - LRM 11.3

function Raised_Exception (Raise_Statement : in Statement)
  return Name_Expression;

-- Returns the name of the raised exception.
-- A Nil_Element is returned if there is no explicitly named exception.
--
-- Appropriate Statement Kinds:
--   A_Raise_Statement


------------------------------------------------------------------------
-- CODE STATEMENTS - LRM 13.8

function Qualified_Expression (Code_Statement : in Statement)
  return Expression;
```

```
   -- Returns the qualified expression representing the code statement.
   --
   -- Appropriate Statement Kinds:
   --   A_Code_Statement



end ASIS_Statements;
```

```
-------------------------------------------------------------------------------
-- ASIS PRELIMINARY REVIEW VERSION 0.4
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-------------------------------------------------------------------------------


with ASIS_Ada_Program;
package ASIS_Representation_Clauses is

  -- LRM Chapter 13

  subtype Element is ASIS_Ada_Program.Element;
    -- Use ASIS_Elements operations.

  subtype Representation_Clause is ASIS_Ada_Program.Element;
    -- Use ASIS_Representation_Clauses operations.

  subtype Declaration is ASIS_Ada_Program.Element;
    -- Use ASIS_Declarations operations.

  subtype Expression is ASIS_Ada_Program.Element;
    -- Use ASIS_Names_And_Expression operations.

  subtype Type_Definition is ASIS_Ada_Program.Element;
    -- Use ASIS_Type_Definitions operations.

  subtype Identifier_Reference is ASIS_Ada_Program.Element;
    -- Use ASIS_Names_And_Expression operations.
```

```
subtype Identifier_Definition is ASIS_Ada_Program.Element;
  -- Use ASIS_Names_And_Expression operations.

-------------------------------------------------------------------
-- REPRESENTATION CLAUSE KINDS


type Representation_Clause_Kinds is

   (A_Length_Clause,
    An_Enumeration_Representation_Clause,
    A_Record_Representation_Clause,
    An_Address_Clause,
    Not_A_Representation_Clause);

function Kind (Clause : in Representation_Clause)
  return Representation_Clause_Kinds;

-- Returns the kind of the Representation_Clause
--
-- Returns Not_A_Representation_Clause for any inappropriate element
-- such as a Statement, Declaration, or Nil_Element.


function Associated_Type (Clause : in Representation_Clause)
  return Type_Definition;

-- Returns the definition of the type specified in the length clause,
-- enumeration representation clause or record representation clause.
--
-- Raises Inappropriate_Program_Element
-- if Kind(Clause) = Not_A_Representation_Clause


-------------------------------------------------------------------
-- LENGTH CLAUSES - 13.2

type Length_Clause_Attribute_Kinds is

   (A_Size_Attribute,                      -- LRM 13.2(a)
    A_Collection_Storage_Size_Attribute,   -- LRM 13.2(b)
    A_Task_Storage_Size_Attribute,         -- LRM 13.2(c)
    A_Small_Attribute,                     -- LRM 13.2(d)
    Not_A_Length_Clause_Attribute);
```

```
function Length_Clause_Attribute_Kind
   (A_Length_Clause : in Representation_Clause)
  return Length_Clause_Attribute_Kinds;

-- Returns the kind of the Length_Clause_Attribute.
--
-- Returns Not_A_Length_Clause_Attribute for any inappropriate element
-- such as a Statement, Declaration, or Nil_Element.


function Associated_Size (A_Type_Definition : in Type_Definition)
  return Expression;

-- Returns the expression that describes the size associated with a type
-- definition if there is a representation clause associated with this type.
--
-- A Nil_Element is returned if no associated representation clause exists.
--
-- Raises Inappropriate_Program_Element
-- if ASIS_Type_Definitions.Kind(A_Type_Definition) = Not_A_Type_Definition


function Associated_Storage_Size (A_Type_Definition : in Type_Definition)
  return Expression;

-- Returns the expression that describes the storage_size associated
-- with a type definition.
--
-- A Nil_Element is returned if no associated representation clause exists.
--
-- Raises Inappropriate_Program_Element
-- if ASIS_Type_Definitions.Kind(A_Type_Definition) = Not_A_Type_Definition


-------------------------------------------------------------------
-- ENUMERATION REPRESENTATION CLAUSES - 13.3


function Associated_Enumeration_Literal_Representation
   (Enumeration_Literal : in Identifier_Definition)
  return Expression;

-- Returns the expression that describes the representation of
-- enumeration literal.
--
```

```
-- Raises Inappropriate_Program_Element
-- if ASIS_Names_And_Expression.Kind(Enumeration_Literal)
--   /= An_Enumeration_Literal


function Enumeration_Type_Simple_Name
   (Enumeration_Clause : in Representation_Clause)
  return Identifier_Reference;

-- Returns the identifier reference of the type simple name in
-- the enumeration representation clause.
--
-- Appropriate Representation_Clause Kinds:
--   An_Enumeration_Representation_Clause


function Representation_Aggregate
   (Enumeration_Clause : in Representation_Clause)
  return Expression;

-- Returns the aggregate of the representation clause.
--
-- Appropriate Representation_Clause Kinds:
--   An_Enumeration_Representation_Clause


------------------------------------------------------------------
-- RECORD REPRESENTATION CLAUSES - 13.4


function Associated_Record_Type_Representation
   (Record_Type : in Type_Definition)
  return Representation_Clause;

-- Returns the record representation clause associated with the
-- record type definition.
--
-- A Nil_Element is returned if there is no associated representation
-- clause.
--
-- Appropriate Type_Definition Kinds:
--   A_Record_Type_Definition


function Associated_Record_Component_Representation
```

```
   (Record_Component : in Declaration)
  return Representation_Clause;

-- Returns the record representation clause associated with the
-- record type that encloses the record component declaration.
--
-- A Nil_Element is returned if there is no associated representation
-- clause.
--
-- Appropriate Declaration Kinds:
--   A_Component_Declaration
--   A_Discriminant_Specification


function Record_Type_Simple_Name (Record_Clause : in Representation_Clause)
  return Identifier_Reference;

-- Returns the identifier reference of the type simple name in the
-- representation clause.
--
-- Appropriate Representation_Clause Kinds:
--   A_Record_Representation_Clause


function Alignment_Expression (Record_Clause : in Representation_Clause)
  return Expression;

-- Returns the alignment expression for the representation clause.
--
-- A Nil_Element is returned if an alignment expression is not present.
--
-- Appropriate Representation_Clause Kinds:
--   A_Record_Representation_Clause


-------------------------------------------------------------------
-- COMPONENT CLAUSES - 13.4


subtype Component_Clause is ASIS_Ada_Program.Element;

subtype Component_Clause_List is ASIS_Ada_Program.Element_List;

function Component_Clauses (Record_Clause : in Representation_Clause)
  return Component_Clause_List;
```

```
-- Returns a list of the component clauses of the record clause in order
-- of appearance.
--
-- A Nil list is returned if the representation clause has no component
-- clauses.
--
-- Appropriate Representation_Clause Kinds:
--   A_Record_Representation_Clause


function Component_Simple_Name
   (Record_Component_Clause : in Component_Clause)
  return Identifier_Reference;

-- Returns the identifier reference of the name of the component.
--
-- Appropriate Major_Element_Kind:
--   A_Component_Clause


function Component_Offset (Record_Component_Clause : in Component_Clause)
 return Expression;

-- Returns the offset expression for the component.
--
-- Appropriate Major_Element_Kind:
--   A_Component_Clause


subtype Range_Constraint is ASIS_Ada_Program.Element;

function Component_Range (Record_Component_Clause : in Component_Clause)
  return Range_Constraint;

-- Returns the range constraint for the component.
--
-- Appropriate Major_Element_Kind:
--   A_Component_Clause


------------------------------------------------------------------------
-- ADDRESS CLAUSES - 13.5
```

```
   function Associated_Address (Identifier : in Identifier_Definition)
     return Representation_Clause;

   -- Returns the address clause associated with the identifier.
   --
   -- A Nil_Element is returned if no associated address clause exists.
   --
   -- Raises Inappropriate_Program_Element if the element is a Nil_Element.


   function Entity_Simple_Name (Address_Clause : in Representation_Clause)
     return Identifier_Reference;

   -- Returns the identifier reference of the entity named in
   -- the address clause.
   --
   -- Appropriate Representation_Clause Kinds:
   --    An_Address_Clause


   function Addressed_Declaration (Address_Clause : in Representation_Clause)
     return Declaration;

   -- Returns the declaration of the entity whose address is specified.
   --
   -- Appropriate Representation_Clause Kinds:
   --    An_Address_Clause


   function Address_Expression (Address_Clause : in Representation_Clause)
     return Expression;

   -- Returns the simple expression for the address of the entity.
   --
   -- Appropriate Representation_Clause Kinds:
   --    An_Address_Clause


end ASIS_Representation_Clauses;
```

```
-------------------------------------------------------------------------
-- ASIS PRELIMINARY REVIEW VERSION 0.4
-- Sept 27, 1991
-------------------------------------------------------------------------


with ASIS_Ada_Program;
package ASIS_Text is


  -----------------------------------------------------------------------
  -- This package encapsulates a set of operations to access the text of
  -- ASIS Elements.  It assumes no knowledge of the existence, location, or
  -- form of the program text.
  --
  -- The text of a program consists of the texts of one or more
  -- compilations.  The text of each compilation is a sequence of separate
  -- lexical elements.  Each lexical element is either a delimiter, an
  -- identifier (which may be a reserved word), a numeric literal, a character
  -- literal, a string literal, or a comment.
  --
  -- Each ASIS Element has a text image whose value is a series of characters
  -- that forms the text span of the Element.  The text span covers all the
  -- characters from the first character of the Element through the last
  -- character of the Element over the range of lines.
  --
  -----------------------------------------------------------------------

  subtype Element is ASIS_Ada_Program.Element;


  Maximum_Line_Length : ASIS_Ada_Program.ASIS_Integer
    renames ASIS_Ada_Program.Maximum_Line_Length;
  -- A constant value, Implementation defined.

  Maximum_Line_Number : ASIS_Ada_Program.ASIS_Integer
    renames ASIS_Ada_Program.Maximum_Line_Number;
  -- A constant value, Implementation defined.

  subtype Line_Number is ASIS_Ada_Program.Line_Number;
  -- The range of line numbers within the text of programs.
  -- The value 0 is used to indicate an invalid line number.
```

```
subtype Character_Position is ASIS_Ada_Program.Line_Number range
  0..Maximum_line_Length;
-- The range of character positions within text lines.
-- The value 0 is used to indicate an invalid character position.

subtype Line is ASIS_Ada_Program.Line;
-- A private type

subtype Line_List is ASIS_Ada_Program.Line_List;
-- A list of lines.

Nil_Line_List : Line_List  renames ASIS_Ada_Program.Nil_Line_List;

-------------------------------------------------------------------------
-- EXCEPTIONS

Inappropriate_Line_Number : exception;

-- Raised on attempt to retrieve a line whose number is outside the
-- range of valid text lines.


-------------------------------------------------------------------------
-- LINE NUMBERS


function First_Line_Number (Program_Element : in Element) return Line_Number;

-- Returns the first line number on which the text of the element resides.
-- Returns 0 if a line number is not available for a given element,
-- and for any inappropriate element.


function Last_Line_Number (Program_Element : in Element) return Line_Number;

-- Returns the last line number on which the text of the element resides.
-- Returns 0 if a line number is not available for a given element,
-- and for any inappropriate element.


-------------------------------------------------------------------------
-- TEXT SPANS


type Span     is record
```

```
  First_Line    : Line_Number        := Line_Number'First;
  First_Column  : Character_Position := Character_Position'First;
  Last_Line     : Line_Number        := Line_Number'First;
  Last_Column   : Character_Position := Character_Position'First;
end record;

-- A single text position is identified by a line number and
-- a column representing the character position within the line.
--
-- An implementation may choose to ignore character position values
-- in which case the function Is_Span_Column_Position_Supported returns
-- False;
--
-- The text of an element may span one or more lines.  The Text span
-- of an element identifies the lower and upper bound of a span
-- of text positions.
--
-- Spans and position give client tools the flexibility to access text
-- through this package or through the external text file if any.


function Nil_Span return Span;

-- Returns a span with a void or nil value (the default initialization).


function Element_Span (Program_Element : in Element) return Span;

-- Returns the span of the given element.
--
-- Returns a Nil_Span if not Is_Text_Available(Program_Element),
-- and for any inappropriate element.


function Compilation_Unit_Span (Program_Element : in Element) return Span;

-- Returns the span of the text comprising the enclosing compilation unit
-- of the given element.
--
-- Returns a Nil_Span if text is not available for the enclosing
-- compilation unit, and for any inappropriate element.


function Compilation_Span (Program_Element : in Element) return Span;
```

```
-- Returns the span of the text comprising the compilation to which
-- the element belongs.  The text span may include one or more
-- compilation units.
--
-- Returns a Nil_Span if text is not available for the enclosing
-- compilation unit, and for any inappropriate element.


-------------------------------------------------------------------
-- LINES


-- Lists can be indexed to get each individual line.
-- The bounds of the lists returned correspond to the line numbers of
-- the text.


function Length (Text : in Line) return Character_Position;

-- Returns the length of the line.


function Lines (Program_Element : in Element) return Line_List;

-- Returns a list of lines covering the span of the
-- given program element.
--
-- Returns a Nil list if not Is_Text_Available(Program_Element),
-- and for any inappropriate element.


function Lines
   (Program_Element : in Element;
    Text_Span : in Span)
  return Line_List;

-- Returns a list of lines covering the given span
-- from the compilation containing the given program element.
--
-- This operation can be used to access lines from text outside the
-- span of an element, but still within the compilation.  For example,
-- lines containing preceding comments or lines between two elements.
--
-- Returns a Nil list if not Is_Text_Available(Program_Element),
-- and for any inappropriate element.
```

```
--
-- Raises Inappropriate_Line_Number if the Span defines a Nil_Span or a line
-- whose number is outside the range of text lines that can be accessed
-- through the element.


function Lines
   (Program_Element : in Element;
    First_Line      : in Line_Number;
    Last_Line       : in Line_Number)
  return Line_List;

-- Returns a list of lines covering the given line numbers
-- from the compilation containing the given program element.
-- This operation can be used to access lines from text outside the
-- span of an element, but still within the compilation.
--
-- Returns a Nil list if not Is_Text_Available(Program_Element),
-- and for any inappropriate element.
--
-- Raises Inappropriate_Line_Number if the Span defines a Nil_Span or a line
-- whose number is outside the range of text lines that can be accessed
-- through the element.


-------------------------------------------------------------------------
-- IMAGES

subtype ASIS_Character is ASIS_Ada_Program.ASIS_Character;

-- The component type of the ASIS_String type.


subtype ASIS_String is ASIS_Ada_Program.ASIS_String;

-- ASIS_String values form lexical elements in the text of programs.
-- The ASIS_String type allows implementations to include non-ASCII
-- characters in comments appearing in the text of programs.


Nil_String : ASIS_String renames ASIS_Ada_Program.Nil_String;

-- A constant value
```

```
function Image_Delimiter return ASIS_String;

-- Returns the ASIS_String used as a delimiter separating
-- individual lines of text within the ASIS_String Image of an element.


function Image (Program_Element : in Element) return ASIS_String;

-- Returns an ASIS_String image of the element.
-- The image of an element may span more than one line, in which
-- case the ASIS_Character returned by the function Image_Delimiter
-- separates the individual lines.
--
-- Returns a Nil_String if not Is_Text_Available(Program_Element),
-- and for any inappropriate element.
--
-- NOTE: The image of a large element may exceed the range of an
-- ASIS_String in which case the exception Failed will be raised.
-- Use the Lines operation to operation on the image of large elements.


function Image (Text : in Line) return ASIS_String;

-- Returns an ASIS_String image of the entire line.
-- The image of a single lexical element can be sliced from the
-- ASIS_String value using the first or last column character positions
-- from the span of an Element.


function Non_Comment_Image (Text : in Line) return ASIS_String;

-- Returns an ASIS_String image of the lexical elements of a line
-- up to but excluding any comment on that line.
-- other than a comment.
--
-- The value returned includes any preceding white space characters.


function Comment_Image (Text : in Line) return ASIS_String;

-- Returns an ASIS_string image of any comment on that line excluding
-- any lexical elements preceding the comment.
--
-- The value returned includes the two adjacent hyphens "--".
--
```

```
-- A Nil_String is returned if the line has no comment.
--
-- The bounds of the ASIS_String correspond to the range of
-- Character_Positions the comment occupies in the line.


-------------------------------------------------------------------
-- TEXT AVAILABILITY

function Is_Text_Available (Program_Element : in Element) return Boolean;

-- Returns True if the implementation can return a valid text image for
-- the given element.
--
-- An implementation may choose to make text available only for certain
-- kinds of elements.


function Is_Line_Number_Supported return Boolean;

-- Returns True if the implementation can return valid line
-- numbers for elements.
--
-- An implementation may choose to ignore line number values
-- in which case this function returns False;


function Is_Span_Column_Position_Supported return Boolean;

-- Returns True if the implementation can return valid character
-- positions for elements.
--
-- An implementation may choose to ignore column character position
-- values within spans in which case this function returns False;


function Is_Commentary_Supported return Boolean;

-- Returns True if the implementation can return comments.
--
-- An implementation may choose to ignore comments in the text
-- in which case the function Is_Commentary_Supported returns False;
```

```
   ------------------------------------------------------------------------
   -- LINE DESTRUCTOR


   procedure Dissociate (A_Line : in out Line);

   -- A Line of length 0 is returned.
   --
   -- Postconditions:  (if no exception is raised)
   --   Depending on the ASIS implementation, storage for Line
   --    may be deallocated.
   --   Length(A_Line) = 0



   procedure Dissociate (A_Line_List : in out Line_List);

   -- Severs associations made to the Line_List.
   -- A Nil_Line_List value is returned.
   --
   -- Postconditions:  (if no exception is raised)
   --   Depending on the ASIS implementation, storage for each Line
   --    may be deallocated.


end ASIS_Text;
```