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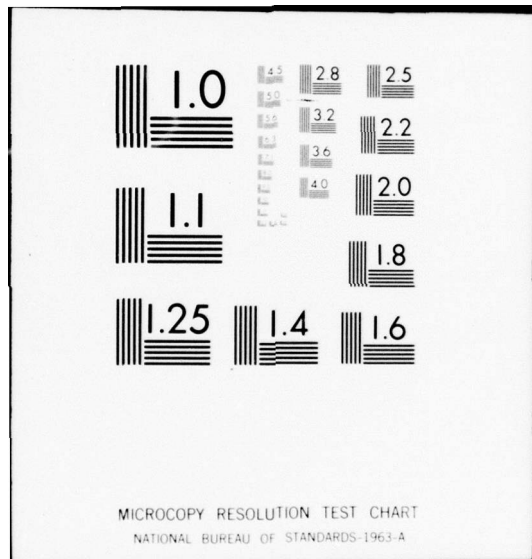
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**ANALYSTS' MANUAL
FOR THE
ITEM ACQUISITION/PRODUCTION
TRADE-OFF MODEL
COLD BASE VERSION**

DECEMBER 1977

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<p>The JCAP Item Acquisition/Production Trade-Off Model is a computerized decision model written in the FORTRAN, MPSX, and COBOL computer languages. The model is designed to develop an optimum cost-readiness relationship for an end item considering all available trade-off options that might meet requirements specified by logistics guidance. The model uses integer programming to identify specific optimum cost-readiness points either by maximizing readiness for a given cost or by minimizing cost for a given readiness.</p>			

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- (1) General background information to assist in understanding the environment for which the model is intended;
- (2) A mathematical description of the model;
- (3) A description of how the model is exercised; and
- (4) An appendix with computer source listings.

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ANALYSTS' MANUAL
FOR THE
ITEM ACQUISITION PRODUCTION/TRADE-OFF MODEL

FOREWORD

In the Department of Defense environment, there is a need for the capability of evaluating the cost effectiveness of inventory acquisition and production trade-offs in the procurement process. This cost effectiveness is based on the optimum procurement plan for achieving a specified readiness. This plan is achieved by the utilization of component stockpiling and industrial preparedness measures (IPM's) and modernization investments.

To determine these optimum plans, based on joint specification by the Military Services, the Item Acquisition/Production Trade-Off Model was designed under the auspices of the Joint Conventional Ammunition Program Coordinating Group. This model has been successfully demonstrated by the Military Services.

This Analysts' Manual and a companion document, The Users' Manual, comprise an export package which will permit the Military Services to install and use this Item Acquisition/Production Trade-Off Model.

The Analysts' Manual consists of an explanation of the Item Acquisition/Production Trade-Off Model concept, along with appropriate uses of the model. It also describes in detail the input variables and how they are entered and arranged. Included also are descriptions of the model output and sample formats with descriptions of data input and output.

Configuration management of the model is retained by the Joint Conventional Ammunition Program Decision Models Directorate. Proposals for modification of the model and inquiries with respect to the model application and operation should be addressed to the Director, Joint Conventional Ammunition Program Decision Models Directorate, Rock Island Arsenal, IL 61299. Telephone inquiries should be addressed to the Chief, Item Acquisition and Materiel Planning Division, Decision Models Directorate, AUTOVON 793-5980.



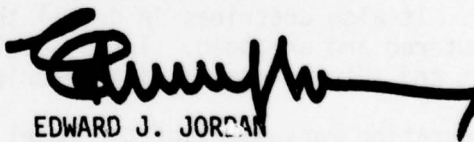
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Rock Island Arsenal, IL. 61201

ANALYSTS' MANUAL
FOR THE
ITEM ACQUISITION/PRODUCTION TRADE-OFF MODEL

This Analysts' Manual and a separately published Users' Manual provide detailed instructions and information for the Item Acquisition/Production Trade-Off (IA/PT) Model. The IA/PT Model was designed, developed, and demonstrated by the Joint Conventional Ammunition Program Decision Models Directorate in response to requirements established by the Military Services. The model has been accepted for their use as described herein.

Although the Item Acquisition/Production Trade-Off Model was designed to assist managers in the ammunition production base area, it is applicable to any commodity when the effects of inventory acquisition and production trade-off must be evaluated by decision makers.



EDWARD J. JORDAN
Executive Director

ABSTRACT

The JCAP Item Acquisition/Production Trade-Off Model is a computerized decision model written in the FORTRAN, MPSX, and COBOL computer languages. The model is designed to develop an optimum cost-readiness relationship for an end item considering all available trade-off options that might meet requirements specified by logistics guidance. The model uses integer programming to identify specific optimum cost-readiness points either by maximizing readiness for a given cost or by minimizing cost for a given readiness.

This volume contains:

- (1) General background information to assist in understanding the environment for which the model is intended.
- (2) A mathematical description of the model.
- (3) A description of how the model is exercised.
- (4) An appendix with computer source listings.

ACKNOWLEDGEMENTS

The contributions of the following individuals to the development, modification, application, and documentation efforts on this model are gratefully acknowledged.

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SUMMARY

In May 1972 the Joint Logistics Commanders (JLC) established the Joint Conventional Ammunition Production Coordinating Group (JCAP/CG) and gave it the authority to coordinate and take action on all conventional ammunition production base activities and programs delegated by the respective commanders. The JCAP/CG basic charter was expanded in October 1974 to include conventional ammunition logistics programs and activities; and the name of JCAP/CG was changed to Joint Conventional Ammunition Program Coordinating Group. Under the sponsorship of the JCAP/CG, the Joint Conventional Ammunition Program Operating Group (JCAP/OG) has the responsibility for administering the Coordinated Management System for the DoD Conventional Ammunition Logistics Activities and Programs.

As directed by the JCAP/OG, the JCAP Decision Models Directorate (JCAP-DM) designs, develops, tests and provides guidance for implementation of all decision models, both economic and non-economic, required in the joint management of conventional ammunition logistics activities and programs.

The Joint Panel Report which led to the formation of JCAP states the motivation for development of the Item Acquisition/Production Trade-Off (IA/PT) Model: "An economic model(s) is needed that enables the determination of the most cost effective manner to program the ammunition production base so as to minimize the amount of inventory required while maximizing the responsiveness of the production base to meet wartime needs."

There are two ways of reducing inventory or inventory costs through use of the IA/PT model. Speed of production response to mobilization demands may be improved; or ammunition components may be stored instead of storing end items only. The IA/PT Model compares costs of increasing component and end item inventories with production response alternatives and identifies the least-cost alternative for improving readiness for management use.

The following table lists some of the end items studied during model development. The potential savings are found by comparing the IA/PT Model solution to buying end items only.

<u>STUDY</u>	<u>ITEM</u>	<u>POTENTIAL COST AVOIDANCE (\$ in millions)</u>
JCAP MOBILIZATION LEADTIME STUDY APRIL 1975	CBU58B Bomb (Air Force)	67.7*
	MK82 Bomb (Navy)	77.5
	105mm HE, M1 (Army)	298.0
ARMCOM COMPONENT STOCKPILE STUDY APRIL 1975	81mm, M374A2 (Army)	212.0
	155mm, M107 (Army)	201.0
JCAP MOBILIZATION LEADTIME STUDY, SUPPLEMENTAL DECEMBER 1975	5"/54 Full Charge (Navy)	21.2
	5"/54 Projectile FCC (VT) (Navy)	20.7
	76mm Cartridge HE-IR (Navy)	19.3
JCAP CBU 58B STUDY MARCH 1976	CBU 58B Bomb (Air Force)	42.9
JCAP AMMUNITION READINESS STUDY FOR THE AIR FORCE FY79 BUDGET ESTIMATE JULY 1977	MK84 Bomb (Air Force)	205.0
	CBU MK20 Rockeye (Air Force)	4.8
	30mm API (Air Force)	6.7
	30mm HEI (Air Force)	54.9
	20mm HEI M56 (Air Force)	105.6
	TOTAL	\$1,269.6

*Total does not include first CBU 58B study

This IA/PT Model Analysts' Manual contains basic model concepts, a mathematical description of the model, a program listing, and information needed to make computer runs. A companion IA/PT Model User's Manual describes input data and input data formats used in the model. For further information about the IA/PT Model and its application, the point of contact is Mr. George Martin (JCAP-DM) AUTOVON 793-5980, Commercial (309) 794-5980.

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TABLE OF CONTENTS

	<u>Page</u>
CHAPTER 1 INTRODUCTION	
1-1. General	1
1-2. Background	1
a. Post D-Day Concept	1
b. Inventory Production Response Tradeoff	2
c. Costing Policies	4
d. Period Considered in IA/PT Analysis.	4
e. Model Application.	5
CHAPTER 2 MODEL	
2-1. Introduction	10
2-2. Definition of Variables.	10
2-3. Techniques Used.	12
2-4. Costs Considered	12
2-5. Optimization	12
2-6. Constraints.	12
CHAPTER 3 OPERATION	
3-1. Introduction	15
3-2. Method of Operation.	15
3-3. Method for Obtaining Cost-Readiness Points	16
3-4. Additional Input Controls.	16
3-5. Problem Size and Running Time.	18
APPENDIX A SOURCE LISTINGS AND JOB CONTROL LANGUAGE.	19
APPENDIX B COMPARATIVE RUN TIMES	73

FIGURES

	Page
Figure 1. Wartime Production and Consumption Rates Versus Time. . . .	2
Figure 2. Production Rate and Consumption Versus Time	3
Figure 3. Determination of N-Day.	6
Figure 4. Component Trade-Off	7
Figure 5. IPM Trade-Off	8
Figure 6. Computer Runs for IA/PT Analysis.	17

TABLES

Table B-1. Run Time as a Function of Problem Size	75
Table B-2. Problem Size	76

CHAPTER 1
INTRODUCTION

1-1. GENERAL

This Analysts' Manual is one of two manuals for the JCAP Item Acquisition/Production Trade-Off Model (IA/PT). It contains sufficient information to permit the reader to operate the model. The companion Users' Manual describes how to prepare the input and interpret the output.

1-2. BACKGROUND

In planning to meet mobilization requirements, it is necessary to consider the mix of inventory and production response. The IA/PT model was developed to evaluate the trade-offs involved. The following discussion provides a basis for understanding how the model functions.

a. Post D-day Concept

(1) The post D-day (D-day is the day hostilities are declared) concept is a planning method used for the evaluation of the capability of meeting combat requirements from inventory and production. It provides a tool for ammunition planning that is independent of the duration of the conflict, but which assures the defense planner a reasonable degree of readiness to meet wartime consumption. The classic inventory/production response trade-off is based on a known demand for the product under consideration. Knowing this demand, the planner establishes an appropriate stock level (inventory policy) and production response to meet the demand. Demand for an ammunition item is supported from inventory procured before D-day and from production after D-day. Combat ammunition uses requirements rates which eventually level off at a constant value. Since the production rate for an item will not be programmed to decrease during a mobilization period, it is only necessary that the IA/PT address satisfaction of the requirements up to the time that the production rate meets or exceeds the requirements (this time is called "P-day") or some earlier specified time.

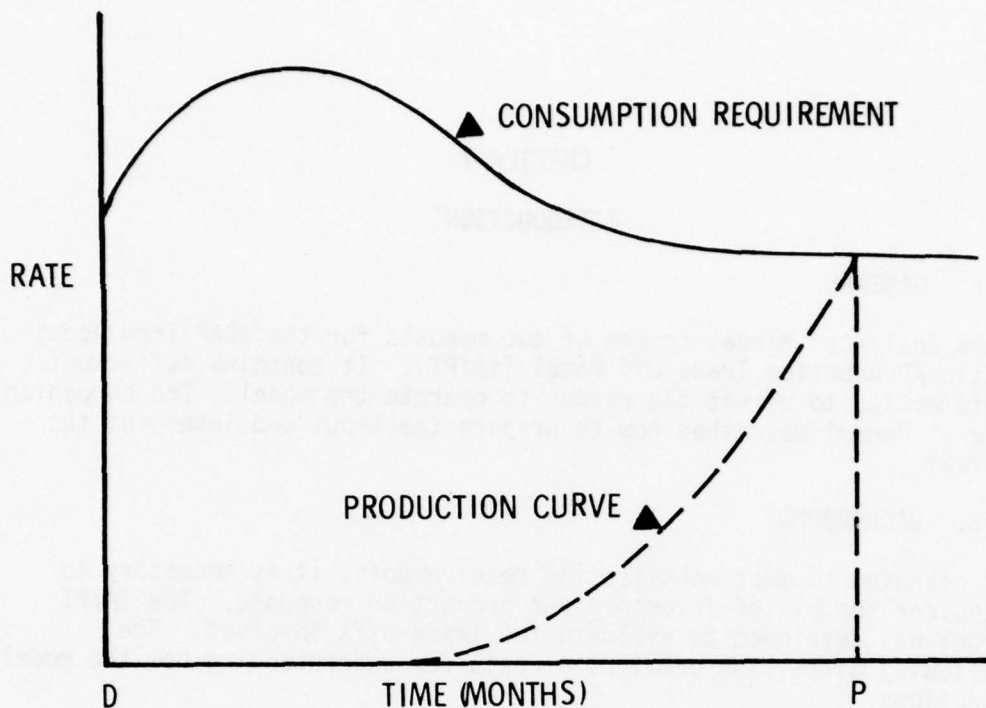


FIGURE 1. WARTIME PRODUCTION AND CONSUMPTION RATES VERSUS TIME

(2) Figure 1 illustrates projected ammunition consumption and production for an item. The vertical axis represents a rate (rounds/month) and the horizontal axis represents time (months). Therefore, an area on the chart represents a quantity of ammunition. The area under the production curve for a specified time period is the quantity of ammunition produced (the "production offset" for the period). The difference between what ought to be available for conflict (cumulative requirements) and what can be produced during conflict (production offset) must be stockpiled if requirements are to be met.

b. Inventory/Production Response Trade-Off

(1) Production rate decisions are sensitive to maintenance and layaway policies, modernization programs, item and component inventory, and production base activity. When the goal is to minimize cost, the planner should select the combination of item and component inventory and production response expenditures that incurs the least cost and still meets the desired level of readiness. If the funding level changes for these expenditures, the mobilization production response rate changes and the inventory required to provide a specified readiness changes.

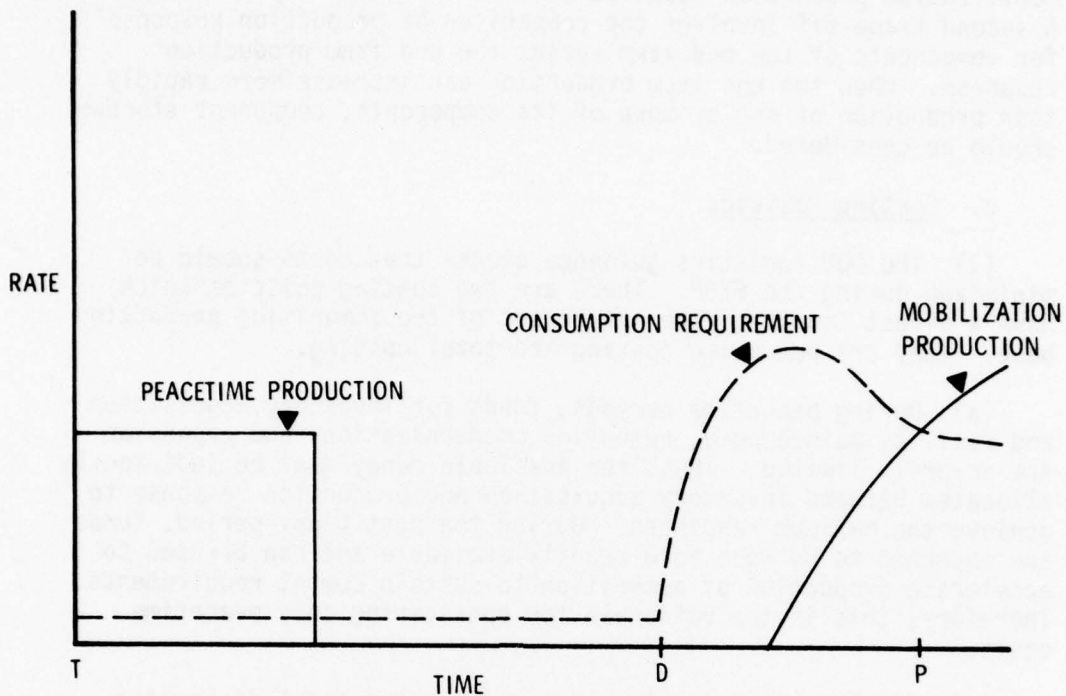


FIGURE 2. PRODUCTION RATE AND CONSUMPTION VERSUS TIME

(2) Figure 2 portrays major events and activities involved in the trade-off process. The end of the planning period and the beginning of the Five Year Defense Program (FYDP) is designated as T-day. Assets-on-hand (inventory) as of T-day are considered to have been acquired with sunk funds (funds that have been committed) and are not available for trade-off and so are not a part of the current decision process. (Assets on hand contribute to current readiness but can't be converted to funds to improve production response). The production curve (solid line) can be moved as a result of decisions made by the planner.

(3) To exactly meet requirements, initial assets plus production must equal consumption plus quantity in transit (not shown in figures). Because mobilization production cannot start immediately on D-day, a large part of the combat requirements must be met by inventory. This is illustrated in Figure 2. The inventory accumulated in peacetime must be adequate to support consumption until mobilization production can increase to support consumption needs (materiel in transit must

be included). One of the trade-offs to be considered is improving mobilization production response so that inventory may be decreased. A second trade-off involves the comparison of production response for components of the end item versus the end item production response. When the end item production can increase more rapidly than production of one or more of its components, component storage should be considered.

c. Costing Policies

(1) The DOD logistics guidance states that costs should be minimized during the FYDP. There are two costing policies which have a direct impact on the management of the ammunition production base. They are peacetime costing and total costing.

(a) During peacetime periods, funds for inventory acquisition and facility maintenance, retention, modernization, and expansion are severely limited. Thus, the available money must be judiciously allocated between inventory acquisition and production response to achieve the maximum readiness. During the post D-day period, funds are expected to be much more readily available and can be used to accelerate production of ammunition to sustain combat requirements. Therefore, this is the rationale for considering only peacetime costs.

(b) Total costing involves determining the total discounted cost of inventory acquisition and facilities modernization and expansion for a specific time frame.

(2) Costing policies are significant in the management of the ammunition production base, but they have little impact on the modeling techniques used. The IA/PT model is normally operated with peacetime costing but can be modified for use with total costing.

d. Period Considered in IA/PT Analysis

Any planning period may be used with the IA/PT model. The period following D-day for which requirements and production are included in the analysis depends on the scenario desired for the study. Since the post-mobilization period is variable, the model can be used to perform short to long term planning. For the long term situation, a 24-month period is normally used. There is no need to consider post-mobilization periods extending past the point that production exceeds requirements. The use of the FYDP period in describing data inputs reflects the intended use of the IA/PT model in FYDP planning, but the user should select the period appropriate to the planning situation.

e. Model Application

(1) The IA/PT model makes trade-offs for a single end item at a time; it selects a plan specifying a combination of plant response, end item inventory, industrial preparedness measures (IPM's), and component inventory. The model provides either the least cost plan to meet a specified level of item readiness, or a maximum readiness plan for a specified budget.

(2) Ammunition readiness is a measure of the availability of an item relative to the requirements for that item. The IA/PT model uses a readiness measure, the readiness ratio (RR), to indicate the capability to support requirements following mobilization. The readiness ratio for an item defines a planned asset allocation until no assets remain (N-Day); subsequent requirements are supported only by production. An equation for readiness ratio may be written as follows, for each item:

$$RR = \frac{\text{Assets}_T + \sum_1^5 (\text{Proc} + \text{Prod-Losses}) + \sum_D^N \text{Production}}{\sum_D^N \text{Requirements}}$$

Where

Assets_T	Represents those assets for which funds will have been committed by T-day
$\sum_1^5 \text{Proc} + \text{Prod}$	Total Peacetime Procurement and Production unfunded at T-day
$\sum_1^5 \text{Losses}$	Total of training and other peacetime ammunition uses
$\sum_D^N \text{Production}$	The production offset through N-day
$\sum_D^N \text{Requirements}$	Represents cumulative requirements through N-day (including materiel in transit)

(3) The use of the RR defined above is intended to apply only in the 0.0 to 1.0 interval. A current RR is calculated to project readiness obtained by using T-day assets and projected mobilization production response figures in the above equation. At the two extremes: if the "basic load", "ships stores" or similar stockage cannot be met, then no assets will be available for trade-off (N-day is the same as D-day) and current RR = 0.0; if assets equal or exceed cumulative requirements to P-day then the current RR is 1.0.

(4) The period over which requirements are considered is variable. This will be determined by the scenario or specific study constraints but in any case, extending time past P-day will have no effect on results from the model.

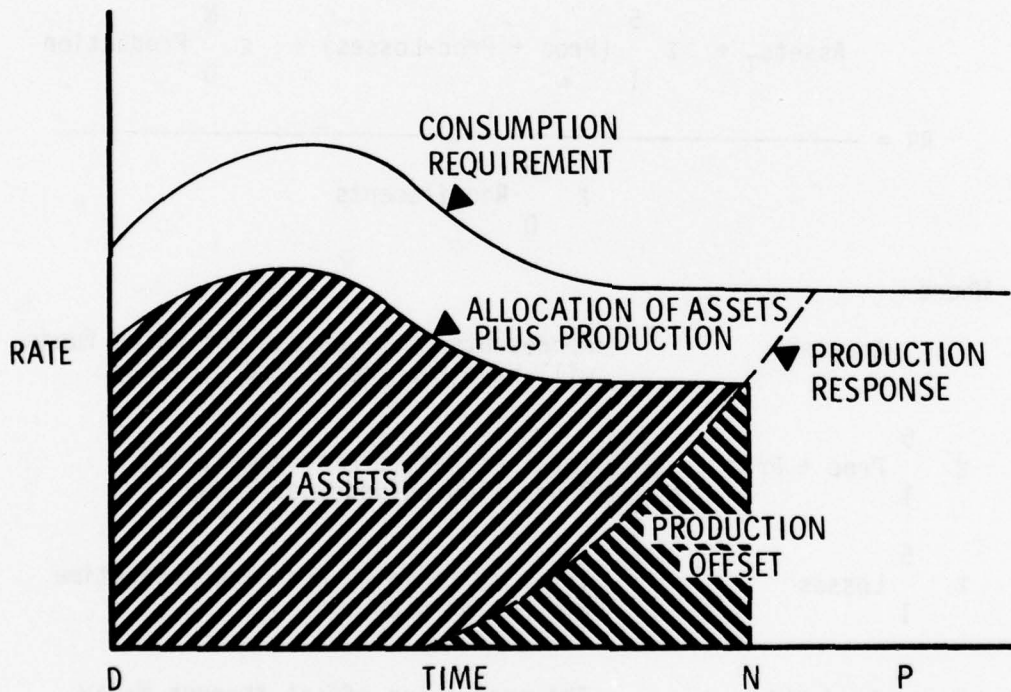


FIGURE 3. DETERMINATION OF N-DAY

(5) Figure 3 shows how N-day is normally determined. Assets are allocated so that the sum of assets plus production is a constant fraction of requirements and there are no more assets when the production rate equals this allocation rate. (Cross-hatching is used to show that assets fill the area above the production response.) N-day is the day inventory is exhausted, when allocation is made by the above rule. If requirements are met without using up all of the assets, N-day and P-day are the same and $RR = 1.0$. For RR less than 1.0, the production rate continues to increase after N-day and from N-day to P-day the ratio of the amount of ammunition available to the amount required is larger than the readiness ratio. After N-day, requirements are satisfied only from post D-day production. If the period selected for the analysis is too short to permit the production rate to equal the allocation rate at N-day, assets are to be used up in the period and N-day is the end of the period.

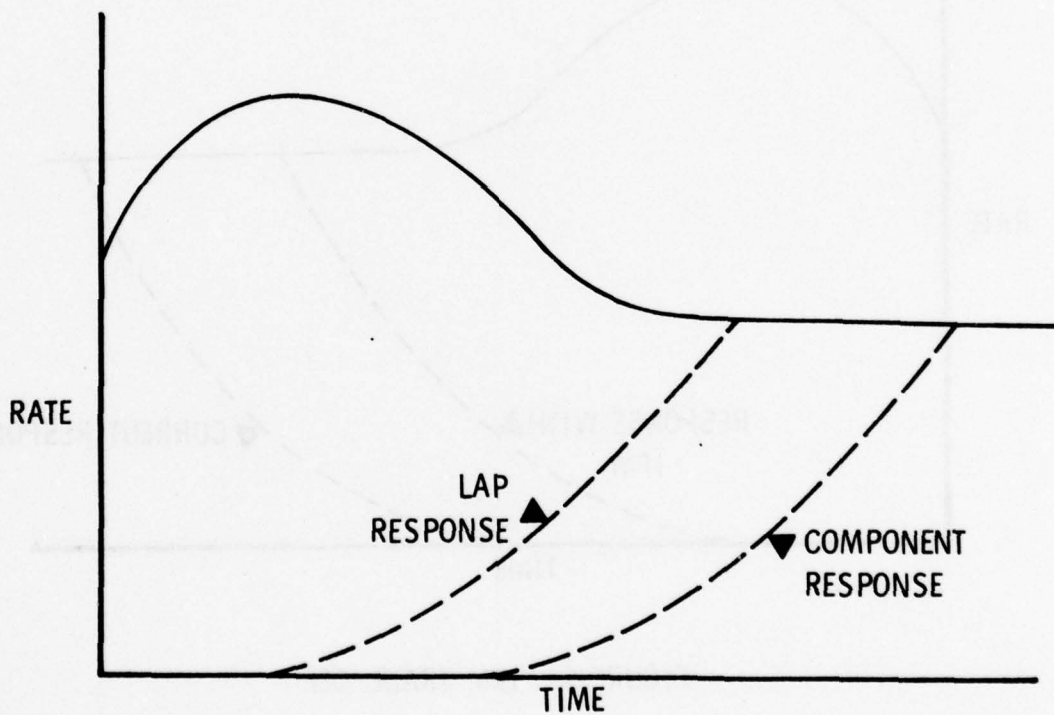


FIGURE 4. COMPONENT TRADE-OFF

(6) The selection of component buy or end item buy depends on the relationship of the component production to the end item production (Load, Assembly, and Pack or "LAP") response. If, as shown in Figure 4, a component production rate occurs later than the end item LAP rate, requirements represented by the area between the two curves can be satisfied by stockpiling components. These stockpiled components would then be available to supply maximum LAP capabilities. For one end item, more than one component may need to be stockpiled. Lower costs associated with component storage often make component stockpiling cheaper than end item stockpiling. The model will select the lowest cost alternative.

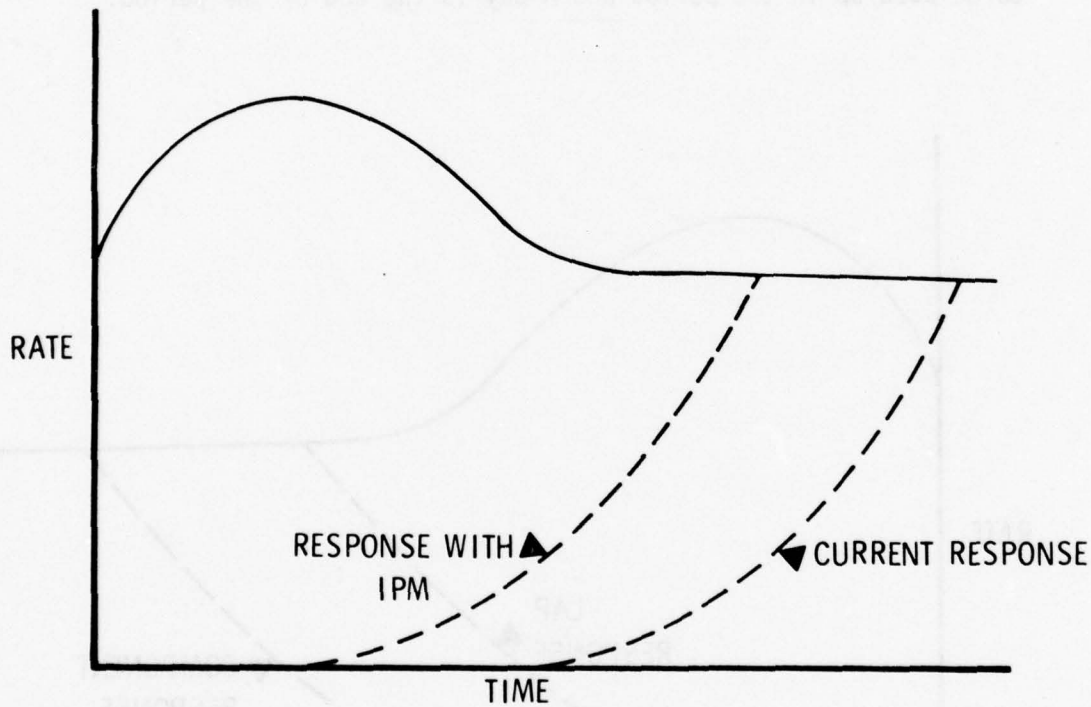


FIGURE 5. IPM TRADE-OFF

(7) An Industrial Preparedness Measure (IPM) is any action taken prior to D-day to improve post D-day response. If the time improvement resulting from the implementation of an IPM is as shown in Figure 5, then the area between the two response curves is equivalent to a specific amount of inventory. The IA/PT model compares the costs of the IPMs to the cost of this inventory and selects the cheapest.

(8) Depending on the objective of the user, the IA/PT model selects either the least-cost solution or the maximum readiness solution. In either case, the solution specifies the quantities of components and end items to be procured and the IPM's to be implemented.

CHAPTER II

MODEL

2-1. INTRODUCTION

The Item Acquisition/Production Trade-Off Model (IA/PT) is used for a single end item and its components. For any specific readiness ratio (RR), it yields the total minimum peacetime costs (or for any dollar budget, it maximizes the readiness ratio) by specifying quantities of end items and components to be stockpiled for use following mobilization, and selects IPM's for selected plants and production lines.

2-2. DEFINITION OF VARIABLES

a. Model decision variables used are:

$X_{p,g,i,j,k}$	amount of p production on line g with alternative i in month j for use in month k
$Y_{p,-1,k}$	amount of p to be produced in FYDP to be used in month k
$Y_{p,-2,k}$	amount of p available at beginning of planning period (T-day) to be used in month k
$I_{p,g,i}$	1 if p is produced on line g using alternative i, 0 otherwise
R	readiness ratio (RR)

b. The coefficients and constraints used by the model are:

c_p	average unit cost to produce product p
E	limit on available dollars
$r_{p,g,i}$	cost for alternative i on line g to produce p
D_k	requirement for end item in month k

Q_p	limit on procurement of p
P	peacetime requirement (5 year)
T_p	inventory of p on hand at T-day
$b_{p,g,i,j}$	during production buildup, the fraction of the eventual maximum capacity to produce p on line g with alternative i in month j
$W_{p,g,i}$	monthly capacity to produce p on line g using alternative i
U_p	total storage capacity for p (including the quantity of p already stored)
V	pipeline requirement (materiel in transit)

c. Subscripts and terminology used are:

p	product may be a component or an end item, p=1 represents the end item
p*	end item or component that p supports
g	line
i	identifier for IPM alternatives
j	month of production
k	month of use
s	number of months from D-day to P-day
T-day	termination of current planning period (start of FYDP)
R-day	end of FYDP
D-day	declaration of war or mobilization
N-day	day assets are exhausted when allocated at constant readiness
P-day	day when production meets requirements

2-3. TECHNIQUES USED

The model utilized mixed integer programming optimization. Implementation of the current version is through the IBM MPSX software package.

2-4. COSTS CONSIDERED

Only two types of costs are considered. The first cost is for inventory acquisition of end items and components. The second cost is to implement each IPM. All costs are current year dollars.

2-5. OPTIMIZATION

The model can be run to obtain the lowest cost plan for some specified readiness "Mode 1" or obtain the highest readiness plan within some fixed budget "Mode 2".

- a. For the Mode 1 case, the objective is to minimize total cost.

$$\text{Minimize } \left(\sum_p \sum_k c_p \cdot Y_{p,-1,k} + \sum_p \sum_g \sum_i r_{p,g,i} \cdot I_{p,g,i} \right) \quad (1)$$

This represents minimizing the sum of total component and end item production cost in the FYDP (with peacetime costing, production after D-day is "free") and the cost for those IPMs selected. Applicable constraints are discussed in paragraph 2-6.

- b. For the Mode 2 case, the objective is to maximize readiness:

$$\text{Maximize } R \quad (2)$$

subject to a funding constraint in addition to the constraints discussed in paragraph 2-6. This funding constraint is a limitation on production and IPM set-up costs in the same form as in 2-5a.

$$\sum_p \sum_k c_p \cdot Y_{p,-1,k} + \sum_p \sum_g \sum_i r_{p,g,i} \cdot I_{p,g,i} \leq E \quad (3)$$

2-6. CONSTRAINTS

The following discusses constraints which apply for both of the optimizations above.

- a. For each month, demand for the end item can be satisfied from three sources: inventory on hand, inventory to be purchased, and/or production before or during the month.

$$Y_{1,-2,k} + Y_{1,-1,k} + \sum_g \sum_i \sum_{j \leq k} X_{1,g,i,j,k} \geq D_k \cdot R \quad (4)$$

For $k = 1, 2, \dots, s$

b. For components, demand in a given month (k_0) is the total monthly production of the end item or component supported. There is a minimum 30-day shipping period provided between component production and utilization; component production must occur by month $k_0 - 1$.

$$Y_{p,-2,k_0} + Y_{p,-1,k_0} + \sum_g \sum_i \sum_{j \leq k_0 - 1} X_{p,g,i,j,k_0 - 1} \geq \quad (5)$$

$$\sum_g \sum_i \sum_{k \geq k_0} X_{p^*,g,i,k_0,k} \quad \forall p > 1, k_0 = 1, 2, \dots, s$$

The left-hand-side (l.h.s.) has the same form as in the constraint in paragraph 2-6a; the right-hand-side (r.h.s.) represents production of the product support in month k_0 for use in k_0 or after.

c. After P-day, demand at the level described by the RR must be satisfied by production.

$$\sum_g \sum_i X_{1,g,i,s+1,s+1} \geq D_{s+1} \cdot R \quad (6)$$

$$\sum_g \sum_i X_{p,g,i,r,r} \geq \sum_g \sum_i X_{p^*,g,i,s+1,s+1} \quad \forall p > 1, r = s, s+1 \quad (7)$$

For relation (6), the l.h.s. is total end item production on the month following P-day; the r.h.s. shows the fraction of requirements which must be supported. For relation (7), the l.h.s. is the component production in the month in which P-day occurs and the following month; the r.h.s. shows the production of components supported.

d. The allocation of inventory on hand, by month, must be consistent with total T-day inventory.

$$\sum_k Y_{p,-2,k} \leq T_p \quad \forall p \quad (8)$$

e. To limit procurement, the total FYDP period production is constrained after the RR = 1.0 run (Constraint can be eliminated if not applicable).

$$\sum_k Y_{p,-1,k} \leq Q_p \quad \forall p \quad (9)$$

f. For any month, production can be used in any later month for each line (the l.h.s.) and cannot exceed its buildup capability (the r.h.s.).

$$\sum_{k \geq j} X_{p,g,i,j,k} \leq b_{p,g,i,j} \cdot W_{p,g,i} \cdot I_{p,g,i} \quad \forall p,g,i,j \quad (10)$$

g. Insure that no unnecessary lines are opened to satisfy post P-day requirements (constraints can be eliminated if not applicable and may be overridden by redefining the right hand side to a fixed value).

$$\sum_g \sum_i W_{p,g,i} \cdot I_{p,g,i} \leq D_{s+1} + \text{Min}_{g,i} W_{p,g,i} \quad \forall p \quad (11)$$

The l.h.s. shows the monthly capacity (not buildup) for a product; the r.h.s. is the demand at P+1 month plus the smallest capacity line producing the product.

h. At most, one alternative may be selected for each line, the IPMs are mutually exclusive, only one can be selected.

$$\sum_i I_{p,g,i} \leq 1 \quad \forall p,g \quad (12)$$

i. The total inventory for a product (the l.h.s.) is constrained by storage capacity (the r.h.s.) (constraint can be eliminated if not applicable).

$$\sum_k Y_{p,-1,k} + \sum_k Y_{p,-2,k} \leq U_p \quad \forall p \quad (13)$$

j. The materiel in transit (l.h.s.) is filled at the same level as the readiness ratio (r.h.s.).

$$Y_{1,-1,0} + Y_{1,-2,0} \geq V \cdot R \quad (14)$$

CHAPTER III

OPERATION

3-1. INTRODUCTION

This chapter describes operation of the Mathematical Programming System, Extended (MPSX) version of the model on the IBM 360/65. Computer input must be prepared as described in the IA/PT Users' Manual.

3-2. METHOD OF OPERATION

Four sets of Job Control Language (JCL), two FORTRAN Programs, and three MPSX Programs are required to run the model. In addition, a COBOL Report Generator is available for use in interpreting the output. The listings for these programs are presented in Appendix A. Operation of the model is a three-step process: generate the matrix, solve the mixed integer program, and write a report.

a. MPSX program A is run with the first set of JCL. The input information (as described in the Users' Manual) is processed using a FORTRAN matrix generator called from MPSX program A. A matrix in MPSX format is generated and then processed. This program can terminate (the second FORTRAN program controls this) with one of three conditions: (1) optimal solution found, (2) the specified maximum time is exceeded with the optimal continuous solution not found, or (3) the specified maximum time is exceeded with the optimal continuous solution found but the optimal mixed integer solution is not. The status of the solution is saved on tape using the problem file.

b. MPSX program B and the second set of JCL are used to resume solution if MPSX program A or B terminates before reaching an optimal continuous solution. Using the problem file the program restores the problem and continues processing until one of the three conditions described in paragraph 3-2a is again reached.

c. MPSX Program C and the third set of JCL are used to resume solution, if MPSX Program A, B, or C terminate because the maximum time is exceeded after the optimal continuous solution is found but before the optimal solution is found. Using the problem file, the program restores the problem and then proceeds to termination under one of two conditions: Optimal solution or time exceeded.

d. Once the optimal solution is found, management reports can be generated using the fourth set of JCL, MPSX program C and the COBOL report generator.

3-3. METHOD FOR OBTAINING COST-READINESS POINTS

Running the model is portrayed in Figure 6 and is described below.

a. The first phase consists of two runs. One run is done with Mode 1 with RR fixed at 1.0. This run determines the cost as well as quantities of end item and components to be procured and IPM's to be implemented to meet requirements. The other run is done in Mode 2 with the budget fixed at \$0.0. This gives the current readiness (C.R.). The use of more than two significant figures for the readiness ratio is normally not meaningful in planning.

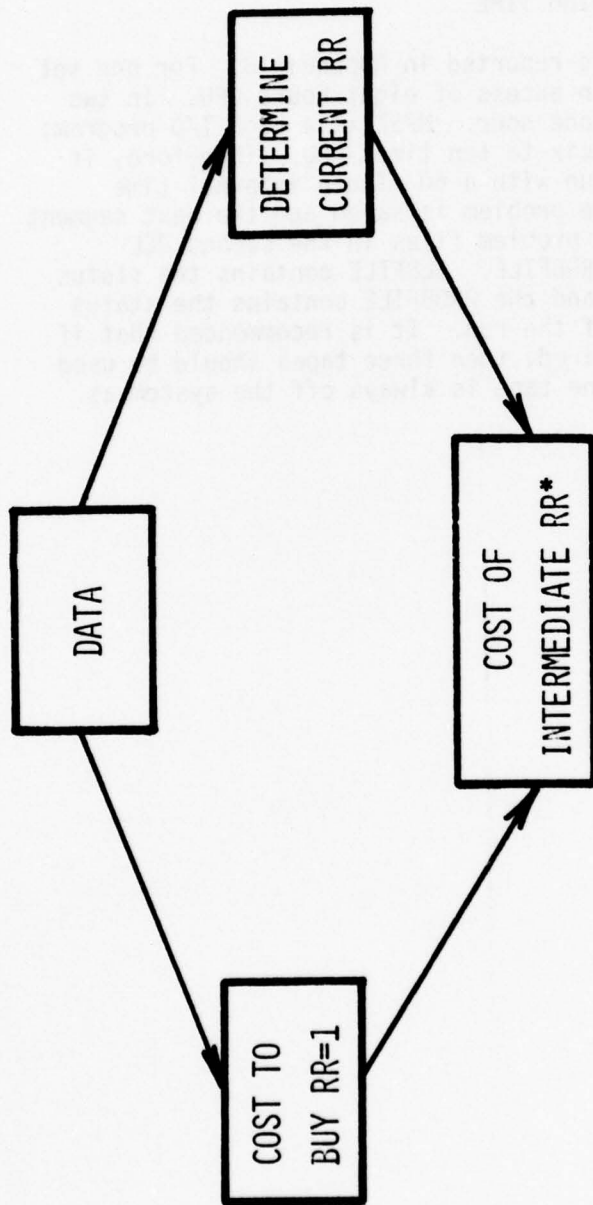
b. The second phase consists of up to three runs for intermediate points (more runs may be done if time permits or conditions require). Suggested intermediate readiness ratios to be run are given by the relation $CR + (1-CR) \cdot X$, where X takes on the values 0.1, 0.3, and 0.6. For CR above 0.7, only the last two values should be used. The uneven spacing is suggested to provide more points where the cost-readiness relation is changing most rapidly. For intermediate readiness runs, include only those IPM's selected in the first phase. Procurement (Q_p) of the end item and components should be constrained by the amounts obtained for RR = 1.0 to make planning consistent with reaching 100% readiness.

c. If it is desired to obtain readiness versus cost information with the restriction that component procurement is not permitted, then the runs in the first phase must have this restriction. Intermediate runs with this restriction are then run.

3-4. ADDITIONAL INPUT CONTROLS

In addition to the input described in the Users' Manual, the analyst may use card B to specify run parameters. The card columns, format, and description are as follows:

- a. Column 50 (I1) - The mode (1 or 2); default is 1.
- b. Columns 51-55 (F5.3) - The readiness ratio; default is 1.0.
- c. Column 56 (I1) - A scaling factor expressed as an exponent of 10. For example, 3 means all quantities will be converted to thousands; default is 0 (units).



* AS MANY AS REQUIRED

FIGURE 6 COMPUTER RUNS FOR IA/PT ANALYSIS

d. Columns 57-58 (12) - Number of periods after D-day; default is 24.

e. Columns 59-68 (F100) - Limit of post-P day production permitted (Q_p); zero means limit to be calculated, negative means no limit; default is -1.

3-5. PROBLEM SIZE AND RUNNING TIME

Experience with the model is reported in Appendix B. For one set of data, solution time is in excess of eight hours CPU. In two others, it is in excess of one hour. MPSX is a high I/O program; execution time is normally six to ten times CPU. Therefore, it has been found prudent to run with a 60 minute internal time control after which time the problem is saved and the next segment can execute. There are two problem files in the second JCL identified as OLDFILE and PROBFIL. OLDFILE contains the status of problem used to restart and the PROBFIL contains the status of the problem at the end of the run. It is recommended that if three or more runs are required, then three tapes should be used in rotation. In that way one tape is always off the system as backup.

APPENDIX A

SOURCE LISTINGS AND JOB CONTROL LANGUAGE

C	ISC - SCALING FOR SOLUTION (3 FOR THOUSANDS)	00003900
C	ITD - TIME FROM T-DAY TO D-DAY	00004000
C	ITR - TIME FROM T-DAY TO R-DAY	00004100
C	J - INDEX, USED MOSTLY AS SPECIFIC ALTERNATIVE	00004200
C	JI - INDEX	00004300
C	J10 - INDEX FOR MARKER CARDS	00004400
C	J11 - LINE NUMBER + 10	00004500
C	K - INDEX	00004600
C	KF - LAST INDEX ON READ	00004700
C	KI - INDEX	00004800
C	KJ - INDEX	00004900
C	KS - FIRST INDEX ON READ	00005000
C	L - INDEX	00005100
C	LI - INDEX	00005200
C	M - INDEX	00005300
C	MF - NO OF MONTHS IN D TO P PERIOD	00005400
C	MFA - INDEX	00005500
C	MFI - INDEX BOUND	00005600
C	MFL - INDEX BOUND	00005700
C	MF1 - MF INCREASED BY 10	00005800
C	MF2 - MF INCREASED BY 10	00005900
C	SUSRAT - MINIMUM SUSTAINING RATE	00005950
C	MODE - OPERATION MODE (1 IF MINIMIZING DOLLARS, 2 IF MAXIMIZING RR)	00006000
C	MPF - LAST TO READ IN	00006100
C	MPI - FIRST TO READ IN	00006200
C	MPP - MONTH FULL PRODUCTION REACHED FOR INDIVIDUAL LINE	00006300
C	MPS - MONTH PRODUCTION STARTS FOR INDIVIDUAL LINE	00006400
C	MSI - INDEX BOUND	00006500
C	MZ - INDEX	00006600
C	NA - NUMBER OF ALTERNATIVES	00006700
C	NI - INDEX	00006750
C	NP - NO OF PRODUCTS	00006800
C	NUM - CARD SEQUENCE NUMBER	00006900
C	PEREQ - PEACETIME REQUIREMENTS	00006950
C	PIPEM - PIPE TIMES FAC	00006980
C		00007000

C	PIPE - PIPELINE REQUIREMENT	00007100
C	PIPEN - NEGATIVE OF PIPE	00007200
C	PLNAME - PRODUCER/LINE NAME	00007230
C	PNAME - PRODUCT NAME	00007250
C	PREQ - VALUE OF REQUIREMENTS TIMES READINESS RATIO	00007300
C	PRFAC - PROCUREMENT FACTOR	00007350
C	PROCLM - LIMIT OF PROCUREMENT (IN END ITEM EQUIVALENT)	00007400
C	REQ - MONTHLY REQUIREMENTS	00007500
C	RLEV - BUILDUP FACTOR	00007600
C	RINVOH - ASSETS OF PRODUCT	00007700
C	STORCP - STORAGE CAPACITY	00007800
C	TEMP - TEMPERATURE OF ALTERNATIVE, W IF WARM, C IF COLD	00007840
C	TITLE - TITLE OF STUDY	00007850
C	TITID - SHORT TITLE	00007860
C	YRCRD - YEARLY COSTS R TO D DAY	00007900
C	YRCTD - YEARLY COSTS T TO D DAY	00008000
C	Z - LOCATION WHERE Z STORED, USED AS END OF FILE TEST	00008100
C	INITIALIZE	00008200
C	DOUBLE PRECISION HEAD	00008300
C	DIMENSION AP(99), COSTI(99), RINVOH(99), CAP(99), FICT(99), FICR(900008500	00008400
	19), YRCTD(99), YRCRD(99), RLEV(99,32), HP(99), HL(99), HA(99), HS(00008600	
	299), MPS(99), MPP(99), COSTE(99), REQ(99), STORCP(99),	00008700
	3 PROCLM(99), TITLE(17), TITLID (2), DATE(2), HOLLS(3), PNAME(99,5),	00008800
	4 ALFAC(99), PRFAC(99), PLNAME(99,5), SUSRAT(99), ALLLIN(99),	00008810
	5 TEMP(99), IPMDES(99,11)	00008820
	DATA Z/IHZ/, BL/IH /, C/IHC/	00008900
	J10=100	00009000
C	READING INPUT.	00009100
C		00009200
C		00009300
C		00009400
C	CARD A - TITLE OF STUDY	00009500
C	READ(5,400) HDL, TITLE, NUM	00009600
		00009700

```

C      WRITE(6,401) NUM, HOL, TITLE
C      CARD B - CONTROL CARD
C
C      READ(5,405) HOL, TITLID, NP, NA, DATE, DOLLAR,MODE, FAC, ISC, MF
1, EQ8LM, NUM
IF (MODE.EQ.0) MODE=1
IF (FAC.EQ.0.) FAC=1.
IF (MF .EQ. 0) MF=24
IF (MF.LT.24) MF=MF+1
IF (EQ8LM .LE. 0.) EQ8LM =-1.
WRITE(6,406) NUM, HOL, TITLID, NP, NA, DATE, DOLLAR
ITD=5
ITR=5
CC
C      CARD C - ASSETS MODIFICATION CARD
C
C      READ(5,410) HOL, ALLOW, PEREQ, ALDS, PIPE, NUM
C      WRITE(6,411) NUM, HOL, ALLOW, PEREQ, ALDS, PIPE
C
C      CARD D - REQUIREMENTS
C
C      WRITE(6,414)
DU 10 I=1,3
READ(5,415) HOL, HOLDS(I), (REQ((I-1)*8+J),J=1,8), IEXP, NUM
JI = (I-1)*8 + 1
JF = JI + 7
DU 11 J=JI,JF
11 REQ(J) = REQ(J) * 10.** IEXP
10 WRITE(6,416) NUM, HOL, HOLDS(I), (REQ((I-1)*8+J),J=1,8)
DU 12 I=25,99
12 REQ(I) = REQ(24)
C
C      CARD E - PRUDUCT INFORMATION
C
C      DU 20 I=1,NP

```

```

00009800
00009900
00009950
00010100
00010200
00010205
00010210
00010220
00010230
00010240
00010250
00010300
00010310
00010320
00010400
00010500
00010600
00010700
00010800
00010900
00011100
00011200
00011250
00011300
00011400
00011500
00011600
00011700
00011800
00011900
00011910
00011920
00012000
00012100
00012200
00012300

```



```

C
READ(5,430) HOL, FICT(I), YRCTD(I), (IPMDES(I,J),J=1,11), NUM
WRITE(6,431) NUM, HOL, FICT(I), YRCTD(I), (IPMDES(I,J),J=1,11)
FICR(I)=0.
YCRD(I)=0.
C
CARD H - BUILDUP CAPABILITY
C
WRITE(6,434)
RLEV(I,1) = 0.
RLEV(I,2) = 0.
DO 30 J=1,3
READ(5,435) HOL, HOL(I), (RLEV(I,(J-1)*8+K),K=3,10), IEXP, NUM
KI=(J-1)*8+1
KF=KI+7
DO 31 K=KI,KF
31 RLEV(I,K) =(RLEV(I,K)*10.+#IEXP)*ALLIN(I)
1 *ALFAC(L)/PRFAC(L)
30 WRITE(6,436) NUM, HOL, HOL(I), (RLEV(I,(J-1)*8+K),K=1,8)
GO TO 29
35 I=I-1
IF (I.NE.NA) WRITE(6,437) I, NA
NA=I
DO 33 I=1,NA
DO 32 J=1,24
IF (RLEV(I,J) .NE. 0.) GO TO 33
32 CONTINUE
33 MPS(I) = J
DO 34 I=1,NA
DO 34 J=25,32
34 RLEV(I,J)=RLEV(I,24)
C
C WRITING ROWS PORTION OF MATRIX
C
140 I=NA
C

```

```

00014100
00014200
00014300
00014310
00014320
00014400
00014500
00014600
00014700
00014730
00014760
00014800
00014900
00015000
00015100
00015200
00015300
00015301
00015350
00015360
00015370
00015380
00015400
00015410
00015420
00015430
00015435
00015440
00015450
00015460
00015470
00016900
00017000
00017100
00017200
00017300

```

```

C      WRITE NAME AND ROWS CARDS AND OBJECTIVE FUNCTION
C      AND CONSTRAINT C-3
C
C      IF (MODE.EQ.1) WRITE (8,460)
C      IF (MODE.EQ.2) WRITE (8,470)
C
C      WRITE ROWS FOR CONSTRAINTS C-4 TO C-7
C
C      MFI=MF+1
C      DO 150 J=1,NP
C      DO 150 K=1,MFI
C      KI=K+10
C      WRITE (8,480) KI, AP(J)
C      IF (( J.EQ. 1) .OR. (K. LT. MFI)) GO TO 150
C      KI = MFI + 11
C      WRITE (8,480) KI, AP(J)
C      CONTINUE
150
C      WRITE ROWS FOR CONSTRAINT C-8
C
C      DO 160 J=1,NP
C      WRITE (8,490) AP(J)
C
C      WRITE ROWS TO SUM BUY
C
C      DO 161 J=1,NP
C      WRITE(8,491) AP(J)
C
C      WRITE ROWS FOR CONSTRAINT C-9
C
C      DO 165 J=1,NP
C      IF (PROCLM(J) .LT. 0) GO TO 165
C      WRITE(8,495) AP(J)
C      CONTINUE
165
C

```

```

00017400
00017500
00017600
00017700
00017800
00017900
00018000
00018100
00018200
00018300
00018400
00018500
00018600
00018610
00018620
00018630
00018640
00018700
00018800
00018900
00019000
00019100
00019110
00019120
00019140
00019150
00019160
00019200
00019300
00019400
00019500
00019600
00019700
00019800
00019900
00020000

```

```

C
C
C
WRITE ROWS FOR CONSTRAINT C-10
DU 180 J=1,I
KS=MPS(J)
IF (KS.GT.MF) KS=MF
MFA=MF+1
DU 170 K=KS,MFA
KI=K+10
WRITE (8,500) HP(J),HL(J),HA(J),KI
CONTINUE
C
C
WRITE ROWS FOR CONSTRAINT C-11
DU 190 J=1,NP
IF(EQ8LM.LT. 0.) GO TO 190
WRITE (8,510) AF(J)
CONTINUE
C
C
WRITE ROWS FOR CONSTRAINT C-12
HPC=Z
HLC=Z
DU 210 J=1,I
IF ((HP(J).EQ.HPC).AND.(HL(J).EQ.HLC)) GO TO 200
WRITE (8,520) HP(J),HL(J)
HPC=HP(J)
HLC=HL(J)
C
C
WRITE ROWS FOR CONSTRAINT C-13
DU 213 J=1,NP
IF(STORCP(J).LT. 0.) GO TO 213
WRITE(8,525) AP(J)
CONTINUE
C
C

```

```

00020100
00020200
00020300
00020400
00020500
00020550
00020600
00020800
00020900
00021000
00021100
00021200
00021300
00021400
00021500
00021600
00021700
00021800
00021900
00022000
00022100
00022200
00022300
00022400
00022500
00022600
00022700
00022800
00022900
00023000
00023100
00023200
00023300
00023400
00023500
00023600

```

```

C      WRITE ROWS FOR CONSTRAINT C-14
C      WRITE(8,527) AP(1)
C      WRITING COLUMNS PORTION OF MATRIX
C      WRITE HEADER
C      WRITE (8,530)
C      WRITE READINESS RATIO VARIABLE (RR)
C      WRITE(8,533)
MF3 = MF+1
DO 215 J=1,MF3
  J11= J + 10
  PREQ = -REQ(J)
  WRITE(8,536) J11, AP(1), PREQ
  PIPEM = -PIPE
  WRITE(8,537) AP(1), PIPEM
C      WRITE CURRENT INVENTORY VARIABLES (Y-2)
C      CONTINUE
C      WRITE(8,538) AP(1), AP(1), AP(1)
C      MF1 = MF + 1
C      DO 221 J=1,NP
C      DO 221 K=1,MF1
C      IF (J.EQ.1 .AND. K.EQ.MF1) GO TO 221
C      KI=K+10
C      IF(STORCP(J) .LT. 0.) GO TO 220
C      WRITE(8,539) AP(J), KI, AP(J)
C      WRITE (8,540) AP(J),KI,KI,AP(J),AP(J)
C      CONTINUE
C      WRITE INVENTORY TO PROCURE VARIABLES (Y-1)
C      CONTINUE
C      WRITE INVENTORY TO PROCURE VARIABLES (Y-1)

```

```

00023700
00023800
00023900
00024000
00024100
00024200
00024300
00024400
00024500
00024600
00024700
00024800
00025000
00025100
00025200
00025300
00025400
00025500
00025600
00025900
00026000
00026100
00026200
00026300
00026400
00026450
00026500
00026600
00026650
00026700
00026800
00026900
00027000
00027100
00027150
00027200

```

```

215
216
220
221

```

```

C
WRITE (8,542) AP(1), COSTI(1), AP(1)
1 , AP(1), AP(1)
DO 231 J=1,NP
WRITE(8,545) AP(J), AP(J)
DO 231 K=1,MF1
IF (J.EQ.1 .AND. K.EQ.MF1) GO TO 231
KI=K+10
WRITE(8,544) AP(J), KI, AP(J)
IF(STORCP(J) .LT. 0.) GO TO 235
WRITE(8,543) AP(J), KI, AP(J)
IF(PROCLM(J) .LT. 0.) GO TO 229
WRITE(8,546) AP(J), KI, AP(J)
IF (MODE.EQ.2) GO TO 230
IF (J.GT.1) WRITE(8,555) AP(J), KI, COSTI(J)
230 WRITE (8,550) AP(J),KI,KI,AP(J),AP(J),KI,COSTI(J)
231 CUNTINUE
C
WRITE X AND I VARIABLES
C
DO 300 J=1,I
C
WRITE PRODUCTION VARIABLES (X)
C
MSI=MPS(J)
IF (MSI.GT.MF) MSI=MF
DO 250 K=MSI,MF
KI=K+10
DO 250 L=K,MF
LI=L+10
LII=LI
IF (HS(J).NE.BL) LII=LI+1
WRITE (8,560) HP(J),HL(J),HA(J),KI,LI,HP(J),HL(J),HA(J),KI,LII,HP(
1J)
HPC=Z
MFO=MF+10
00027300
00027400
00027401
00027500
00027550
00027600
00027650
00027700
00027750
00027800
00027900
00028000
00028100
00028150
00028200
00028300
00028350
00028400
00028500
00028600
00028700
00028800
00028900
00029000
00029100
00029150
00029200
00029300
00029400
00029500
00029600
00029700
00029800
00029900
00030000
00030050

```

```

00030100
00030200
00030300
00030400
00030410
00030420
00030430
00030500
00030600
00030700
00030800
00030900
00031000
00031100
00031160
00031200
00031300
00031400
00031520
00031600
00031700
00031710
00031720
00031725
00031730
00031740
00031745
00031750
00031755
00031760
00031765
00031770
00031780
00031800
00031900
00032000

DO 250 M=1,I
IF (HS(M).NE.HP(J)) GO TO 250
IF (HP(M).EQ.HPC) GO TO 240
WRITE (8,570) HP(J),HL(J),HA(J),KI,LI,KI,HP(M)
IF(KI.NE.MFO) GO TO 240
MF1=MFO+1
WRITE(8,570) HP(J), HL(J), HA(J), KI, LI, MF1, HP(M)
HPC=HP(M)
CONTINUE
MF1=MF+11
IF (HS(J) .NE. BL) GO TO 261
WRITE (8,580) HP(J),HL(J),HA(J),MF1,MF1,HP(J),HL(J),HA(
1),MF1
HPC=Z
MF3=MF1+1
DO 260 M=1,I
IF (HS(M).NE.HP(J)) GO TO 260
IF (HP(M).EQ.HPC) GO TO 260
WRITE (8,570) HP(J), HL(J), HA(J), MF1, MF1, MF3, HP(M)
HPC=HP(M)
CONTINUE
GO TO 270
MF1 = MF + 12
MF2 = MF + 11
WRITE(8,580) HP(J), HL(J), HA(J), MF2, MF2, MF1, HP(J),
1 HL(J), HA(J), MF2
HPC=Z
DO 265 M=1,I
IF (HS(M) .NE. HP(J)) GO TO 265
IF (HP(M) .EQ. HPC) GO TO 264
WRITE(8,570) HP(J), HL(J), HA(J), MF2, MF2, MF1, HP(M)
HPC=HP(M)
CONTINUE

240
250
260
261
264
265
C
C
C
WRITE CHOICE OF ALTERNATIVE VARIABLES (I) (INTEGER)

```

```

270 CONTINUE
    J10=J10+1
    WRITE (8,590) J10
    WRITE (8,600) HP(J),HL(J),HA(J),HP(J),HL(J)
275 MSI=MPS(J)
    IF (MSI.GT.MF) MSI=MF
    DO 280 K=MSI,MF
    KI=K+10
    BCAP=-RLEV(J,K)
280 WRITE (8,630) HP(J),HL(J),HA(J),HP(J),HL(J),HA(J),KI,BCAP
    MFA=MF+11
    BCAP = -CAP(J)
    WRITE (8,630) HP(J),HL(J),HA(J),HP(J),HL(J),HA(J),MFA,BCAP
    C REWRITE FOR DISCOUNTING
290 COST=FICT(J)+FICR(J)+YRCTD(J)*ITD+YRCRD(J)*(ITD-ITR)
    C
    COST=COST/10.*ISC
    DO 298 L=1,NP
    IF (HP(J) .EQ. AP(L)) GO TO 299
298 CONTINUE
299 CONTINUE
    COST = COST * ALLIN(4) * ALFAC(L) / PRFAC(L)
    WRITE (8,635) HP(J),HL(J),HA(J),COST
    IF (EQ8LM .GE. 0.) WRITE (8,620) HP(J),HL(J),HA(J),HP(J),CAP(J)
300 J10=J10+1
    WRITE (8,640) J10
    C
    C WRITING RHS PORTION OF MATRIX
    C
    C WRITE HEADER
    C
    C WRITE (8,650)
    C
    C WRITE RHS FOR CONSTRAINT C-3 (IF MODE 2)
    C
    C IF (MODE .EQ. 2) WRITE(8,665) DOLLAR

```



```

00040600
00040700
00040800
00040900
00041000
00041100
00041200
00041300
00041400
00041500
00041600
00041700
00041800
00041900
00042000
00042100
00042200
00042300
00042400
00042500
00042600
00042700
00042800
00043700
00043800
00043900
00044000
00044100
00044200
00044300
00044400
00044500
00044600
00044700
00044800
00044900

```

```

340 CONTINUE
    CARY=CARY+REQ(MF+1) * FAC
    IF (EQ8LM.NE.0.) CARY=EQ8LM
    WRITE (8,690) HP(I),CARY
    C
    C WRITE RHS FOR CONSTRAINT C-12
    C
    C
345 HPC=Z
    HLC=Z
    DO 370 J=1,I
    IF (HP(J).NE.HPC) GO TO 350
    IF (HL(J).EQ.HLC) GO TO 360
    WRITE (8,700) HP(J),HL(J)
350 HPC=HP(J)
360 HLC=HL(J)
    C
    C WRITE RHS FOR CONSTRAINT C-13
    C
    C
    DO 375 J=1,NP
    IF (STORCP(J) .LT. 0.) GO TO 375
    STORCP (J) = STORCP(J) / 10** ISC
    WRITE(8,705) AP(J), STORCP(J)
375 CONTINUE
    C
    C WRITING BOUNDS PORTION OF MATRIX
    C
    C WRITE HEADER
    C
    C
377 CONTINUE
    WRITE (8,710)
    C
    C WRITE INTEGER BOUNDS
    C
    C
    DO 380 J=1,I
380 WRITE (8,720) HP(J),HL(J),HA(J)
    C

```

```

C      WRITE LOWER BOUND FOR NEGATIVE INVENTORY
C
C      PIPEN = -PIPE
390    WRITE(8,730) AP(1), PIPEN
C
C      WRITE BOUND FOR RR
C
C      CONTINUE
395    IF (MODE .EQ. 2) WRITE(8,735)
C
C      WRITE ENDATA CARD
C
C      WRITE (8,740)
C      WRITE (8,750)
C      IF (MODE .EQ. 1) WRITE (8,760)
C      IF (MODE .EQ. 2) WRITE (8,770)
C      WRITE(8,780) TITLID
C      WRITE (8,740)
C      REWIND 8
C      STOP
C
C      FORMAT STATEMENTS
C
C      INPUT FORMATS
C
400    FORMAT(A1, 1X, 16A4, A2, 4X, 18)
401    FORMAT(I2H)INPUT DATA:/1H0, 18, 1X, A1, 1X, 8HTITLE - ,16A4,A2)
405    FORMAT(A1, 1X, 2A4, 1X, I2, 1X, I3, 1X, A4, A3, 1X, F15.0, 8X, 11,
      1 F5.3, 11, 12, F10.0, 4X, 18)
406    FORMAT(1H0, 18, 1X, A1, 1X, 14HSHORT TITLE - , 2A4,
      1 23H, NUMBER OF PRODUCTS - , 12, 26H, NUMBER OF ALTERNATIVES - ,
      2 12, 29H, START OF PLANNING PERIOD - , A4, A3/ 12X,
      3 10HBUDGET - $, F15.0)
410    FORMAT(A1, 1X, 4(F10.0, 1X), 26X, 18)
411    FORMAT (1H0, 18, 1X, A1, 22H INITIAL ALLOWANCES - , F10.0,
      1 27H, PEACETIME REQUIREMENTS - , F10.0, 11H, LOSSES - , F10.0/

```

```

00045000
00045100
00045300
00045600
00045700
00045800
00045900
00046000
00046100
00046200
00046300
00046400
00046500
00046510
00046520
00046530
00046540
00046550
00046600
00046700
00046800
00046900
00047000
00047100
00047200
00047300
00047320
00047340
00047350
00047360
00047380
00047400
00047410
00047420
00047440
00047460

```

2 12X, 24HPIPELINE REQUIREMENTS -, F10.0) 00047480
 414 FORMAT (1H0, 11X, 13HREQUIREMENTS:) 00047500
 415 FORMAT(2A1, 8F8.0, 1X, 11, 4X, 18) 00047520
 416 FORMAT (1X, 18, 1X, 2A1, 8(1X, F14.0)) 00047540
 420 FORMAT (A1, 1X, 5A4, 1X, A1, 2(1X, F10.0), 1X, F10.8, 1X, F10.4 00047560
 1, F8.0, 14) 00047580
 421 FORMAT(1H0, 18, 1X, A1, 1X, 10HPRODUCT -, 5A4, 9H, CODE -, A1, 00047600
 1 22H, INVENTORY ON HAND -, F10.0, 23H, AVERAGE UNIT COST - \$, 00047620
 2 F10.2/ 12X, 20HALLOCATION FACTOR -, F10.8, 00047640
 3 23H, PROCUREMENT FACTOR -, F10.6) 00047660
 425 FORMAT (A1, 1X, 5A4, 1X, 4A1, 2(1X, F10.0), 1X, F5.3, 1X, A1, 15X, 00047680
 1 18) 00047690
 426 FORMAT(1H0, 18, 1X, A1, 1X, 16HPRDUCER/LINE -, 5A4, 00047700
 1 33H, CODES IDENTIFYING ALTERNATIVE -, 4A1/ 12X, 00047720
 2 19HMAXIMUM CAPACITY -, F10.0, 27H, MINIMUM SUSTAINING RATE -, 00047740
 3 F10.0, 16H, TEMPERATURE -, A1) 00047760
 430 FORMAT(A1, 1X, 2(F10.0,1X), 11A4, 4X, 18) 00047780
 431 FORMAT(1H, 18, 1X, A1, 1X, 17HUNE TIME COST - \$, F10.0, 00047800
 1 17H, ANNUAL COST - \$, F10.0, 16H, DESCRIPTION -, 11A4) 00047820
 434 FORMAT(1H, 11X, 20HBUILDUP CAPABILITY:) 00047840
 435 FORMAT(2A1, 8F8.0, 1X, 11, 4X, 18) 00047860
 436 FORMAT(1X, 18, 1X, 2A1, 8(1X, F14.0)) 00047880
 437 FORMAT (1H0, 12, ' ALTERNATIVES READ IN ', 12, ' ALTERNATIVES ' 00047883
 1 'SPECIFIED IN INPUT. ADJUSTMENTS MADE FOR PROCESSING.')

C 00047886
 C 00048000
 C 00048100
 C 00048200
 C 00048300
 C 00048310
 C 00048400
 C 00048500
 C 00048600
 C 00048650
 C 00048700
 C 00048800
 C 00048900

ROWS FORMATS
 460 FURMAT (4HNAME, 10X, 5HBLOCK/ 4HROWS/ 8H N COST/, 00048300
 1 11H N ADDCOST/ 6H L RR) 00048310
 470 FURMAT (4HNAME, 10X, 5HBLOCK/4HROWS/8H N RR /, 8H L COST) 00048400
 480 FURMAT (5H G M, 12, A1) 00048500
 490 FURMAT (9H L INVDH, A1) 00048600
 491 FURMAT (7H E BUY, A1) 00048650
 495 FURMAT (8H L PROC, A1) 00048700
 500 FURMAT (6H L Ph, 3A1, 1HM, 12) 00048800
 510 FURMAT (9H L PUSTP, 1A1) 00048900

520	FORMAT (7H L SEL,2A1)	00049000
525	FORMAT (8H L STOR, A1)	00049100
527	FORMAT (8H G PIPE , A1)	00049200
C		00049300
C	COLUMNS FORMATS	00049400
C		00049500
530	FORMAT (7HCOLUMNS)	00049600
533	FORMAT (4X, 2HRR, 8X, 2HRR, 8X, 3H-1.)	00049700
536	FORMAT(4X, 2HRR, 8X, 1HM, I2, A1, 6X, E12.5)	00049800
537	FORMAT (4X, 2HRR, 8X, 4HPIPE, A1, 5X, E12.5)	00049900
538	FORMAT(4X, 3HH-2, A1, 2H10 , 4X, 5HINVQH, A1, 4X, 2H1., 13X,	00050000
	1 4HPIPE, A1, 5X, 2H1.)	00050100
539	FORMAT (4X, 3HY-2, A1, I2, 4X, 4HSTOR, A1, 5X, 2H1.)	00050200
540	FORMAT (4X,3HY-2,A1,I2,4X,1HM,I2,A1,6X,2H1.,13X,5HINVQH,A1,4X,2H1.	00050300
	1)	00050400
542	FORMAT (4X, 3HH-1, A1, 2H10, 4X, 4HCOST, 6X, E12.5, 3X,	00050500
	1 4HPIPE, A1, 5X, 2H1./ 4X, 3HH-1, A1, 2H10, 4X, 3HBUY, A1, 6X,	00050600
	2 2H1.)	00050610
543	FORMAT (4X, 3HY-1, A1, I2, 4X, 4HSTOR, A1, 5X, 2H1.)	00050700
544	FORMAT (4X, 3HY-1, A1, I2, 4X, 3HBUY, A1, 6X, 2H1.)	00050730
545	FORMAT (4X, 3HY-1, A1, 6X, 3HBUY, A1, 6X, 3H-1.)	00050760
546	FORMAT (4X, 3HY-1, A1, I2, 4X, 4HPRDC, A1, 5X, 2H1.)	00050800
550	FORMAT (4X,3HY-1,A1,I2,4X,1HM,I2,A1,6X,2H1.,13X/4X,3HY-1,A1,I2,4X,	00050900
	14HCOST,6X,E12.5)	00051000
555	FORMAT (4X, 3HY-1, A1, I2, 4X, 7HADDCOST, 3X, E12.5)	00051100
560	FORMAT (4X,1HX,3A1,2I2,2X,2HPW,3A1,1HM,I2,2X,2H1.,13X,1HM,I2,A1,6X	00051200
	1,2H1.)	00051300
570	FORMAT (4X,1HX,3A1,2I2,2X,1HM,I2,A1,6X,3H-1.)	00051400
575	FORMAT (4X, 1HX,3A1,2I2, 2X, 1HM, I2, A1, 6X, 3H+1.)	00051450
580	FORMAT (4X,1HX,3A1,2I2,2X,1HM,I2,A1,6X,2H1.,13X,2HPW,3A1,1HM,I2,	00051500
	1,2H1.)	00051600
590	FURMAT (4X,3HINT,I3,4X,8H'MARKER',17X,8H'INTORG')	00051700
600	FORMAT (4X,1HI,3A1,6X,3HSEL,2A1,5X,2H1.)	00051800
620	FURMAT (4X,1HI,3A1,6X,5HPOSTP,A1,4X,E12.5)	00052100
630	FORMAT (4X,1HI,3A1,6X,2HPW,3A1,1HM,I2,2X,E12.5)	00052200
635	FORMAT(4X,1HI,3A1,6X,4HCOST,6X,E12.5)	00052300

```

640 FORMAT (4X,3HINT,13,4X,6H'MARKER',17X,8H'INTEND')
C
C
C
650
660
665
670
675
690
700
705
C
C
C
710
720
730
735
740
C
C
750
760
770
780
END

```

```

RHS FORMATS
FORMAT (3HRHS)
FORMAT (4X, 6HCGNSTR, 4X, 2HRR, 8X, E12.5)
FORMAT(4X, 6HCONST, 4X, 4HCOST, 6X, E12.5)
FORMAT (4X,6HCONST,4X,5HINVOH,A1,4X,E12.5)
FORMAT (4X, 6HCONST, 4X, 4HPRDC, A1, 5X, E12.5)
FORMAT (4X,6HCONST,4X,5HPOSTP,A1,4X,E12.5)
FORMAT (4X,6HCONST,4X,3HSEL,2A1,5X,2H1.)
FORMAT (4X, 6HCCNSTR, 4X, 4HSTOR, A1, 5X, E12.5)

BOUNDS FORMATS
FORMAT (6HBUUNDS)
FORMAT (4H UP , 5HBOUND, 5X, 1H1, 3A1, 6X, 2H1.)
FORMAT (4H LO , 5HBOUND, 5X, 3HY-2, A1, 2H11, 4X, E12.5)
FORMAT(4H UP , 5HBOUND, 5X, 2HRR, 8X, 2H1.)
FORMAT (6HENDATA)

FORMATS FOR INPUT TO READ
FORMAT (4HNAME, 10X, 8HBLDCKCTL)
FORMAT (30HXMINMAX='MIN',XOBJJ='COST'
)
FORMAT (30HXMINMAX='MIN',XOBJJ='RR'
)
FORMAT(10HXCHARO1= ' , A8, 1H'
)

```

```

00052400
00052500
00052600
00052700
00052800
00053100
00053200
00053400
00053500
00053600
00053700
00053800
00054100
00054200
00054300
00054400
00054500
00054700
00054800
00054900
00055000
00055100
00055600
00055800
00055900
00055950
00056000
00056100
00056200

```

3. MPSX PROGRAM A READS THE MATRIX GENERATED BY THE FORTRAN SUB-ROUTINE. IT THEN PROCEEDS UNTIL REACHING AN OPTIMAL SOLUTION OR REACHING AN INTERNAL TIME CONTROL AT WHICH POINT IT SAVES THE

STATUS OF THE PROBLEM:

```

PROGRAM('ND')
  INITIALZ
  TITLE('JCAP IA/PT MODEL - INITIAL RUN')
  WRITE('START TIMERB')
  TIMERB(XDELTM)
  TYPE('JCAP IA/PT MODEL RUN - UP TO ', XDELTM, 'MIN CP TIME')
  ASSIGN('MATRIX','FT08F001','CARD')
  WRITE('START IAPTMG')
  IAPTMG
  MOVE(XDATA,'BLOCK')
  MOVE(XPBNAME,'PBFILE')
  CONVERT('FILE','MATRIX')
  MVADR(XDDDELTM,JUMP)
  MOVE(XDATA,'BLOCKCTL')
  READ('FILE','MATRIX')
  SETUP('BOUND','BOUND')
  MOVE(XDATA,'BLOCKB')
  MOVE(XRHS,'CONSTR')
  XFREQLGD=1000000
  PRIMAL
  INIMIX
  MVADR(XDDPRINT,CONT)
  MVADR(XDDDELTM,JUMPI)
  MVADR(XDDPRIM,A)
  MIXSTART('COST')
  MIXFLOW
  MIXSAVE
  MIXSTATS
  SOLUTION('ACTIVE')
  EXIT
  INVERT
  SAVE
  JUMP

```

```

00000100
00007900
00008000
00008005
00008010
00008015
00008020
00008025
00008030
00008100
00008200
00008300
00008500
00008600
00008700
00008800
00008900
00009000
00009100
00009200
00009300
00009305
00009310
00009315
00009320
00009330
00009340
00009350
00009400
00009500
00009900
00010000

```

```

00010100
00010200
00010210
00010220
00010230
00010240
00010250
00010260
00010270
00010280
00010290
00010300
00010305
00010310
00010320
00010330

```

```

EXIT
JUMPI
MIXSAVE
MIXSTATS
EXIT
CONTINUE
XINVERT=1
  INVERT
XDUNFS=0
PRIMAL
XINVERT=0
MVADR(XDUNFS,B)
CONTINUE
MIXSAVE
MIXSTATS
EXIT
PEND

```

4. MPSX PROGRAM B RESUMES WITH A PROBLEM WHERE THE CONTINUOUS OPTIMAL SOLUTION HAS NOT BEEN FOUND AND PROCEEDS UNTIL REACHING AN OPTIMAL SOLUTION OR REACHING AN INTERNAL TIME CONTROL AT WHICH POINT IT SAVES THE PROBLEM:

```

PROGRAM('ND')
  INITIALZ
  TITLE('JCAP IA/PT MODEL - RESUME IN CONTINUOUS PHASE')
  WRITE('START TIMERB')
  TIMERB(XDELTM)
  TYPE('JCAP IA/PT MODEL RUN - UP TO ', XDELTM, 'MIN CP TIME')
  MOVE(XDATA,'BLOCK')
  MOVE(XPBDNAME,'PBDNAME')
  MOVE(XOLDNAME,'PBDNAME')

```

```

00000100
00007900
00008000
00008005
00008010
00008015
00008100
00008200
00008300

```

00006400
 00008500
 00008800
 00008850
 00008900
 00009100
 00009200
 00009300
 00009305
 00009310
 00009315
 00009320
 00009330
 00009340
 00009350
 00009400
 00009500
 00009900
 00010000
 00010100
 00010200
 00010210
 00010220
 00010230
 00010240
 00010250
 00010260
 00010270
 00010280
 00010290
 00010300
 00010305
 00010310
 00010320
 00010330

```

    COPY('ENTIRE')
    MVADR(XDDDELT, JUMP)
    SETUP('BOUND', 'BOUND')
    RESTORE('STATUS')
    MOVE(XDATA, 'BLOCKB')
    XFREQLG0=1000000
    PRIMAL
    INMIX
      MVADR(XDDPRINT, CONT)
    MVADR(XDDDELT, JUMPI)
    MVADR(XDGPRI, A)
    MIXSTART('COST')
    MIXFLOW
    MIXSAVE
    MIXSTATS
    SOLUTION('ACTIVE')
    EXIT
    INVERT
    SAVE
    JUMP
    EXIT
    JUMPI
    CONT
    A
      MIXSAVE
      MIXSTATS
      EXIT
      CONTINUE
      XINVERT=1
      INVERT
      XDUNFS=0
      PRIMAL
      XINVERT=0
      MVADR(XDUNFS, B)
      CONTINUE
      MIXSAVE
      MIXSTATS
      EXIT
      PEND
    B
  
```

5. MPSX PROGRAM C RESUMES WITH A PROBLEM IN THE INTEGER TREE
 SEARCH AND PROCEEDS UNTIL REACHING AN OPTIMAL SOLUTION OR REACHING
 AN INTERNAL TIME CONTROL AT WHICH POINT IT SAVES THE STATUS OF

THE PROBLEM:

```

PROGRAM('ND')
  INITIALZ
  TITLE('JCAP IA/PT MODEL - RESUME IN MIP PHASE')
  WRITE('START TIMERB')
  TIMERB(XDELTM)
  TYPE('JCAP IA/PT MODEL RUN - UP TO ', XDELTM, 'MIN CP TIME')
  MOVE(XDATA, 'BLOCK')
  MOVE(XPBNNAME, 'PBFILE')
  MOVE(XOLDNAME, 'PBFILE')
  COPY('ENTIRE')
  SETUP('BOUND', 'BOUND')
  MOVE(XDATA, 'BLOCKB')
  XFREQLG0=100000
  INIMIX
  MVADR(XDUPRINT,CONT)
  MVADR(XDDELTM,JUMPI)
  MVADR(XDUPRIM,A)
  MIXSTART('RESTORE')
  MIXFLOW
  MIXSAVE
  MIXSTATS
  SOLUTION('ACTIVE')
  EXIT
  JUMPI
  MIXSAVE
  MIXSTATS
  EXIT
00000100
00007900
00008000
00008005
00008010
00008015
00008100
00008200
00008300
00008400
00008800
00008900
00009100
00009300
00009305
00009310
00009315
00009320
00009330
00009340
00009350
00009400
00009500
00010200
00010210
00010220

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00010230
 00010240
 00010250
 00010260
 00010270
 00010280
 00010290
 00010300
 00010305
 00010310
 00010320
 00010330

CONT CONTINUE
 A XINVERT=1
 INVERT
 XDDNFS=0
 PRIMAL
 XINVERT=0
 MVADR(XDDNFS,B)
 CONTINUE
 B MIXSAVE
 MIXSTATS
 EXIT
 PEND

6. THE FOLLOWING COBOL PROGRAM READS THE MPSX OUTPUT AND
 GENERATES A REPORT. FOR DETAILS SEE THE USERS' MANUAL.

000100 IDENTIFICATION DIVISION.
 000200 PROGRAM-ID. 'RPTGN'.
 000300 AUTHR. SCHWEGLER.
 000400 ENVIRONMENT DIVISION.
 000500 CONFIGURATION SECTION.
 000600 SPECIAL-NAMES.
 000700 COI IS NEXT-PAGE.
 000800 INPUT-OUTPUT SECTION.
 000900 FILE-CONTROL.
 001000 SELECT GLOSSARY-IN ASSIGN TO UT-S-GLOSSARY.
 001100 SELECT DATA-IN ASSIGN TO UT-S-DATA.
 001200 SELECT OUTPUT-FILE ASSIGN TO UT-S-PRINT.
 001300 DATA DIVISION.
 001400 FILE SECTION.
 001500 FD DATA-IN
 001600 DATA RECORDS ARE DISC-REC, SEARCH-REC,
 001700 RECORDING MODE IS F,

001800		BLOCK CONTAINS 0 RECORDS,
001900		LABEL RECORDS ARE STANDARD.
002000	01	DISC-REC.
002100		02 FILLER PIC X(10).
002200		02 IXY-CODE PIC X.
002300		02 PLANT-CODE.
002400		03 ITEM-MADE PIC X.
002500		03 FILLER PIC XX.
002600		02 CODE-FIELD REDEFINES PLANT-CODE.
002700		03 FILLER PIC X.
002800		03 INV-CUDE PIC X.
002900		03 ITEM-CODE PIC X.
003000		02 MONTH-USE PIC 99.
003100		02 PROD-MONTH REDEFINES MONTH-USE PIC 99.
003200		02 UTIL-MONTH PIC 99.
003300		02 FILLER PIC X(6).
003400		02 INPUT-REC.
003500		03 ACT-INT PIC X(7).
003600		03 ACT OCCURS 6 TIMES PIC X.
003700		02 ACT-SIGN PIC X.
003800		02 FILLER PIC X(95).
003900	01	SEARCH-REC.
004000		02 FILLER PIC X.
004100		02 START-FILE PIC X(19).
004200		02 END-FILE REDEFINES START-FILE.
004300		03 END-KEY PIC X(12).
004400		03 FILLER PIC X(7).
004500		02 FILLER PIC X(113).
004600	FD	OUTPUT-FILE
004700		DATA RECORD IS PRINT-OUT,
004800		RECORDING MODE IS F,
004900		LABEL RECORD IS OMITTED.
005000	01	PRINT-OUT PIC X(133).
005100	FD	GLOSSARY-IN
005200		DATA RECORDS ARE A-CARD, B-CARD, C-CARD, D1-CARD, D2-CARD,
005300		D3-CARD, E-CARD, F-CARD, G-CARD, H1-CARD, H2-CARD, H3-CARD,

005400		RECORDING MODE IS F,	
005500		LABEL RECORDS ARE OMITTED.	
005600	01	A-CARD.	
005700		02 CC-A	PIC X.
005800		02 FILLER	PIC X.
005900		02 STUDY-TITLE	PIC X(66).
006000		02 FILLER	PIC X(12).
006100	01	B-CARD.	
006200		02 CC-B	PIC X.
006300		02 FILLER	PIC X.
006400		02 TITLE-ID	PIC X(8).
006500		02 FILLER	PIC X.
006600		02 NO-PRD1	PIC XX.
006700		02 NO-PRD2	REDEFINES NO-PRD1 PIC 99.
006800		02 FILLER	PIC X.
006900		02 NO-ALT1	PIC XXX.
007000		02 NO-ALT2	REDEFINES NO-ALT1 PIC 999.
007100		02 FILLER	PIC X.
007200		02 FYDP-DATE	PIC X(7).
007300		02 FILLER	PIC X.
007400		02 FY-BUD1	PIC X(15).
007500		02 FY-BUD2	REDEFINES FY-BUD1 PIC 9(15).
007600		02 FILLER	PIC X(39).
007700	01	C-CARD.	
007800		02 CC-C	PIC X.
007900		02 FILLER	PIC X.
008000		02 INT-ALLOW1	PIC X(10).
008100		02 INT-ALLOW2	REDEFINES INT-ALLOW1 PIC 9(10).
008200		02 FILLER	PIC X.
008300		02 PEACE-REQ1	PIC X(10).
008400		02 PEACE-REQ2	REDEFINES PEACE-REQ1 PIC 9(10).
008500		02 FILLER	PIC X.
008600		02 LUSSES1	PIC X(10).
008700		02 LUSSES2	REDEFINES LUSSES1 PIC 9(10).
008800		02 FILLER	PIC X.
008900		02 PIPE-REQ1	PIC X(10).

009000	02	PIPE-REQ2	REDEFINES	PIPE-REQ1	PIC 9(10).
009100	02	FILLER		PIC X(35).	
009200	01	D1-CARD.			
009300	02	CC-D1		PIC XX.	
009400	02	D1-MCR	UCCURS 8	TIMES PIC X(8).	
009500	02	FILLER		PIC X.	
009600	02	EC-D11		PIC X.	
009700	02	EC-D12	REDEFINES	EC-D11	PIC 9.
009800	02	FILLER		PIC X(12).	
009900	01	D2-CARD.			
010000	02	CC-D2		PIC XX.	
010100	02	D2-MCR	UCCURS 8	TIMES PIC X(8).	
010200	02	FILLER		PIC X.	
010300	02	EC-D21		PIC X.	
010400	02	EC-D22	REDEFINES	EC-D21	PIC 9.
010500	02	FILLER		PIC X(12).	
010600	01	D3-CARD.			
010700	02	CC-D3		PIC XX.	
010800	02	D3-MCR	UCCURS 8	TIMES PIC X(8).	
010900	02	FILLER		PIC X.	
011000	02	EC-D31		PIC X.	
011100	02	EC-D32	REDEFINES	EC-D31	PIC 9.
011200	02	FILLER		PIC X(12).	
011300	01	E-CARD.			
011400	02	CC-E		PIC X.	
011500	02	FILLER		PIC X.	
011600	02	PRDD-NAME		PIC X(20).	
011700	02	FILLER		PIC X.	
011800	02	PRDD-CODE		PIC X.	
011900	02	FILLER		PIC X.	
012000	02	ASSETS-UN-HAND1		PIC X(10).	
012100	02	ASSETS-UN-HAND2	REDEFINES	ASSETS-ON-HAND1	PIC 9(10).
012200	02	FILLER		PIC X.	
012300	02	UNIT-COST1		PIC X(5).	
012400	02	FILLER		PIC X.	
012500	02	UNIT-COST2		PIC XXXX.	

012600	02 FILLER	PIC X.
012700	02 ALLDC-FAC1	PIC X.
012800	02 FILLER	PIC X.
012900	02 ALLDC-FAC2	PIC XXX.
013000	02 FILLER	PIC X.
013100	02 PRD-FAC1	PIC X(6).
013200	02 FILLER	PIC X.
013300	02 PRD-FAC2	PIC XXX.
013400	02 FILLER	PIC X(17).
013500	01 F-CARD.	
013600	02 CC-F	PIC X.
013700	02 FILLER	PIC X.
013800	02 PRD-LINE	PIC X(20).
013900	02 FILLER	PIC X.
014000	02 PRODT-CODE	PIC X.
014100	02 PRODR-CUDE	PIC X.
014200	02 ALTER-CUDE	PIC X.
014300	02 PRD-SUPPORT	PIC X.
014400	02 FILLER	PIC X.
014500	02 MAX-CAP1	PIC X(10).
014600	02 MAX-CAP2 REDEFINES MAX-CAP1	PIC 9(10).
014700	02 FILLER	PIC X.
014800	02 MSR1	PIC X(10).
014900	02 MSR2 REDEFINES MSR1	PIC 9(10).
015000	02 FILLER	PIC X.
015100	02 LINE-ALLDC-CODE1	PIC X.
015200	02 FILLER	PIC X.
015300	02 LINE-ALLDC-CODE2	PIC XXX.
015400	02 FILLER	PIC X.
015500	02 BASE-TEMP	PIC X.
015600	02 FILLER	PIC X(23).
015700	01 G-CARD.	
015800	02 CC-G	PIC X.
015900	02 FILLER	PIC X.
016000	02 DT-IPM-COSTS1	PIC X(10).
016100	02 DT-IPM-COSTS2 REDEFINES DT-IPM-COSTS1	PIC 9(10).

016200	02	FILLER	PIC X.
016300	02	A-IPM-CU1S1	PIC X(10).
016400	02	A-IPM-CC1S2	REDEFINES A-IPM-CD1S1 PIC 9(10).
016500	02	FILLER	PIC X.
016600	02	IPM-DESC	PIC X(44).
016700	02	FILLER	PIC X(12).
016800	01	H1-CARD.	
016900	02	CC-H1	PIC XX.
017000	02	PROD-BU-H1	OCCURS 8 TIMES PIC X(8).
017100	02	FILLER	PIC X.
017200	02	EC-H11	PIC X.
017300	02	EC-H12	REDEFINES EC-H11 PIC 9.
017400	02	FILLER	PIC X(12).
017500	01	H2-CARD.	
017600	02	CC-H2	PIC XX.
017700	02	PROD-BU-H2	OCCURS 8 TIMES PIC X(8).
017800	02	FILLER	PIC X.
017900	02	EC-H21	PIC X.
018000	02	EC-H22	REDEFINES EC-H21 PIC 9.
018100	02	FILLER	PIC X(12).
018200	01	H3-CARD.	
018300	02	CC-H3	PIC XX.
018400	02	PROD-BU-H3	OCCURS 8 TIMES PIC X(8).
018500	02	FILLER	PIC X.
018600	02	EC-H31	PIC X.
018700	02	EC-H32	REDEFINES EC-H31 PIC 9.
018800	02	FILLER	PIC X(12).
018900		WORKING-STORAGE SECTION.	
019000	77	STORAGE-START	PIC X(27) VALUE 'WORKING STORAGE STARTS HERE'.
019100	77	PREV-ITEM	PIC X VALUE SPACES.
019200	77	PREV-INV-CODE	PIC X VALUE SPACES.
019300	77	SWITCH-A	PIC XXX VALUE 'ON'.
019400	77	SWITCH-B	PIC XXX VALUE 'ON'.
019500	77	SWITCH-C	PIC XXX VALUE 'ON'.
019600	77	SWITCH-D	PIC XXX VALUE 'ON'.
019700	77	SWITCH-E	PIC XXX VALUE 'ON'.

019800	77	SWITCH-F	PIC XXX VALUE	DN	0.
019900	77	SWITCH-G	PIC XXX VALUE	UN	0.
020000	77	PLANT-CTR	PIC 99 VALUE		0.
020100	77	MONTH-CTR	PIC 99 VALUE		0.
020200	77	ITEM-CTR1	PIC 99 VALUE		0.
020300	77	ND-OF-ITEMS1	PIC 99 VALUE		0.
020400	77	ITEM-CTR2	PIC 99 VALUE		0.
020500	77	ND-DF-ITEMS2	PIC 99 VALUE		0.
020600	77	ITEM-CTR	PIC 99 VALUE		0.
020700	77	ND-OF-ITEMS	PIC 99 VALUE		0.
020800	77	ND-OF-PLANTS	PIC 99 VALUE		0.
020900	77	ND-OF-MONTHS	PIC 99 VALUE		0.
021000	77	PREV-PLANT	PIC XXX VALUE	SPACES.	
021100	77	GLOSSARY-CTR	PIC 99 VALUE		0.
021200	77	GLOSSARY-MAX	PIC 99 VALUE		0.
021300	77	SUB1	PIC 99 VALUE		0.
021400	77	SUB2	PIC 99 VALUE		0.
021500	77	SUB3	PIC 99 VALUE		0.
021600	77	SUB4	PIC 99 VALUE		0.
021700	77	SUB5	PIC 99 VALUE		0.
021800	77	DEC-CHK	PIC 99 VALUE		0.
021900	77	DEC-COUNT	PIC 99 VALUE		0.
022000	77	ZERO-COUNT	PIC 99 VALUE		0.
022100	77	CTR1	PIC 99 VALUE		0.
022200	77	CTR2	PIC 99 VALUE		0.
022300	77	CTR3	PIC 99 VALUE		0.
022400	77	MULTIPLIER	PIC 99 VALUE		0.
022500	77	LINE-TOTAL1	PIC 9(6)V99 VALUE		0.
022600	77	LINE-TOTAL2	PIC 9(6)V99 VALUE		0.
022700	77	VARI	PIC 99 VALUE		0.
022800	77	VAR2	PIC 99 VALUE		0.
022900	77	TOTAL-REQUIREMENTS	PIC 9(6)V99 VALUE		0.
023000	77	TABLE-CTR	PIC 99 VALUE		0.
023100	77	GRAND-TOTAL	PIC 9(12) VALUE	ZERO.	
023200	77	TOTAL-ITEM-COST	PIC 9(10) VALUE		0.
023300	77	TOTAL-PLAN-COST	PIC 9(11) VALUE		0.

023400 77 IPM-TOTAL-COST PIC 9(9)V99 VALUE 0.
023500 77 IPM-COST PIC 9(9)V99 VALUE 0.
023600 77 NO-DF-ALTERNATIVES PIC 99 VALUE 0.
023700 77 TITLE-UF-STUDY PIC X(66) VALUE SPACES.
023800 77 SHORT-TITLE PIC X(8) VALUE SPACES.
023900 77 FYDP-START PIC X(7) VALUE SPACES.
024000 77 FY-BUDGET PIC 9(15) VALUE 0.
024100 77 INITIAL-ALLOWANCES PIC 9(10) VALUE 0.
024200 77 PEACE-REQUIREMENT PIC 9(10) VALUE 0.
024300 77 LOSSES-GONE PIC 9(10) VALUE 0.
024400 77 PIPELINE-REQUIREMENT PIC 9(10) VALUE 0.
024500 77 COST-CHECK PIC 9(12) VALUE 0.
024600 77 STORAGE-END PIC X(25) VALUE 'WORKING STORAGE ENDS HERE'.
024700 01 ACTIVITY-NG.
024800 02 BASE-ACT.
024900 03 ACT-INT-ND PIC X(7).
025000 03 ACT-ND OCCURS 6 TIMES PIC X.
025100 02 ACTIVITY1 REDEFINES BASE-ACT PIC 9(7)V9(6).
025200 02 ACTIVITY2 REDEFINES BASE-ACT PIC 9(8)V9(5).
025300 02 ACTIVITY3 REDEFINES BASE-ACT PIC 9(9)V9(4).
025400 02 ACTIVITY4 REDEFINES BASE-ACT PIC 9(10)V999.
025500 02 ACTIVITY5 REDEFINES BASE-ACT PIC 9(11)V99.
025600 02 ACTIVITY6 REDEFINES BASE-ACT PIC 9(10)V9.
025700 02 ACTIVITY7 REDEFINES BASE-ACT PIC 9(13).
025800 01 TABLE-NUMBER-LINE.
025900 02 TABLE-WURD PIC X(68) VALUE 'TABLE' JUSTIFIED RIGHT.
026000 02 TABLE-NU PIC ZZ9.
026100 02 FILLER PIC X(62) VALUE SPACES.
026200 01 SUMMARY-UTIL-TOTALS.
026300 02 ITEM-UTIL OCCURS 20 TIMES.
026400 03 ITEM-MONTH-UTIL OCCURS 26 TIMES PICTURE 9(8).
026500 01 SUMMARY-TOTALS.
026600 02 ITEM-SUMMARY OCCURS 20 TIMES.
026700 03 ITEM-MONTH-TOTAL OCCURS 26 TIMES PIC 9(8).
026800 01 SUMMARY-GRAND-TOTALS.
026900 02 ITEM-GRAND-TOTAL OCCURS 20 TIMES PIC 9(6)V99.

027000 01 SUMMARY-REQUIREMENTS.
 027100 02 REQ OCCURS 26 TIMES PIC 9(8).
 027200 01 ACTIVITY-JOIN.
 027300 02 PARTS-JOIN.
 027400 03 PART1 PIC 9(12).
 027500 03 PART2 PIC 9(5).
 027600 02 ACTIVITY REDEFINES PARTS-JOIN PIC 9(12)V9(5).
 027700 01 ITEM-COST-TABLE.
 027800 02 A-ITEM-LIST OCCURS 20 TIMES.
 027900 03 A-ITEM-COST PIC 9(5)V9999.
 028000 03 A-ITEM-NAME PIC X(20).
 028100 03 A-ITEM-ASSETS PIC 9(8).
 028200 01 ITEM1-TABLE.
 028300 02 ITEM1 OCCURS 20 TIMES PIC X.
 028400 01 ITEM2-TABLE.
 028500 02 ITEM2 OCCURS 20 TIMES PIC X.
 028600 01 ITEM-TABLE.
 028700 02 ITEM OCCURS 20 TIMES PIC X.
 028800 01 PLANT-STORAGE.
 028900 02 PLANT OCCURS 50 TIMES.
 029000 03 PLANT-ITEM PIC X.
 029100 03 PLANT-NAME-ALT PIC XX.
 029200 01 ASSETS-ON-HAND-TABLE.
 029300 02 ITEM-ON-HAND OCCURS 20 TIMES.
 029400 03 QTY-ON-HAND OCCURS 26 TIMES PIC 9(8).
 029500 01 ASSETS-ON-HAND-TOTALS.
 029600 02 TOTAL-ASSETS-ON-HAND OCCURS 50 TIMES PIC 9(8).
 029700 01 ASSETS-TU-BUY-TABLE.
 029800 02 ITEM-USE OCCURS 20 TIMES.
 029900 03 QTY OCCURS 26 TIMES PIC 9(8).
 030000 01 IA-PT-BUY-HD1.
 030100 02 FILLER PIC X(71) VALUE 'IA/PT PROCUREMENT PLAN FOR '
 030200 JUSTIFIED RIGHT.
 030300 02 IA-PT-ITEM PIC X(20).
 030400 02 FILLER PIC X(42) VALUE SPACES.
 030500 01 IA-PT-BUY-HD2.

030600 02 FILLER PIC X(34) VALUE 'ITEM' JUSTIFIED RIGHT.
030700 02 FILLER PIC X(25) VALUE 'UNIT COST' JUSTIFIED RIGHT.
030800 02 FILLER PIC X(15) VALUE 'BUY QUANTITY' JUSTIFIED RIGHT.
030900 02 FILLER PIC X(18) VALUE 'TOTAL ITEM COST' JUSTIFIED RIGHT.
031000 02 FILLER PIC X(41) VALUE SPACES.
031100 01 IA-PT-BUY-LINE.
031200 02 FILLER PIC X(28) VALUE SPACES.
031300 02 IA-PT-NAME PIC X(20).
031400 02 FILLER PIC X(2) VALUE SPACES.
031500 02 IA-PT-COST PIC \$Z(5).9999.
031600 02 FILLER PIC X(2) VALUE SPACES.
031700 02 IA-PT-BUY PIC ZZ,ZZZ,ZZ9.
031800 02 FILLER PIC X(4) VALUE SPACES.
031900 02 TOTAL-IA-PT-ITEM-COST PIC \$ZZ,ZZZ,ZZZ,ZZ9.
032000 02 FILLER PIC X(40) VALUE SPACES.
032100 01 IA-PT-TOTAL-PLAN-COST.
032200 02 FILLER PIC X(76) VALUE 'THE COST FOR THE PROCUREMENT PLAN
'IS' JUSTIFIED RIGHT.
032300 -
032400 02 IA-PT-TOTAL-COST-OUT PIC \$ZZ,ZZZ,ZZZ,ZZ9.
032500 02 FILLER PIC X(42) VALUE SPACES.
032600 01 ASSETS-TU-BUY-TOTALS.
032700 02 TOTAL-ASSETS-TD-BUY OCCURS 50 TIMES PIC 9(8).
032800 01 PRD-UTIL-TABLE.
032900 02 PRD-UTIL-USE OCCURS 50 TIMES.
033000 03 PRD-UTIL-MONTH OCCURS 26 TIMES.
033100 04 ELEM OCCURS 2 TIMES PIC 9(8).
033200 01 PRD-UTIL-TABLE-ZEKD REDEFINES PRD-UTIL-TABLE PIC X(20000).
033300 01 UTIL-TOTALS-TABLE.
033400 02 TOTAL-UTIL OCCURS 50 TIMES PIC 9(8).
033500 01 PRD-TOTALS-TABLE.
033600 02 TOTAL-PRD OCCURS 50 TIMES PIC 9(8).
033700 01 ERR-MESS1.
033800 02 FILLER PIC X(10) VALUE SPACES.
033900 02 FILLER PIC X(24) VALUE 'ERROR IN PRODUCT-SEARCH1'.
034000 02 FILLER PIC X(99) VALUE SPACES.
034100 01 ERR-MESS2.

034200 02 FILLER PIC X(10) VALUE SPACES.
034300 02 FILLER PIC X(25) VALUE 'RECEIVING FIELD TOO SMALL'.
034400 02 FILLER PIC X(97) VALUE SPACES.
034500 01 ERR-MESS3.
034600 02 FILLER PIC X(5) VALUE SPACES.
034700 02 FILLER PIC X(75) VALUE 'REPORT WRITER TOTAL COST DIFFERS F
034800- 'RUM MPX TOTAL COST BY MORE THAN 10 UNITS'.
034900 02 FILLER PIC X(53) VALUE SPACES.
035000 01 ERR-MESS4.
035100 02 FILLER PIC X(10) VALUE SPACES.
035200 02 FILLER PIC X(14) VALUE 'ERROR IN LOOP2'.
035300 02 FILLER PIC X(109) VALUE SPACES.
035400 01 IPM-HD1.
035500 02 FILLER PIC X(89) VALUE 'INDUSTRIAL PREPAREDNESS MEASURES S
035600- 'ELECTED FOR ' JUSTIFIED RIGHT.
035700 02 IPM-HD1-ITEM PIC X(20).
035800 02 FILLER PIC X(24) VALUE SPACES.
035900 01 IPM-HD4.
036000 02 FILLER PIC X(8) VALUE 'PLANT' JUSTIFIED RIGHT.
036100 02 FILLER PIC X(14) VALUE 'PRODUCT' JUSTIFIED RIGHT.
036200 02 FILLER PIC X(18) VALUE 'ONE-TIME-COST' JUSTIFIED RIGHT.
036300 02 FILLER PIC X(16) VALUE 'ANNUAL-COST' JUSTIFIED RIGHT.
036400 02 FILLER PIC X(18) VALUE 'TOTAL-IPM-COST' JUSTIFIED RIGHT.
036500 02 FILLER PIC X(21) VALUE 'DESCRIPTION OF IPM' JUSTIFIED
RIGHT.
036600
036700 02 FILLER PIC X(38) VALUE SPACES.
036800 02 FILLER PIC X(38) VALUE SPACES.
036900 01 IPM-LINE.
037000 02 FILLER PIC X VALUE SPACES.
037100 02 PLANT-T PIC X(10).
037200 02 FILLER PIC XXX VALUE SPACES.
037300 02 PRODUCT-T PIC X(10).
037400 02 FILLER PIC XXX VALUE SPACES.
037500 02 DTC PIC \$Z,ZZZ,ZZZ,ZZ9.
037600 02 FILLER PIC X(3) VALUE SPACES.
037700 02 AC PIC \$Z,ZZZ,ZZZ,ZZ9.

037800 02 FILLER PIC XXX VALUE SPACES.
037900 02 IPM-TC PIC \$Z,ZZZ,ZZZ,ZZ9.
038000 02 FILLER PIC XXX VALUE SPACES.
038100 02 IPM-NDTE1 PIC X(22).
038200 02 FILLER PIC X(33) VALUE SPACES.
038300 01 IPM-LINE2.
038400 02 FILLER PIC X VALUE SPACES.
038500 02 PLANT-T2 PIC X(10).
038600 02 FILLER PIC XX VALUE SPACES.
038700 02 PRODUCT-T2 PIC X(10).
038800 02 FILLER PIC X(54) VALUE SPACES.
038900 02 IPM-NDTE2 PIC X(22).
039000 02 FILLER PIC X(33).
039100 01 IPM-COST-LINE.
039200 02 FILLER PIC X(80) VALUE 'THE COST FOR ALL INDUSTRIAL PREPAR
039300 - 'EDNESS MEASURES SELECTED IS ' JUSTIFIED RIGHT.
039400 02 IPM-AMT PIC \$ZZ,ZZZ,ZZZ,ZZ9.
039500 02 FILLER PIC X(40) VALUE SPACES.
039600 01 GRAND-TOTAL-LINE.
039700 02 FILLER PIC X(80) VALUE 'THE TOTAL COST FOR THE IA/PT SOLUT
039800 - 'IDN IS ' JUSTIFIED RIGHT.
039900 02 GRAND-AMT PIC \$ZZZ,ZZZ,ZZZ,ZZ9.
040000 02 FILLER PIC X(37) VALUE SPACES.
040100 01 MOBIL-REQUIRE-TABLE.
040200 02 MOB-REQ OCCURS 25 TIMES PIC 9(8).
040300 01 PRODUCTS-TABLE.
040400 02 PRODUCTS-LIST OCCURS 10 TIMES.
040500 03 PRODUCT PIC X(20).
040600 03 PRODUCT-CODE PIC X.
040700 03 PRODUCT-ASSETS PIC 9(10).
040800 03 PRODUCT-UNIT-COST PIC 9(5)V9999.
040900 03 PRODUCT-ALLDC-FACTOR PIC 9V999.
041000 03 PROCURE-FACTOR PIC 9(6)V999.
041100 01 PLANT-TABLE.
041200 02 PLANT-LIST OCCURS 20 TIMES.
041300 03 APRUD-LINE PIC X(20).

041400 03 APLANT-CODE.
041500 04 APROOT-CODE PIC X.
041600 04 APRDDR-CODE PIC X.
041700 04 AALTER-CODE PIC X.
041800 03 APRDD-SUPPORT PIC X.
041900 03 AMAX-CAP PIC 9(10).
042000 03 AMSR PIC 9(10).
042100 03 ALINE-ALLDC-CODE PIC 9V9999.
042200 03 ABASE-TEMP PIC X.
042300 03 AUT-IPM-COSTS PIC 9(10).
042400 03 AA-IPM-COSTS PIC 9(10).
042500 03 AIPM-DESC PIC X(44).
042600 03 ABUILD-UP OCCURS 25 TIMES PIC 9(8).
042700 01 GLOSSARY-TABLE.
042800 02 GLIST OCCURS 50 TIMES.
042900 03 ITEM-SYMBOL PIC X.
043000 03 ITEM-NAME.
043100 04 ITEM-NAME1 PIC X(10).
043200 04 ITEM-NAME2 PIC X(10).
043300 03 PLANT-SYMBOL PIC XXX.
043400 03 PLANT-NAME.
043500 04 PLANT-NAME1 PIC X(10).
043600 04 PLANT-NAME2 PIC X(10).
043700 03 ITEM-UNIT-COST PIC 9(5)V9999.
043800 03 ONE-TIME-COST PIC 9(10).
043900 03 ANNUAL-COST PIC 9(10).
044000 03 IPM-DESCRIPTION.
044100 04 IPM-DESCRIPTION1 PIC X(22).
044200 04 IPM-DESCRIPTION2 PIC X(22).
044300 03 IPM-CODE PIC X.
044400 01 UNIT-COST-JOIN.
044500 02 UC-STORE.
044600 03 UC-PART1 PIC X(5).
044700 03 UC-PART2 PIC XXXX.
044800 02 UC-DUM REDEFINES UC-STORE PIC 9(5)V9999.
044900 01 ALLOC-FAC-JOIN.

045000	02	AF-STORE.	
045100	03	AF-PART1	PIC X.
045200	03	AF-PART2	PIC XXX.
045300	02	AF-DUM REDEFINES AF-STORE	PIC 9V999.
045400	01	PROC-FAC-JOIN.	
045500	02	PF-STORE.	
045600	03	PF-PART1	PIC X(6).
045700	03	PF-PART2	PIC XXX.
045800	02	PF-DUM REDEFINES PF-STORE	PIC 9(6)V999.
045900	01	NEW-FORM.	
046000	02	ALPHA	PIC X(8).
046100	02	NUM REDEFINES ALPHA	PIC 9(8).
046200	01	PAGE-HEADING.	
046300	02	FILLER PIC X(44)	VALUE SPACES.
046400	02	PAGE-TITLE	PIC X(66).
046500	02	FILLER PIC X(23)	VALUE SPACES.
046600	01	GLOSSARY-CHECK.	
046700	02	FILLER PIC X(5)	VALUE SPACES.
046800	02	GLOSS-OUT.	
046900	03	ITEM-INFO	PIC X(21).
047000	03	PLANT-INFO	PIC X(23).
047100	03	COST-INFO.	
047200	04	INF01	PIC 9(10).
047300	04	INF02	PIC 9(10).
047400	04	INF03	PIC 9(10).
047500	03	IPM-INFO	PIC X(45).
047600	02	FILLER PIC X(9)	VALUE SPACES.
047700	01	ITEM1-CHECK.	
047800	02	FILLER PIC X(10)	VALUE SPACES.
047900	02	ITEM1-OUT	PIC X.
048000	02	FILLER PIC X(122)	VALUE SPACES.
048100		PROCEDURE DIVISION.	
048200		OPEN INPUT GLOSSARY-IN,	OUTPUT OUTPUT-FILE.
048300		MOVE SPACES TO PRODUCTS-TABLE.	
048400		MOVE SPACES TO PLANT-TABLE.	
048500		MOVE SPACES TO GLOSSARY-TABLE.	

048510* INPUT-READ THRU EOJ1 ESTABLISHES THE GLOSSARY-TABLE USED TO
048520* TRANSLATE THE CODES USED IN THE MPSX PROGRAM.
048600 INPUT-READ.
048700 READ GLOSSARY-IN AT END GO TO NEXT-STEP.
048800 IF CC-A = 'A' MOVE STUDY-TITLE TO PAGE-TITLE.
048900 IF CC-A = 'A' MOVE STUDY-TITLE TO TITLE-OF-STUDY GO TO
049000 INPUT-READ.
049100 IF CC-B = 'B' MOVE TITLE-ID TO SHORT-TITLE
049200 EXAMINE NO-PROD1 REPLACING ALL ' ' BY '0'
049300 MOVE NO-PROD2 TO NO-OF-ITEMS
049400 EXAMINE NO-ALT1 REPLACING ALL ' ' BY '0'
049500 MOVE NO-ALT2 TO NO-OF-ALTERNATIVES MOVE
049600 FYDP-DATE TO FYDP-START EXAMINE FY-BUDI REPLACING ALL ' '
049700 BY '0' MOVE FY-BUD2 TO FY-BUDGET GO TO
049800 INPUT-READ.
049900 IF CC-C = 'C' EXAMINE INT-ALLOW1 REPLACING ALL ' ' BY '0'
050000 MOVE INT-ALLOW2 TO INITIAL-ALLOWANCES
050100 EXAMINE PEACE-REQ1 REPLACING ALL ' ' BY '0'
050200 MOVE PEACE-REQ2 TO PEACE-REQUIREMENT
050300 EXAMINE LOSSES1 REPLACING ALL ' ' BY '0'
050400 MOVE LOSSES2 TO LOSSES-GONE
050500 EXAMINE PIPE-REQ1 REPLACING ALL ' ' BY '0'
050600 MOVE PIPE-REQ2 TO PIPELINE-REQUIREMENT GO TO INPUT-READ.
050700 IF CC-D1 = 'D1' MOVE 0 TO CTR2 PERFORM REQ-ROUT THRU
050800 REQ-EXIT VARYING CTR1 FROM 1 BY 1 UNTIL CTR1 > 8.
050900 IF CC-D1 = 'D1' GO TO INPUT-READ.
051000 IF CC-D2 = 'D2' PERFORM REQ-ROUT THRU REQ-EXIT VARYING
051100 CTR1 FROM 1 BY 1 UNTIL CTR1 > 8.
051200 IF CC-D2 = 'D2' GO TO INPUT-READ.
051300 IF CC-D3 = 'D3' PERFORM REQ-ROUT THRU REQ-EXIT VARYING
051400 CTR1 FROM 1 BY 1 UNTIL CTR1 > 8.
051500 IF CC-D3 = 'D3' MOVE 0 TO CTR1 GO TO INPUT-READ.
051600 IF CC-E = 'E' PERFORM E-ROUT.
051700 IF CC-E = 'E' GO TO INPUT-READ.
051800 IF CC-F = 'F' AND SWITCH-A = 'ON'
051900 MOVE CTR2 TO NO-OF-MONTHS

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052000 MOVE 0 TO CTR2
052100 MOVE 0 TO CTR1
052200 MOVE 'OFF' TO SWITCH-A.
052300 IF CC-F = 'F' AND SWITCH-A = 'OFF' PERFORM F-ROUT.
052400 IF CC-F = 'F' AND SWITCH-A = 'OFF' GO TO INPUT-READ.
052500 IF CC-G = 'G' PERFORM G-ROUT.
052600 IF CC-G = 'G' GO TO INPUT-READ.
052700 IF CC-H1 = 'H1' PERFORM BU-ROUT THRU BU-EXIT VARYING CTR1
052800 FROM 1 BY 1 UNTIL CTR1 > 8.
052900 IF CC-H1 = 'H1' GO TO INPUT-READ.
053000 IF CC-H2 = 'H2' PERFORM BU-ROUT THRU BU-EXIT VARYING CTR1
053100 FROM 1 BY 1 UNTIL CTR1 > 8.
053200 IF CC-H2 = 'H2' GO TO INPUT-READ.
053300 IF CC-H3 = 'H3' PERFORM BU-ROUT THRU BU-EXIT VARYING CTR1
053400 FROM 1 BY 1 UNTIL CTR1 > 8.
053500 IF CC-H3 = 'H3' GO TO INPUT-READ.
053510* NEXT-STEP THRU PRODUCT-SEARCH2 MOVES DATA FROM AUXILIARY
053520* STORAGE AREAS INTO THE GLOSSARY-TABLE.
053600 NEXT-STEP.
053700 MOVE NO-OF-ALTERNATIVES TO GLOSSARY-MAX.
053800 MOVE NO-OF-ALTERNATIVES TO NO-OF-PLANTS.
053900 MOVE 0 TO CTR1.
054000 MOVE 0 TO CTR2.
054100 MOVE 0 TO CTR3.
054200 GLOSSARY-ROUT.
054300 ADD 1 TO CTR2.
054400 MOVE APROD-LINE (CTR2) TO PLANT-NAME (CTR2).
054500 MOVE APROD-CODE (CTR2) TO ITEM-SYMBOL (CTR2).
054600 MOVE APLANT-CODE (CTR2) TO PLANT-SYMBOL (CTR2).
054700 MOVE AALTER-CODE (CTR2) TO IPM-CODE (CTR2).
054800 MOVE AUT-IPM-COSTS (CTR2) TO ONE-TIME-COST (CTR2).
054900 MOVE AA-IPM-COSTS (CTR2) TO ANNUAL-COST (CTR2).
055000 MOVE AIPM-DESC (CTR2) TO IPM-DESCRIPTION (CTR2).
055100 PRODUCT-SEARCH1.
055200 ADD 1 TO CTR1.
055300 IF APROD-CODE (CTR2) = PRODUCT-CODE (CTR1) MOVE

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055400 PRODUCT (CTR1) TO ITEM-NAME (CTR2)
055500 MOVE PRODUCT-UNIT-COST (CTR1) TO ITEM-UNIT-COST (CTR2)
055600 MOVE 0 TO CTR1 GO TO PRODUCT-SEARCH2.
055700 IF CTR1 = NO-OF-ITEMS GO TO ERROR-MSG1 ELSE GO TO
055800 PRODUCT-SEARCH1.
055900 PRODUCT-SEARCH2.
056000 IF CTR2 = NO-OF-PLANTS GO TO EDJ1 ELSE GO TO
056100 GLOSSARY-ROUT.
056110* THE REQ-ROUT PARAGRAPH STORES DATA FROM THE D1, D2, AND D3
056120* CARDS IN THE MOBIL-REQ-TABLE.
056200 REQ-ROUT.
056300 ADD 1 TO CTR2.
056400 IF CC-D1 = 'D1' MOVE D1-MCR (CTR1) TO ALPHA EXAMINE ALPHA
056500 REPLACING ALL ' ' BY '0' MOVE NUM TO MOB-REQ (CTR2).
056600 IF CC-D2 = 'D2' MOVE D2-MCR (CTR1) TO ALPHA EXAMINE ALPHA
056700 REPLACING ALL ' ' BY '0' MOVE NUM TO MOB-REQ (CTR2).
056800 IF CC-D3 = 'D3' MOVE D3-MCR (CTR1) TO ALPHA EXAMINE ALPHA
056900 REPLACING ALL ' ' BY '0' MOVE NUM TO MOB-REQ (CTR2).
057000 GO TO REQ-EXIT.
057100 REQ-EXIT.
057200 EXIT.
057210* E-ROUT TAKES DATA FROM THE E-CARDS, ZERO FILLS THE NUMERIC
057220* FIELDS AND STORES THE DATA IN THE PRODUCTS-TABLE.
057300 E-ROUT.
057400 ADD 1 TO CTR1.
057500 MOVE PROD-NAME TO PRODUCT (CTR1).
057600 MOVE PKDD-CODE TO PRODUCT-CODE (CTR1).
057700 EXAMINE ASSETS-ON-HAND1 REPLACING ALL ' ' BY '0'.
057800 MOVE ASSETS-ON-HAND2 TO PRODUCT-ASSETS (CTR1).
057900 EXAMINE UNIT-COST1 REPLACING ALL ' ' BY '0'.
058000 EXAMINE UNIT-COST2 REPLACING ALL ' ' BY '0'.
058100 MOVE UNIT-COST1 TO UC-PART1.
058200 MOVE UNIT-COST2 TO UC-PART2.
058300 MOVE UC-DUM TO PRODUCT-UNIT-COST (CTR1).
058400 EXAMINE ALLOC-FAC1 REPLACING ALL ' ' BY '0'.
058500 EXAMINE ALLOC-FAC2 REPLACING ALL ' ' BY '0'.

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058600 MOVE ALLOC-FAC1 TO AF-PART1.
058700 MOVE ALLOC-FAC2 TO AF-PART2.
058800 MOVE AF-DUM TO PRODUCT-ALLOC-FACTOR (CTR1).
058900 EXAMINE PRO-FAC1 REPLACING ALL , , BY '0'.
059000 EXAMINE PRO-FAC2 REPLACING ALL , , BY '0'.
059100 MOVE PRO-FAC1 TO PF-PART1.
059200 MOVE PRO-FAC2 TO PF-PART2.
059300 MOVE PF-DUM TO PROCURE-FACTOR (CTR1).
059310* F-ROUT TAKES DATA FROM THE F-CARDS, ZERO FILLS THE NUMERIC
059320* FIELDS AND STORES THE DATA IN THE PLANT-TABLE.
059400 F-ROUT.
059500 ADD 1 TO CTR2.
059600 MOVE PROD-LINE TO APROD-LINE (CTR2).
059700 MOVE PRODT-CODE TO APRODT-CODE (CTR2).
059800 MOVE PRODR-CODE TO APRODR-CODE (CTR2).
059900 MOVE ALTER-CODE TO AALTER-CODE (CTR2).
060000 MOVE PROD-SUPPORT TO APROD-SUPPORT (CTR2).
060100 EXAMINE MAX-CAPI REPLACING ALL , , BY '0'.
060200 MOVE MAX-CAP2 TO AMAX-CAP (CTR2).
060300 EXAMINE MSR1 REPLACING ALL , , BY '0'.
060400 MOVE MSR2 TO AMSR (CTR2).
060500 EXAMINE LINE-ALLOC-CODE1 REPLACING ALL , , BY '0'.
060600 MOVE LINE-ALLOC-CODE1 TO AF-PART1.
060700 EXAMINE LINE-ALLOC-CODE2 REPLACING ALL , , BY '0'.
060800 MOVE LINE-ALLOC-CODE2 TO AF-PART2.
060900 MOVE AF-DUM TO ALINE-ALLOC-CODE (CTR2).
061000 MOVE BASE-TEMP TO ABASE-TEMP (CTR2).
061010* G-ROUT ZERO FILLS NUMERIC FIELDS FROM THE G-CARD AND STORES
061020* DATA IN THE PLANT-TABLE.
061100 G-ROUT.
061200 EXAMINE OT-IPM-COSTS1 REPLACING ALL , , BY '0'.
061300 MOVE OT-IPM-COSTS2 TO AOT-IPM-COSTS (CTR2).
061400 EXAMINE A-IPM-COSTS1 REPLACING ALL , , BY '0'.
061500 MOVE A-IPM-COSTS2 TO AA-IPM-COSTS (CTR2).
061600 MOVE IPM-DESC TO AIPM-DESC (CTR2).
061610* BU-ROUT ZERO FILLS NUMERIC FIELDS FROM THE H1,H2,AND H3 CARDS

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061620* AND STORES DATA IN THE PLANT-TABLE.
061700 BU-ROUT.
061800 ADD 1 TO CTR3.
061900 IF CC-H1 = 'H1' MOVE PROD-BU-H1 (CTR1) TO
062000 ALPHA EXAMINE ALPHA REPLACING ALL , , BY '0' MOVE NUM TO
062100 ABUILD-UP (CTR2, CTR3).
062200 IF CC-H2 = 'H2' MOVE PROD-BU-H2 (CTR1) TO
062300 ALPHA EXAMINE ALPHA REPLACING ALL , , BY '0' MOVE NUM TO
062400 ABUILD-UP (CTR2, CTR3).
062500 IF CC-H3 = 'H3' MOVE PROD-BU-H3 (CTR1) TO
062600 ALPHA EXAMINE ALPHA REPLACING ALL , , BY '0' MOVE NUM TO
062700 ABUILD-UP (CTR2, CTR3).
062800 IF CTR3 = NO-OF-MONTHS MOVE 0 TO CTR3.
062900 GO TO BU-EXIT.
063000 BU-EXIT.
063100 EXIT.
063200 EDJ1.
063300 MOVE 0 TO CTR1.
063400 MOVE 0 TO CTR2.
063500 MOVE 0 TO CTR3.
063600 MOVE ' ON' TO SWITCH-A.
063700 CLOSE GLOSSARY-IN.
063800 OPEN INPUT DATA-IN.
063900 MOVE ZERUS TO ASSETS-ON-HAND-TABLE.
064000 MOVE ZERUS TO ASSETS-ON-HAND-TOTALS.
064100 MOVE ZERUS TO ASSETS-TO-BUY-TABLE.
064200 MOVE ZERUS TO ASSETS-TO-BUY-TOTALS.
064300 MOVE ZERUS TO PROD-UTIL-TABLE-ZERO.
064400 MOVE ZERUS TO UTIL-TOTALS-TABLE.
064500 MOVE ZERUS TO PROD-TOTALS-TABLE.
064600 MOVE ZERUS TO SUMMARY-GRAND-TOTALS.
064700 MOVE ZERUS TO SUMMARY-REQUIREMENTS.
064800 DATA-READ.
064900 READ DATA-IN AT END GO TO EOJ2.
065000 IF START-FILE = 'SECTION 1 - ROWS' MOVE 'OFF' TO
065100 SWITCH-B GO TO DATA-READ.

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065200 IF SWITCH-B = 'ON' GO TO DATA-READ.
065210* THE FOLLOWING 'IF' CLAUSE LOCATES THE COST ASSOCIATED WITH
065220* THE IA/PT RUN BEING REPORTED AND STORES THE COST IN THE
065230* COST-CHECK FIELD FOR LATER REFERENCE.
065300 IF IXY-CODE = 'C' AND PLANT-CODE = 'DST'
065400 PERFORM DECIMAL-LOCATE THRU DECIMAL-LOCATE-END
065500 MOVE ACTIVITY TO COST-CHECK.
065600 IF START-FILE = 'SECTION 2 - COLUMNS' MOVE 'OFF' TO
065700 SWITCH-D GO TO DATA-READ.
065800 IF SWITCH-D = 'ON' GO TO DATA-READ.
065900 IF IXY-CODE = 'X' GO TO PROD-UTIL-ROUT.
066000 IF (IXY-CODE = 'Y' OR IXY-CODE = 'H') AND INV-CODE IS NOT
066100 EQUAL TO PREV-INV-CODE MOVE SPACES TO PREV-ITEM.
066200 IF IXY-CODE = 'Y' OR IXY-CODE = 'H' NEXT SENTENCE ELSE GO
066300 TO DATA-READ.
066310* INV-ROUT THRU JUMP ACCUMULATES ASSETS-ON-HAND AND ASSETS-TO-BUY
066320* AND STORES THEM IN TABLES.
066400 INV-ROUT.
066500 PERFORM DECIMAL-LOCATE THRU DECIMAL-LOCATE-END.
066600 IF DEC-COUNT = 1 AND ZERO-COUNT = 12 GO TO DATA-READ.
066700 IF DEC-COUNT = 0 AND ZERO-COUNT = 13 GO TO DATA-READ.
066800 IF ITEM-CODE = PREV-ITEM GO TO JUMP.
066900 IF INV-CODE = '2' ADD 1 TO ITEM-CTR2 MOVE ITEM-CODE TO
067000 ITEM2 (ITEM-CTR2) ELSE ADD 1 TO ITEM-CTR1 MOVE
067100 ITEM-CODE TO ITEM1 (ITEM-CTR1).
067200 PERFORM ITEM-TABLE-SEARCH-Y THRU END-SEARCH-Y.
067300 JUMP.
067400 MOVE INV-CODE TO PREV-INV-CODE.
067500 SUBTRACT 10 FROM MONTH-USE GIVING MONTH-USE.
067600 IF MONTH-USE = 0 OR MONTH-USE < 0 MOVE 1 TO MONTH-USE.
067700 IF INV-CODE = '2' AND ITEM-MADE = PRODUCT (1) AND MONTH-USE =
067800 '11' AND ACT-SIGN = '-' SUBTRACT ACTIVITY FROM 0 GIVING
067900 ACTIVITY.
068000 IF INV-CODE = '2' ADD ACTIVITY TO
068100 QTY-ON-HAND (ITEM-CTR2, MONTH-USE) ROUNDED
068200 ADD ACTIVITY TO TOTAL-ASSETS-ON-HAND (ITEM-CTR2) ROUNDED

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068300 ELSE
068400 ADD ACTIVITY TO QTY (ITEM-CTR1, MONTH-USE) ROUNDED
068500 ADD ACTIVITY TO TOTAL-ASSETS-TO-BUY (ITEM-CTR1) ROUNDED.
068600 MOVE ITEM-CODE TO PREV-ITEM.
068700 GO TO DATA-READ.
068710* THE PROD-UTIL-ROUT PARAGRAPH ACCUMULATES THE MONTHLY PRODUCT-
068720* ION AND THE MONTHLY UTILIZATION BY PLANT AND STORES THE DATA
068730* IN TABLES.
068800 PROD-UTIL-ROUT.
068900 PERFORM DECIMAL-LOCATE THRU DECIMAL-LOCATE-END.
069000 IF DEC-COUNT = 1 AND ZERO-COUNT = 12 GO TO DATA-READ.
069100 IF DEC-COUNT = 0 AND ZERO-COUNT = 13 GO TO DATA-READ.
069200 IF PLANT-CODE IS NOT EQUAL TO PREV-PLANT ADD 1 TO PLANT-CTR
069300 MOVE PLANT-CODE TO PLANT (PLANT-CTR).
069400 PERFORM ITEM-TABLE-SEARCH-X THRU END-SEARCH-X.
069500 SUBTRACT 10 FROM PROD-MONTH GIVING PROD-MONTH.
069600 SUBTRACT 10 FROM UTIL-MONTH GIVING UTIL-MONTH.
069700 ADD ACTIVITY TO ELEM (PLANT-CTR, PROD-MONTH, 1) ROUNDED.
069800 ADD ACTIVITY TO ELEM (PLANT-CTR, UTIL-MONTH, 2) ROUNDED.
069900 ADD ACTIVITY TO TOTAL-UTIL (PLANT-CTR) ROUNDED.
070000 ADD ACTIVITY TO TOTAL-PROD (PLANT-CTR) ROUNDED.
070100 MOVE PLANT-CODE TO PREV-PLANT.
070200 GO TO DATA-READ.
070300 ITEM-TABLE-SEARCH-Y.
070400 MOVE ZERO TO CTR3.
070410* ITEM-TABLE-ADD-Y STORES THE CODES FOR ITEMS REPRESENTED BY THE
070420* 'Y' VARIABLES IN THE ITEM-TABLE.
070500 ITEM-TABLE-ADD-Y.
070600 IF ITEM-CTR = 0 ADD 1 TO ITEM-CTR MOVE ITEM-CODE TO
070700 ITEM (ITEM-CTR) GO TO END-SEARCH-Y.
070800 ADD 1 TO CTR3.
070900 IF ITEM-CODE = ITEM (CTR3) GO TO END-SEARCH-Y.
071000 IF CTR3 = ITEM-CTR ADD 1 TO ITEM-CTR MOVE ITEM-CODE TO
071100 ITEM (ITEM-CTR) GO TO END-SEARCH-Y.
071200 GO TO ITEM-TABLE-ADD-Y.
071300 END-SEARCH-Y.

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071400 EXIT.
071410* ITEM-TABLE-SEARCH-X STORES THE CODES FOR ITEMS REPRESENTED BY
071420* THE X VARIABLES IN THE ITEM-TABLE.
071500 ITEM-TABLE-SEARCH-X.
071600 MOVE ZERO TO CTR3.
071700 ITEM-TABLE-ADD-X.
071800 IF ITEM-CTR = 0 ADD 1 TO ITEM-CTR MOVE
071900 ITEM-MADE TO ITEM (ITEM-CTR) GO TO END-SEARCH-X.
072000 ADD 1 TO CTR3.
072100 IF ITEM-MADE = ITEM (CTR3) GO TO END-SEARCH-X.
072200 IF CTR3 = ITEM-CTR ADD 1 TO ITEM-CTR MOVE ITEM-MADE TO
072300 ITEM (ITEM-CTR) GO TO END-SEARCH-X.
072400 GO TO ITEM-TABLE-ADD-X.
072500 END-SEARCH-X.
072600 EXIT.
072700 E0J2.
072800 MOVE PLANT-CTR TO NO-OF-PLANTS.
072900 MOVE ZERO TO ITEM-CTR.
073000 MOVE ZERO TO PLANT-CTR.
073100 MOVE ITEM-CTR1 TO NO-OF-ITEMS1.
073200 MOVE ITEM-CTR2 TO NO-OF-ITEMS2.
073300 MOVE ZERO TO ITEM-CTR1.
073400 MOVE ZERO TO ITEM-CTR2.
073500 MOVE ZERO TO CTR3.
073600 MOVE 0 TO GLOSSARY-CTR.
073610* LOOP1 STARTS THE COMPLETION OF THE ITEM-COST-TABLE.
073700 LOOP1.
073800 ADD 1 TO ITEM-CTR1.
073900 MOVE ZERO TO GLOSSARY-CTR.
074000 LOOP2.
074100 ADD 1 TO GLOSSARY-CTR.
074200 IF GLOSSARY-CTR IS GREATER THAN GLOSSARY-MAX GO TO
074300 ERROR-MSG4.
074400 IF ITEM1 (ITEM-CTR1) IS NOT EQUAL TO
074500 ITEM-SYMBOL (GLOSSARY-CTR) GO TO LOOP2.
074600 MOVE ITEM-UNIT-COST (GLOSSARY-CTR) TO

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074700 A-ITEM-CUST (ITEM-CTR1).
074800 MOVE ITEM-NAME (GLOSSARY-CTR) TO
074900 A-ITEM-NAME (ITEM-CTR1).
075000 MOVE TOTAL-ASSETS-TO-BUY (ITEM-CTR1) TO
075100 A-ITEM-ASSETS (ITEM-CTR1).
075200 IF ITEM-CTR1 = NO-OF-ITEMS1 GO TO LOOP5 ELSE GO TO LOOP1.
075300 * THE PRINT OF THE REPORT STARTS WITH LOOP 5.
075400 LOOP5.
075400 MOVE SPACES TO IA-PT-BUY-LINE.
075500 MOVE ITEM-NAME (1) TO IA-PT-ITEM.
075600 WRITE PRINT-OUT FROM PAGE-HEADING AFTER ADVANCING NEXT-PAGE.
075700 WRITE PRINT-OUT FROM IA-PT-BUY-HD1 AFTER ADVANCING 1 LINES.
075800 WRITE PRINT-OUT FROM IA-PT-BUY-HD2 AFTER ADVANCING 2 LINES.
075900 LOOP6.
076000 ADD 1 TO SUB1.
076100 MOVE A-ITEM-NAME (SUB1) TO IA-PT-NAME.
076200 MOVE A-ITEM-COST (SUB1) TO IA-PT-COST.
076300 MOVE A-ITEM-ASSETS (SUB1) TO IA-PT-BUY.
076400 COMPUTE TOTAL-ITEM-COST ROUNDED = A-ITEM-COST (SUB1) *
076500 A-ITEM-ASSETS (SUB1) ON SIZE ERROR GO TO ERROR-MSG2.
076600 ADD TOTAL-ITEM-COST TO TOTAL-PLAN-COST.
076700 MOVE TOTAL-ITEM-COST TO TOTAL-IA-PT-ITEM-COST.
076800 WRITE PRINT-OUT FROM IA-PT-BUY-LINE AFTER ADVANCING 2 LINES.
076900 IF SUB1 IS NOT EQUAL TO NO-OF-ITEMS1 GO TO LOOP6 ELSE MOVE
077000 TOTAL-PLAN-COST TO IA-PT-TOTAL-COST-OUT WRITE PRINT-OUT
077100 FROM IA-PT-TOTAL-PLAN-COST AFTER ADVANCING 3 LINES
077200 MOVE 0 TO SUB1.
077300 MOVE ITEM-NAME (1) TO IPM-HD1-ITEM.
077400 MOVE SPACES TO PRINT-OUT.
077500 WRITE PRINT-OUT AFTER ADVANCING 3 LINES.
077600 WRITE PRINT-OUT FROM IPM-HD1 AFTER ADVANCING 3 LINES.
077700 WRITE PRINT-OUT FROM IPM-HD4 AFTER ADVANCING 2 LINES.
077800 MOVE 0 TO PLANT-CTR.
077900 PERFORM IPM-SEARCH THRU IPM-EXIT VARYING
078000 PLANT-CTR FROM 1 BY 1 UNTIL PLANT-CTR IS GREATER THAN
078100 NO-OF-PLANTS.

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078200 MOVE IPM-TOTAL-COST TO IPM-AMT.
078300 WRITE PRINT-OUT FROM IPM-COST-LINE AFTER ADVANCING 3 LINES.
078400 ADD TOTAL-PLAN-COST, IPM-TOTAL-COST GIVING GRAND-TOTAL.
078500 MOVE GRAND-TOTAL TO GRAND-AMT.
078600 WRITE PRINT-OUT FROM GRAND-TOTAL-LINE AFTER ADVANCING
078700 3 LINES.
078800 IF (GRAND-TOTAL - COST-CHECK > 0 AND GRAND-TOTAL - COST-CHECK
078900 < 10) OR (GRAND-TOTAL - COST-CHECK < 0 AND GRAND-TOTAL -
079000 COST-CHECK > -10) NEXT SENTENCE ELSE WRITE PRINT-OUT FROM
079100 ERR-MESS3 AFTER ADVANCING 3 LINES.
079200 CLOSE DATA-IN, OUTPUT-FILE.
079300 STOP RUN.
079310* IPM-SEARCH MOVES INFO FROM THE GLOSSARY-TABLE TO PRINT LINE.
079400 IPM-SEARCH.
079500 MOVE SPACES TO IPM-LINE.
079600 MOVE SPACES TO IPM-LINE2.
079700 MOVE ZERO TO GLOSSARY-CTR.
079800 IPM-GLOSS-SEARCH.
079900 IF GLOSSARY-CTR = GLOSSARY-MAX GO TO ERROR-MSG1.
080000 ADD 1 TO GLOSSARY-CTR.
080100 IF PLANT (PLANT-CTR) = PLANT-SYMBOL (GLOSSARY-CTR) NEXT
080200 SENTENCE ELSE GO TO IPM-GLOSS-SEARCH.
080300 IF IPM-CODE (GLOSSARY-CTR) = 1 GO TO IPM-EXIT.
080400 MOVE PLANT-NAME1 (GLOSSARY-CTR) TO PLANT-T.
080500 MOVE PLANT-NAME2 (GLOSSARY-CTR) TO PLANT-T2.
080600 MOVE ITEM-NAME1 (GLOSSARY-CTR) TO PRODUCT-T.
080700 MOVE ITEM-NAME2 (GLOSSARY-CTR) TO PRODUCT-T2.
080800 MOVE ONE-TIME-COST (GLOSSARY-CTR) TO DTC.
080900 MOVE ANNUAL-COST (GLOSSARY-CTR) TO AC.
081000 COMPUTE IPM-COST = ONE-TIME-COST (GLOSSARY-CTR) +
081100 5 * ANNUAL-COST (GLOSSARY-CTR) ON SIZE ERROR GO TO
081200 ERROR-MSG2.
081300 COMPUTE IPM-TOTAL-COST = IPM-TOTAL-COST + IPM-COST ON SIZE
081400 ERROR GO TO ERROR-MSG2.
081500 MOVE IPM-COST TO IPM-TC.
081600 MOVE IPM-DESCRIPTION1 (GLOSSARY-CTR) TO IPM-NOTE1.

```

081700 MOVE IPM-DESCRIPTION2 (GLOSSARY-CTR) TO IPM-NOTE2.
 081800 WRITE PRINT-OUT FROM IPM-LINE AFTER ADVANCING 2 LINES.
 081900 WRITE PRINT-OUT FROM IPM-LINE2 AFTER ADVANCING 1 LINES.
 082000 MOVE SPACES TO IPM-LINE.
 082100 MOVE SPACES TO IPM-LINE2.
 082200 IPM-EXIT.
 082300 EXIT.
 082310* THE FOLLOWING PARA NUMBERS THE TABLES.
 082400 TABLE-NO-ROUT.
 082500 ADD 1 TO TABLE-CTR.
 082600 MOVE TABLE-CTR TO TABLE-NO.
 082700 WRITE PRINT-OUT FROM TABLE-NUMBER-LINE AFTER ADVANCING
 3 LINES.
 082810* DECIMAL-LOCATE THRU DECIMAL-LOCATE-END LOCATES A VARIABLE
 082820* DECIMAL POINT WITHIN A FIELD.
 082900 DECIMAL-LOCATE.
 083000 EXAMINE INPUT-REC REPLACING ALL ' ' BY '0'.
 083100 EXAMINE INPUT-REC TALLYING ALL '...'.
 083200 MOVE TALLY TO DEC-COUNT.
 083300 EXAMINE INPUT-REC TALLYING ALL '0'.
 083400 MOVE TALLY TO ZERO-COUNT.
 083500 IF DEC-COUNT = 1 AND ZERO-COUNT = 12 GO TO
 083600 DECIMAL-LOCATE-END.
 083700 IF DEC-COUNT = 0 AND ZERO-COUNT = 13 GO TO
 083800 DECIMAL-LOCATE-END.
 083900 EXAMINE INPUT-REC TALLYING UNTIL FIRST '...'.
 084000 DECIMAL1.
 084100 ADD 1 TO SUB4.
 084200 DECIMAL2.
 084300 ADD 1 TO SUB5.
 084400 ADD SUB5, 6 GIVING DEC-CHK.
 084500 IF DEC-CHK = TALLY AND TALLY < 13 GO TO DECIMAL2.
 084600 MOVE ACT (SUB5) TO ACT-NO (SUB4).
 084700 IF SUB4 < 5 GO TO DECIMAL1.
 084800 IF SUB4 = 5 AND TALLY < 13 MOVE 0 TO ACT-NO (6)
 084900 GO TO DECIMAL3.

```

085000 IF SUB4 = 5 AND TALLY = 13 MOVE ACT (6) TO ACT-ND (6).
085100 DECIMAL3.
085200 MOVE ACT-INT TO ACT-INT-ND.
085300 IF TALLY = 7 MOVE ACTIVITY1 TO ACTIVITY.
085400 IF TALLY = 8 MOVE ACTIVITY2 TO ACTIVITY.
085500 IF TALLY = 9 MOVE ACTIVITY3 TO ACTIVITY.
085600 IF TALLY = 10 MOVE ACTIVITY4 TO ACTIVITY.
085700 IF TALLY = 11 MOVE ACTIVITY5 TO ACTIVITY.
085800 IF TALLY = 12 MOVE ACTIVITY6 TO ACTIVITY.
085900 IF TALLY = 13 MOVE ACTIVITY7 TO ACTIVITY.
086000 MOVE 0 TO SUB4.
086100 MOVE 0 TO SUB5.
086200 MOVE 0 TO DEC-CHK.
086300 DECIMAL-LOCATE-END.
086400 EXIT.
086500 ITEM-1-WRITE.
086600 MOVE ITEM1 (CTR3) TO ITEM1-OUT.
086700 WRITE PRINT-OUT FROM ITEM1-CHECK AFTER ADVANCING 2 LINES.
086800 GLOSSARY-WRITE.
086900 MOVE GLIST (GLOSSARY-CTR) TO GLOSS-OUT.
087000 WRITE PRINT-OUT FROM GLOSSARY-CHECK AFTER ADVANCING 2 LINES.
087010* ERROR-MSG1 INDICATES AN ERROR IN PRODUCT-SEARCH1.
087100 ERROR-MSG1.
087200 WRITE PRINT-OUT FROM ERR-MESS1 AFTER ADVANCING 2 LINES.
087300 STOP RUN.
087310* ERROR-MSG2 INDICATES THE RECEIVING FIELD IS TOO SMALL.
087400 ERROR-MSG2.
087500 WRITE PRINT-OUT FROM ERR-MESS2 AFTER ADVANCING 2 LINES.
087600 STOP RUN.
087610* ERROR-MSG4 INDICATES AN ERROR IN LOOP2.
087700 ERROR-MSG4.
087800 WRITE PRINT-OUT FROM ERR-MESS4 AFTER ADVANCING 2 LINES.
087900 STOP RUN.

```

7. THE FIRST SET OF JCL IS USED TO INITIATE A PROBLEM BY

GENERATING A MATRIX AND STARTING INTO THE SOLUTION PROCESS:

```
//IAPT1B PROC
//MPSEXEC EXEC PGM=DJLEXEC,REGION=300K,PARM=TASK,DPRTY=(13,13),
// TIME=150
//STEPLIB DD DSN=MMART.IAPT.LOAD,DISP=SHR
//SCRATCH1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//SCRATCH2 DD UNIT=(ITEL,SEP=SCRATCH1),SPACE=(CYL,(10),,CONTIG)
//PROBFILE DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//ETA1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//ETA2 DD UNIT=(ITEL,SEP=ETA1),SPACE=(CYL,(10),,CONTIG)
//MATRIX1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//MATRIX2 DD UNIT=(ITEL,SEP=MATRIX1),SPACE=(CYL,(10),,CONTIG)
//MIXWORK DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//FT05F001 DD DDNAME=SYSIN
//FT06F001 DD SYSOUT=A
//FT08F001 DD UNIT=ITEL,SPACE=(CYL,(10),10)
//SYSMLCP DD DSN=MMART.MLCPF.LOAD(START),DISP=SHR
//SYSRINT DD SYSOUT=A
//SYSPUNCH DD SYSOUT=B
```

```
00001100
00001000
00001050
00001070
00001100
00001200
00001300
00001500
00001600
00001700
00001800
00001900
00002200
00002300
00002350
00002400
00002500
00002600
```

6. THE SECOND SET OF JCL IS USED TO RESUME A PROBLEM THAT HAS

NOT FOUND A CONTINUOUS OPTIMAL SOLUTION BY RESTORING AND

PROCEEDING WITH THE SOLUTION PROCESS:

```
//IAPT2B PROC
//MPSEXEC EXEC PGM=DJLEXEC,REGION=300K,PARM=TASK,DPRTY=(13,13),
// TIME=150
//STEPLIB DD DSN=MMART.IAPT.LOAD,DISP=SHR
//SCRATCH1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
```

```
00001100
00001000
00001050
00001100
00001150
```

```

00001200
00001300
00001350
00001500
00001600
00001700
00001800
00001900
00002300
00002400
00002500
00002600

```

```

//SCRATCH2 DD UNIT=(ITEL,SEP=SCRATCH1),SPACE=(CYL,(10),,CONTIG)
//OLDPFILE DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//PROBFILE DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//ETA1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//ETA2 DD UNIT=(ITEL,SEP=ETA1),SPACE=(CYL,(10),,CONTIG)
//MATRIX1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//MATRIX2 DD UNIT=(ITEL,SEP=MATRIX1),SPACE=(CYL,(10),,CONTIG)
//MIXWORK DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//FT06FOO1 DD SYSOUT=A
//SYSMLCP DD DSN=MMART.MLCPF.LOAD(RESTCONT),DISP=SHR
//SYSRINT DD SYSOUT=A
//SYSPUNCH DD SYSOUT=B

```

9. THE THIRD SET OF JCL IS USED TO RESUME A PROBLEM THAT HAS FOUND A CONTINUOUS OPTIMUM BUT NOT AN INTEGER OPTIMUM BY RESTORING AND PROCEEDING WITH THE SOLUTION PROCESS.

```

00000100
00001000
00001050
00001100
00001150
00001200
00001300
00001350
00001500
00001600
00001700
00001800
00001900
00002300
00002400

```

```

//IAPT3B PROC
//MPSEXEC EXEC PGM=DJLEXEC,REGION=300K,PARM=TASK,DPRTY=(13,13),
// TIME=150
//STEPLIB DD DSN=MMART.IAPT.LOAD,DISP=SHR
//SCRATCH1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//SCRATCH2 DD UNIT=(ITEL,SEP=SCRATCH1),SPACE=(CYL,(10),,CONTIG)
//OLDPFILE DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//PROBFILE DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//ETA1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//ETA2 DD UNIT=(ITEL,SEP=ETA1),SPACE=(CYL,(10),,CONTIG)
//MATRIX1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//MATRIX2 DD UNIT=(ITEL,SEP=MATRIX1),SPACE=(CYL,(10),,CONTIG)
//MIXWORK DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//FT06FOO1 DD SYSOUT=A
//SYSMLCP DD DSN=MMART.MLCPF.LOAD(RESTMIP),DISP=SHR

```

```
00002500
00002600
```

```
//SYSPRINT DD SYSOUT=A
//SYSPUNCH DD SYSOUT=B
```

10. THE FOURTH SET OF JCL IS USED TO EXTRACT A SOLUTION AND

GENERATE A REPORT.

```

//IAPT48 PROC
//MPSEXEC EXEC PGM=DJLEEXEC,REGION=300K,PARM=TASK,DPRTY=(13,13),
// TIME=150
//SCRATCH1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//STEPLIB DD DSN=MMART.IAPT.LOAD,DISP=SHR
//SCRATCH2 DD UNIT=(ITEL,SEP=SCRATCH1),SPACE=(CYL,(10),,CONTIG)
//PROBFILE DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//ETA1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//ETA2 DD UNIT=(ITEL,SEP=ETA1),SPACE=(CYL,(10),,CONTIG)
//MATRIX1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//MATRIX2 DD UNIT=(ITEL,SEP=MATRIX1),SPACE=(CYL,(10),,CONTIG)
//MIXWORK DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//FT05F001 DD DDNAME=SYSIN
//FT06F001 DD SYSOUT=A
//FT08F001 DD UNIT=ITEL,SPACE=(CYL,(10),10)
//SYSMLCP DD DSN=MMART.MLCPF.LOAD(INSRT),DISP=SHR
//SYSPRINT DD SYSOUT=A
//SYSPUNCH DD DUMMY
00000100
00001000
00001050
00001100
00001150
00001200
00001300
00001500
00001600
00001700
00001800
00001900
00002200
00002300
00002350
00002400
00002500
00002600

```

11. THE FOLLOWING FORTRAN SUBROUTINE CHECKS THE DAYS OF THE WEEK

AND THE TIME OF DAY THE JOB STARTS. IF IT IS BETWEEN 0700 AND

1600 ON MONDAY THROUGH FRIDAY IT WILL SET XDELTM AT 9 MIN,

OTHERWISE IT WILL SET XDELTM AT 60 MIN. THE VALUE OF XDELTM

DETERMINES AT WHAT TIME THE SOLUTION WILL BE SAVED.

```
INTEGER*2 HOL(15), DAREA(19)
DATA HOL/2H70, 2H71, 2H72, 2HSA, 2HSU, 2H00, 2H10, 2H20, 2H30,
1 2H40, 2H50, 2H60, 2H70, 2H80, 2H90/
CALL AS9ADD(DAREA)
M=9
IF(DAREA(18).EQ.HOL(4)) GO TO 10
IF(DAREA(18).EQ.HOL(5)) GO TO 10
DU 3 N=1,3
IF (DAREA(14) .EQ. HOL(N)) J=N-1
DO 5 N=6,15
IF(DAREA(15) .GE. HOL(N)) K=N-6
I=10#J+K
IF(I.LT. 7) GO TO 10
IF(I.GE.16) GO TO 10
GO TO 15
M=120
CALL PUTARG(M)
RETURN
END
```

3

5

10

15

00000100
00000200
00000300
00000400
00000500
00000600
00000700
00000800
00000900
00001000
00001100
00001200
00001300
00001400
00001500
00001600
00001700
00001800
00001900

APPENDIX B

COMPARATIVE RUNNING TIME

COMPARATIVE RUNNING TIME

The IA/PT model may require a large amount of CPU time for items with many components and IPMs. Table B-1 relates problem size to run time. This table is provided to assist in estimating time to solution. The most significant variable that affects running time is the size of the problem as measured by the number of alternative solutions. The run time estimate is made as follows:

(1) List the number of alternatives put in for each line (including the current capability).

(2) Sum these alternatives and compare with the first column (number of alternatives) in the table.

(3) Multiply the numbers of alternatives for each line and compare them with the second column (alternative solutions).

(4) The third and fourth columns give observed run times for Modes 1 and 2, respectively. These numbers should not be used as absolutes but as general guidelines. The fourth item of the fourth column (3.3 min) is for a solution for $RR=0.0$; if there were assets, run time would be expected to be considerably longer. Table B-2 provides further information about the mixed integer problems for which the run times are shown.

TABLE B-1 RUN TIME AS A FUNCTION OF PROBLEM SIZE

<u>No. of Alternatives</u>	<u>Alternative Solutions</u>	<u>CP Run Time (Min)</u>	
		<u>Mode 1</u>	<u>Mode 2</u>
19	8	19.3	5.1
21	256	35.4	7.6
25	1024	57.1	13.2
31	4608	105.2	3.3
38	4096	98.9	255.2
43	139968	534.4	209.8

TABLE B-2. PROBLEM MODEL SIZE

<u>Item</u>	<u>Rows</u>	<u>Columns</u>	<u>Inter Variables</u>	<u>Potential Solutions</u>
81mm M374A2	521	3802	19	8
CBU-58B FY77	502	3304	21	256
CBU-58B FY76	596	3342	25	1024
105mm HE, M1	818	6945	31	4608
155mm M07	945	7664	38	4096
MK82 Bomb	1104	9563	43	139968