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AN APPLICATION OF CREATABASE: A MODULE OF AN INTEGRATED DATA BA--ETC(U)

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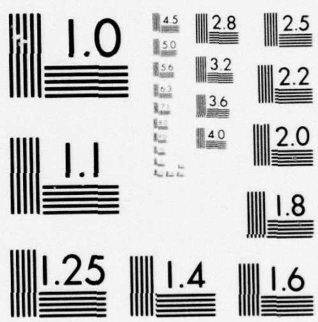
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3.6
4.0
4.5
5.0
5.6
6.3

BRL

REPORT NO. 1979

AN APPLICATION OF CREATABASE: A MODULE OF AN INTEGRATED DATA BASE ANALYSIS SYSTEM

Morton A. Hirschberg

April 1977

USA ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
USA BALLISTIC RESEARCH LABORATORY
ABERDEEN PROVING GROUND, MARYLAND

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Integrated Data Base Analysis	Data Processing	CREATABASE
Data Storage Retrieval	Relational Data Base	
Information Retrieval	Nonprocedural Language	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number) (ams) CREATABASE, a module of an integrated data base analysis system, was used to construct a data base comprised of 10,000 observations collected during 31 tests conducted at the Ballistic Research Laboratory, Aberdeen Proving Ground, Maryland. Uses of the data base as well as other applications of CREATABASE are discussed, and the data base and the commands to implement it are also presented.

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I. INTRODUCTION

This paper briefly describes a relational data base analysis system,[1] CREATABASE,[2,3,4,5] and presents an example of an actual data base. References 2, 3, and 4 when taken together form a complete but terse set of systems documents. A clearer exposition of the system is planned for the near future. The terms data base management and information retrieval systems, as well as other terms describing nearly identical operations or procedures, are in fact defined differently.[6] The user or prospective user of such systems does not usually perceive any difference between these terms and uses them interchangeably. This may be because the operations performed by these systems usually include entry of data into the system, updating and/or correction of data, retrieval and display of data, and to varying degrees manipulation of data.

Notice that the word data was used in the last sentence, and not the word information. Here we must be precise. In general, data itself possesses no information; information is derived from data through a set of manipulations. In some instances, as in the case of a report abstract, the data, which is the abstract itself, does possess information.

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[1] Date, C.J., An Introduction to Data Base Systems, Reading, Mass., Addison-Wesley, 1976.

[2] Daniel Analytical Services Corporation, User Reference Manual for "The CREATABASE Module" of An Integrated Data Base Analysis System: Level U-4A, Houston, Texas, August 1976.

[3] Daniel Analytical Services Corporation, "Primer" for "The CREATABASE Module" of An Integrated Data Base Analysis System: Level U-4A, Houston, Texas, August 1976.

[4] Daniel Analytical Services Corporation, An Illustrative Check Deck for "The CREATABASE Module" of An Integrated Data Base Analysis System: Level U-4A, Houston, Texas, August 1976.

[5] Goldberg, S.A., Final Report of the EDMPAS Committee, Edgewood Arsenal, Aberdeen Proving Ground, Maryland 21010, September 1975.

[6] SIPPL, C.J., & SIPPL, C.P., Computer Dictionary and Handbook, New York, Bobbs-Merrill, 1972.

CREATABASE is a true relational data base system. Using it, one can derive information from data. The language of CREATABASE is essentially natural English; CREATABASE allows a full Boolean query capability. We must note that, while the discussion here centers primarily on data, the bulk of the literature concerns itself with information[7] as opposed to data no matter what title a piece of literature[8] bears. Reference 7 is typical of the many references on information retrieval and examines the subject in all of its facets; it includes many useful references and is worth reading.

Figure 1 shows the relationship of data to information and ultimately to a decision or prediction, the ultimate goals of engineering and science.

II. CREATABASE

The CREATABASE module is a part of an integrated data base analysis system written by the Gulf Universities Research Consortium and marketed by Daniel Analytical Services Corporation of Houston, Texas.

CREATABASE contains 56 instructions which fall into seven command categories (see Figure 2): general, definition, compilation, modification, selective retrieval, subset binary and printout. Of these, all are self-explanatory except for the subset binary commands. Subset binary commands allow all or any portion of the data base to be written onto a file for further processing by the user. A subset binary file may also serve as input to CREATABASE. The subset binary feature allows the crucial step between selective retrieval and manipulation of data to occur (Figure 3).

CREATABASE is written in FORTRAN and the reference version operates on the UNIVAC 1100 series computers.

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[7] Doyle, L.B., Information Retrieval and Processing, Los Angeles, Melville, 1975.

[8] Pierce, P.W. (ed.), Benchmark Data Base Evaluation of Vendor Developed Data Base Management Systems for DARCOM Data Processing Community, DARCOM-ALMSA, 1976.

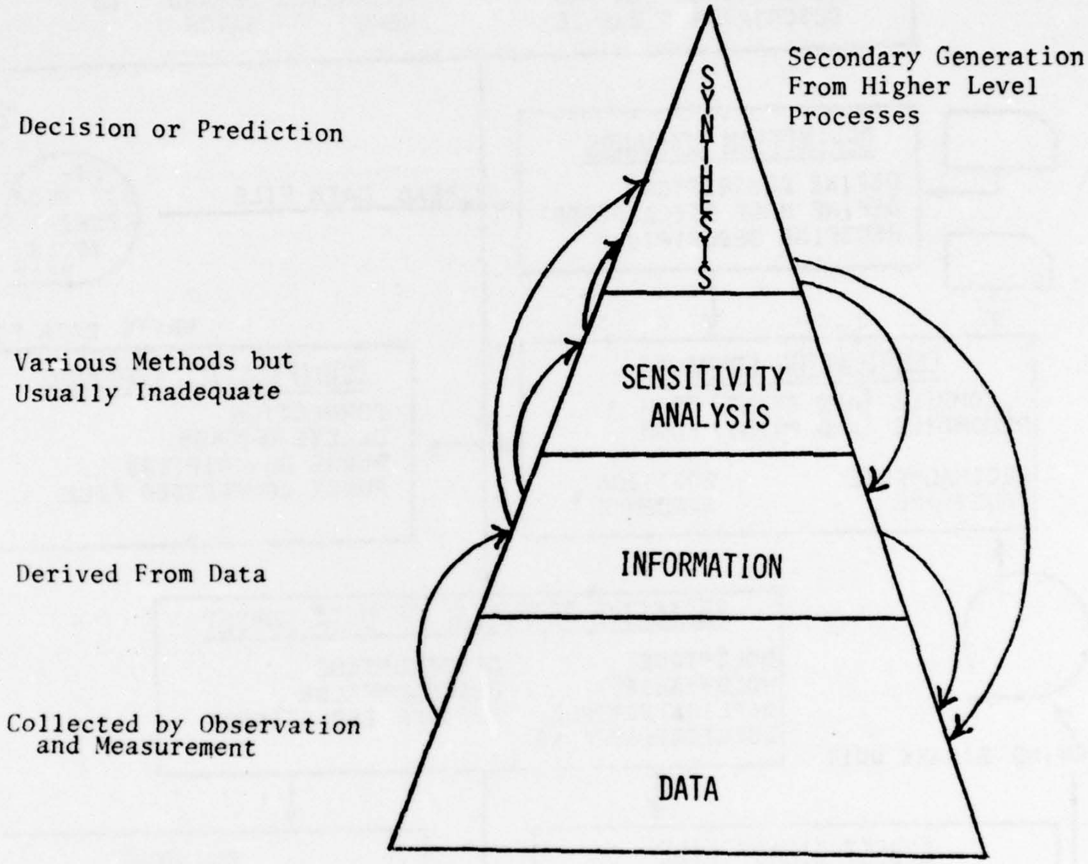

Figure 1. The Relationship of Data to Information and Ultimately to a Decision or Prediction

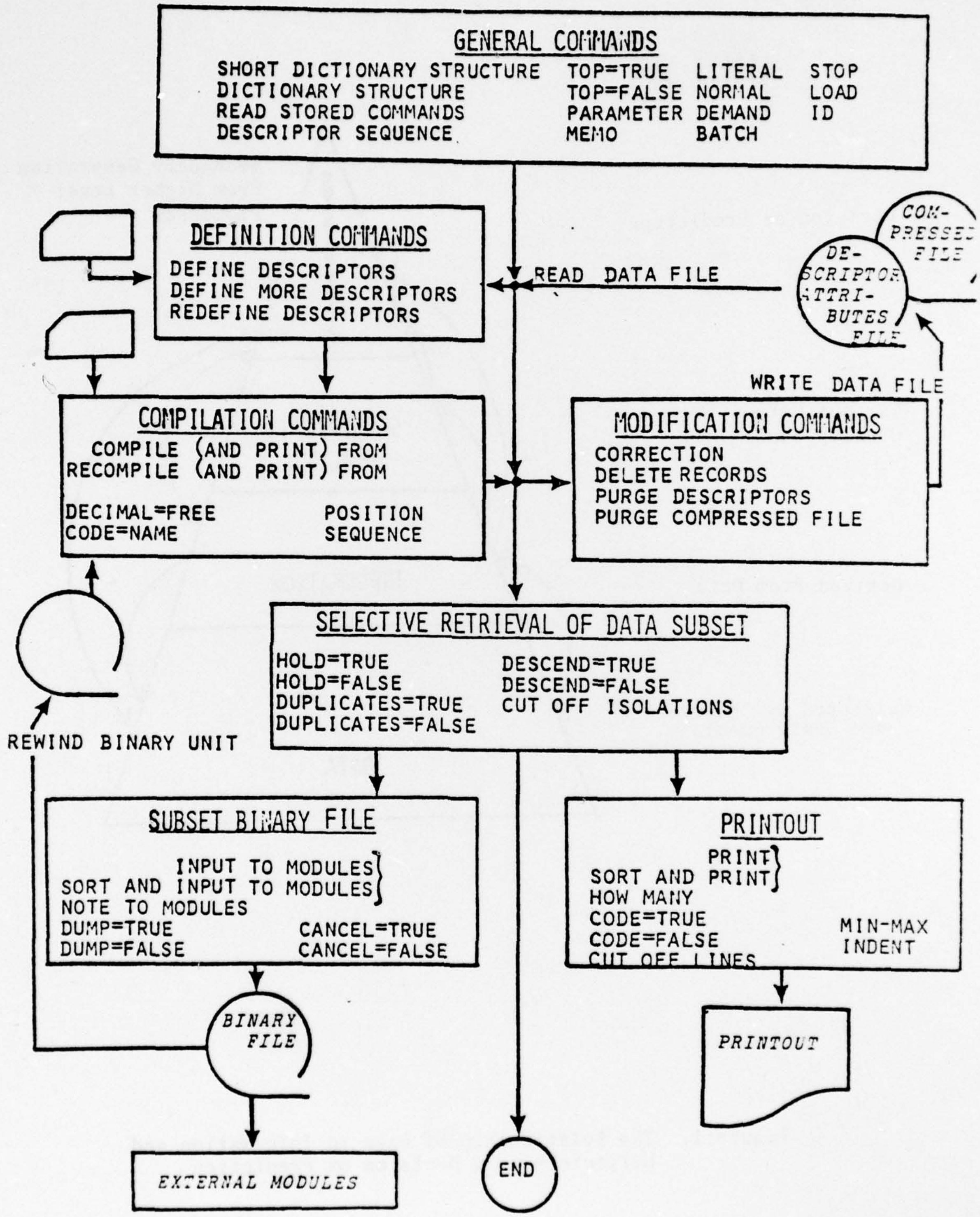

Figure 2. CREATABASE Command Structure

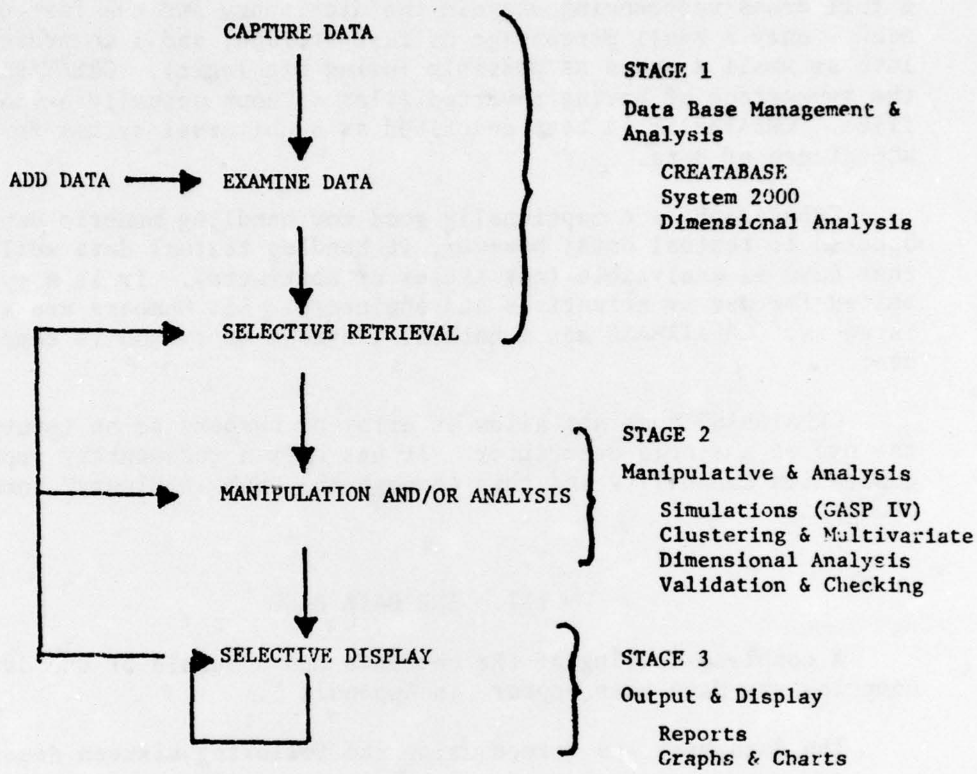

Figure 3. The Data Analysis Process or the Design Process

The basic features of CREATABASE are a vertical storage scheme which allows rapid querying (using only logical arithmetic - complement, and, and or), a wide repertoire of instructions, full Boolean query capability, a full cross-referencing wherein the dictionary and the instructions occupy only a small percentage of fast storage, and a compression of data into as small a space as possible (using bit logic). CREATABASE gives the appearance of having inverted files without actually having inverted files. CREATABASE is best described as a universal system for the acceptance of data.

CREATABASE is exceptionally good for handling numeric data as opposed to textual data; however, it handles textual data well when that data is analyzable (not titles or abstracts). It is a system well suited for use by scientists and engineers. All numbers are stored as integers. CREATABASE has a natural language query and is comfortable to use.

CREATABASE does not allow an array of numbers to be input through the use of a single descriptor. It has only a rudimentary report generation capability and this through the "Subset Binary" command procedure.

III. THE DATA BASE

A complete listing of the commands and a sample of the data that comprise the data base appear in Appendix I.

The data base was formed using the following sixteen descriptors.

ITM1	ITM5	ITM9	ENDNO
ITM2	ITM6	ITM10	NAMES
ITM3	ITM7	SEQNO	TOTAL EXPOSURE
ITM4	ITM8	BEGNO	TOTAL TIME

All descriptors were numeric except for NAMES which was alphanumeric and represents the names of the 31 tests which were conducted at Aberdeen Proving Ground. The data base consisted of approxiamtely 10,000 items.

The data base was constructed by defining the first ten descriptors, ITM1 - ITM10, reading cards with these data, and finally using the SEQUENCE and CORRECTION commands to append the rest of the data to the appropriate test. Appended data consisted of data for the SEQNO, BEGNO, ENDNO, NAMES, TOTAL EXPOSURE and TOTAL TIME descriptors.

One will observe that data items appearing in Appendix I are separated by commas and all commands and data are ended by an asterisk. These are the normal separators and terminators of CREATABASE. The less than symbol (<) is used to tell CREATABASE to complete a record with the value "unknown" (on the Univac this state is represented by all bits on or - 0). Commas without data between them also signify that datum falling between the commas was "unknown".

The data on the cards defined by descriptors ITM1 - ITM10 are observations. Because there is no array capability in CREATABASE, ten separate descriptors were defined; however, a standard set of queries can be generated to minimize the length of a query and repetition of descriptor names. This is the only drawback to the system that the author has observed. Addition of a comprehensive descriptor to the language will correct this feature.

The data base is now ready to be queried or manipulated.

The data base shown in this report took one day to implement once the data was on cards. That is, the design of the data base, punching the commands, and entering the commands and data into the computer were accomplished in a single day. The machine cost, including several test queries, was under five dollars.

IV. COMMANDS USED IN APPENDIX I

The building of the data base can be done using very few of the CREATABASE commands. The data base described in Section III was built using just eight commands. These commands will now be discussed.

The PARAMETER command is used to adjust core allocation. F and G size the compressed file, the file where the data are stored. F represents the number of bits the descriptors occupy (words - the down direction) and G represents the number of records which will be in memory at one time (bits - the across direction).

The DEFINE DESCRIPTORS command sets the specification of the descriptors or dictionary entries which the user wishes to define. A FROM-TO descriptor is a descriptor whose values are numbers satisfying the specified range. The DEFINE DESCRIPTOR and DEFINE MORE DESCRIPTORS statements consist of several parts: the name of the descriptor, a sequence number, a type, a range, and a label. There are three types of descriptors: FROM-TO, CODE, and NAME. The latter two types are for alphanumeric names which are known in advanced (CODE) and which are anticipated but not known in advance (NAME). Where an "=" is used as in the case of descriptors 2-10, it means that the descriptor will share the same descriptor attributes (dictionary entries) as a previously described descriptor. Here, descriptors 2-10 have the same range of values as descriptor 1. There are no labels used in this data base.

The WRITE DATA FILE command saves the latest version of the descriptors and descriptor attributes (if any) on the files specified by the user. This statement causes the system to produce a summary of the core allocation used so far.

The COMPILE (AND PRINT) FROM CARDS command causes input data to be read (and printed) and the data file to be built.

The data as described in Section III appear next, and represent one of the 31 tests. The complete test data were entered on 1056 cards and a statement to that effect is printed. The @EOF terminates the reading of data.

The DEFINE MORE DESCRIPTORS command has been covered above.

The SEQUENCE command generates a sequence number for all the records in the data base (compressed file) and stores it in the selected FROM-TO type descriptor (SEQNØ).

The CORRECTION command allows the user to access any data entry and alter it as specified. In the current usage the command is used to enter data instead of altering it. The form of the command consists of descriptor-descriptor attribute pairs followed by a Boolean expression identifying which records are to be modified. Three examples of the correction command are shown. At this point, the data base has been constructed and is ready for querying or manipulation.

The END command terminates the CREATABASE run and transfers control to the computer's operating system.

V. DISCUSSION

The analysis of data is a difficult and often exasperating task. Since it is easier to collect data than to analyze it, we find ourselves inundated with data. In fact, the design of data bases and the possible uses of data have become entities in themselves, rather than the uses of data. The latter involves theorizing so that a prediction or decision can be reached.

In many instances retrieval programs do not exist where they are sorely needed.[9] Reference 9 is an excellent paper clearly showing that massive amounts of data lie unused. The author feels that CREATABASE is the answer to the problems which concern large amounts of numeric data (i.e., problems which seem prevalent in the Army). As a bonus, CREATABASE has been found to handle alphanumeric data very well too! Such applications will be described in future papers.

---

[9] Yarborough, B.H., Methodology Investigation Development of a Data Storage and Retrieval System, Programs, and Techniques for ADP Reporting of Repetitive Tests, MTD, Aberdeen Proving Ground, Maryland, AD B007378L, April 1975.

The analysis of even relatively small amounts of data can produce fruitful results. This has been demonstrated in fields as diverse as contract bridge[10] and the social sciences.[11] We must do the same in the physical sciences.

To date, CREATABASE has been a highly effective tool for capturing data, organizing data, and deriving information from data. It is hoped that it will be used more widely in the future. Finally, we must not lose sight of the fact that the true pursuits of science (and good engineering) are the examination and manipulation of both old and new data in both old and new ways.[12]

ACKNOWLEDGEMENT

The author would like to thank Daniel Analytical Services Corporation for permission to publish Figure 2.

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10 Jelks, E.G. & Schmitt, R.L., Trick Taking Potential, Normal Illinois, Jett Publishing Company, 1974.

11 de Mille, R. & Hirschberg, M.A., Multivariate Analysis of Concepts Induced from Bounded Predictive Value-Statement, Multivariate Behaviorial Research Vol. 7, January 1972, pp 41-66.

12 Hirschberg, M.A., in reference 5.

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1. Date, C.J., An Introduction to Data Base Systems, Reading Mass., Addison-Wesley, 1976.

2. Daniel Analytical Services Corporation, User Reference Manual for "The CREATABASE Module" of An Integrated Data Base Analysis System: Level U-4A, Houston, Texas, August 1976.

3. Daniel Analytical Services Corporation, "Primer" for "The CREATABASE Module" of An Integrated Data Base Analysis System: Level U-4A, Houston, Texas, August 1976.

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12. Hirschberg, M.A., in reference 5.

APPENDIX I

A PORTION OF THE DATA BASE

```
PARAMETER F=300,G=35 *
 DEFINE DESCRIPTORS
 ITM1(1 FROM 0 TO 14000)
 ITM2(2=1)
 ITM3(3=1)
 ITM4(4=1)
 ITM5(5=1)
 ITM6(6=1)
 ITM7(7=1)
 ITM8(8=1)
 ITM9(9=1)
 ITM10(10=1)
*
      WRITE DATA FILE*

 DATE     TIME    CORE   BUFFERS   RECORDS
091776   171108    36K        1         0

USER ALLOCATION AND ACTUALLY USED VALUES
      A        B        C        D        E        F        G
     50      500       50      500       50      300       35
     10        0        1        0       10      141        1

      H        I        J        K        L
      9       50      500      200     1000

 COMPILE AND PRINT FROM CARDS*

 ,,,,,,,552,525,487 *

 000448,000429,000442,000397,000441,000378,000351,000333,000367,000318 *

 000304,000284,000277,000265,000295,000259,000234,000238,000214,000223 *

 000246,000198,000202,000211,000171,000207,000206,000174,000170,000180 *

 000165,000150,000158,000159,000146,000141,000157,000135,000114,000153 *

 000131,000128,000113,000150,000123,000122,000125,000115,000118,000115 *

 000125,000109,000126,000128,000125,000127,000120,000131,000118,000108 *

 000126,000108,000121,000113,000106,000091,000128,000108,000102,000102 *

 000101,000102,000118,000104,000120,000106,000095,000103,000104,000093 *
```

```
000104,000100,000091,000100,000110,000099,000091,000111,000092,000093 *
000078,000099,000106,000088,000084,000091,000091,000079,000092,000095 *
000086,000090,000087,000068,000080,000088,000101,000084,000090,000077 *
000091,000074,000082,000075,000077,000096,000084,000078,000080,000079 *
000092,000116,000105,000078,000090,000097,000087,000104,000081,000088 *
000095,000064,000100,000083,000078,000081,000108,000092,000099,000098 *
000090,000092,000084,000086,000101,000100,000108,000095,000091,000093 *
000081,000082,000077,000091,000090,000091,000091,000094,000117,000099 *
000103,000098,000090,000076,000103,000080,000111,000103,000115,000114 *
000106,000118,000107,000115,000110,000119,000102,000102,000119,000113 *
000112,000097,000113,000097,000126,000105,000110,000113,000099,000121 *
000104,000095,000106,000111,000095,000100,000097,000108,000092,000093 *
000105,000099,000095,000104,000090,000089,000099,000100,000093,000086 *
000084,000103,000086,000083,000093,000078,000084,000083,000069,000094 *
000091,000081,000076,000088,000079,000085,000067,000072,000079,000076 *
000074,000075,000078,000079,000074,000082,000083,000076,000072,000062 *
000082,000075,000065,000073,000064,000046,000075,000053,000062,000055 *
000065,000062,000050,000073,000058,000060,000052,000048,000064,000059 *
000049,000049,000067,000052,000066,000047,000066,000051,000044,000061 *
000045,000046,000045,000049,000041,000061,000071,000053,000056,000058 *
000047,000049,000039,000051,000050,000039,000032,000040,000035,000038 *
000032,000038,000038,000041,000034,000031,000044,000023,000036,000030 *
000030,000027,000024,000024,000030,000021,000026,000034,000026,000023 *
000036,000027,000024,000017,000021,000032,000031,000027,000020,000024 *
000026,000024,000015,000031,000019,000017,000024,000011,000021,000027 *
000016,000019,000014,000021,000020,000017,000015,000019,000020,000026 *
000020,000017,000014,000022,000026,000018,000022,000026,000024,000023 *
```

000015,000014,000017,000023,000024,000024,000021,000017,000020,000020 *

000018,000011,000016,000021,000015,000018,000008,000013,000013,000014 *

000020,000020,000012,000011,000031,000021,000019,000022,000018,000022 *

000021,000022,000022,000016,000022,000020,000016,000023,000009,000019 *

000015,000009,000020,000016,000014,000016,000007,000014,000015,000014 *

000018,000016,000010,000016,000020,000012,000018,000013,000015,000016 *

000017,000015,000023,000014,000011,000012,000017,000017,000018,000016 *

000010,000016,000015,000011,000017,000016,000014,000009,000016,000012 *

000019,000015,000006,000013,000020,000019,000015,000011,000019,000013 *

000015,000011,000017,000019,000015,000016,000018,000021,000016,000017 *

000017,000012,000018,000006,000011,000011,000011,000010,000016,000008 *

000016,000014,000013,000020,000015,000011,000017,000006,000015,000008 *

000010,000010,000014,000010,000012,000012,000014,000006,000019,000010 *

000013,000009,000011,000010,000007,000007,000007,000012,000008,000008 *

000009,000007,000010,000011,000015,000012,000008,000012,000007,000009 *

000009,000011,000013,000009,000012,000001,000006,000005,000013,000011 *

000009,000006,000010,000008,000006,000012,000005,000010,000008,000013 *

000004,000010,000005,000005,000012,000007,000010,000009,000008,000009 *

000004,000008,000006,000006,000005,000004,000010,000014,000008,000007 *

000012,000004,000004,000007,000011,000008,000002,000008,000010,000008 *

000007,000009,000010,000006,000007,000007,000010,000008,000010,000005 *

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000004,000005,000008,000008,000003,000011,000005,000002,000009,000006 *

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000009,000007,000007,000010,000007,000013,000007,000013,000007,000008 *

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```
000006,000007,000012,000006,000002,000001,000006,000006,000007,000008 *
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000000,000005,000006,000004,000006,000003,000005,000008,000003,000005 *
000005,000007,000007,000005,000002,000005,000003,000001,000009,000004 *
000003,000004,000004,000004,000002,000003,000005,000003,000005,000001 *
000005,000005,000004,000005,000004,000001,000005,000006,000006,000002 *
000005,000003,000004,000002,000000,000002,000003,000002,000004,000005 *
000002,000002,000002,000003,000007,000005,000004,000004,000007,000003 *
4, <*
?EOF
     1056 RECORDS WERE COMPILED AS SPECIFIED

     DEFINE MORE DESCRIPTORS
 SEQNO(11 FROM 1 TO 2000)
 BEGNO(12 FROM 0 TO 10000)
 ENDNO(13=12)
 NAMES(14 CODE   OUT 4 AUG,PHA CAL 20 JUL,SHOT 21,SHOT 8,
SHOT 3 C/T BALL 2,SHOT 4 BALL 2,SHOT 6,SHOT 22,SHOT 2 BALL 2,SHOT 9,
SHOT 30,SHOT 31,SHOT 32,SHOT 33,SHOT 34,SHOT 36,SHOT 37,
SHOT 38,SHOT 39,SHOT 40,SHOT 41,SHOT 42,SHOT 43,SHOT 44,SHOT 45,
SHOT 46,SHOT 47,SHOT 48, SHOT 49,SHOT 50,SHOT 51)
 TOTAL EXPOSURE(15 FROM 0 TO 1000000)
 TOTAL TIME(16 FROM 0 TO 1000000)
*

SEQUENCE 11*

CORRECTION (BEGNO,58) (ENDNO,762)
(NAMES, OUT 4 AUG)
(TOTAL EXPOSURE,38606) (TOTAL TIME,23122)
WITH SEQNO,FROM 1 TO 72*
               72 RECORDS WERE CORRECTED AS REQUESTED

CORRECTION (BEGNO,5) (ENDNO,340)
(NAMES,PHA CAL 20 JUL)
(TOTAL EXPOSURE,10530) (TOTAL TIME,  338)
WITH SEQNO,FROM 73 TO 106*
               34 RECORDS WERE CORRECTED AS REQUESTED
```

```
CORRECTION (BEGNO,1) (ENDNO,252)
     (NAMES,SHOT 21)
(TOTAL EXPOSURE,8305) (TOTAL TIME,0)
WITH SEQNO,FROM 107 TO 132*
               26 RECORDS WERE CORRECTED AS REQUESTED

WRITE DATA FILE*


 DATE     TIME    CORE  BUFFERS  RECORDS
091776  171108    36K         1     1056

USER ALLOCATION AND ACTUALLY USED VALUES
       A        B        C        D        E        F        G
      50      500       50      500       50      300       35
      16       31        5       35       16      225       30

       H        I        J        K        L
       9       50      500      200     1000

      END

@FIN
```

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