AN APPLE II IMPLEMENTATION OF MAN-MOD MANPOWER PLANNING MODEL (U)
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AN APPLE II IMPLEMENTATION OF MAN-MOD
MANPOWER PLANNING MODEL

by

James Lee Downs II

March 1982

Thesis Advisors: J.D. Esary
R.S. Elster

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James Lee Downs II

Naval Postgraduate School
Monterey, California 93940

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This thesis presents an Apple II Markov chain model software package programmed to be flexible, practical, and user interactive. The program addresses the future determination of manpower requirements by an application of a limited Markov chain model, a discrete time Markov process with a stochastic matrix of transition probabilities. The user may manipulate data inputs to vary outcome effects. The program was written in Applesoft, an Apple II basic language. It has the capability to store, retrieve, and modify data for use with the
calculation procedures. The program can be easily modified or enhanced to allow for inclusion or utilization of other models.
An Apple II Implementation of the Man-Mod Manpower Planning Model

by

James Lee Downs II
Lieutenant Commander, United States Navy
B.S.C., University of Louisville, 1965

Submitted in partial fulfillment of the requirements for the degree of

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ABSTRACT

This thesis presents an Apple II Markov chain model software package programmed to be flexible, practical, and user interactive. The program addresses the future determination of manpower requirements by an application of a limited Markov chain model, a discrete time Markov process with a stochastic matrix of transition probabilities. The user may manipulate data inputs to vary outcome effects. The program was written in Applesoft, an Apple II basic language. It has the capability to store, retrieve, and modify data for use with the calculation procedures. The program can be easily modified or enhanced to allow for inclusion or utilization of other models.
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INTRODUCTION

The objective of this thesis is to provide an interactive learning aid in evaluating policies and their effect on manpower requirements. These requirements have been a problem in manning the All-Volunteer Force since its inception. Without the steady flow of personnel into the armed forces prevalent with the draft, it has become increasingly necessary to make an in-depth examination of policies relating to manpower requirements.

For the manpower analyst, or for that matter anyone who utilizes the methodology and problem solving approach of the manpower analyst, some form of a computational device is a necessity. Cost, rigid interface requirements, and a number of other factors have in the past frustrated and stifled the analyst in focusing the necessary computational power on his problem.

In the early 1970's, programmable hand-held calculators were introduced. They gave the analyst a significant amount of computing power packaged in a portable unit. The impact these devices made on manpower analyses was extremely important in real time studies. However, in
spite of the tremendous impact of hand-held calculators, this contribution is yielding to the greater capability found in the microcomputer.

In view of the prospective proliferation of microcomputers and the significant computing power that they now provide, the analyst can ill afford to neglect their capabilities. Today compatible software to support the capabilities is seriously lacking in specialized fields such as manpower analysis. It is this software application that this thesis addresses.

MICROCOMPUTER SYSTEM

Software development was done on an Apple II Plus microcomputer with a 5 1/4 inch floppy-disk drive as an add on peripheral. The standard Apple computer presents a forty column, twenty four line display which is compatible with a standard television set or a commercial monitor. The output format for the program is written to be viewed in forty columns and to be compatible with any standard Apple II Plus operating system with a single disk drive.

SOFTWARE DEVELOPMENT

R. F. Ling's article, "General Considerations on the Design of an Interactive System for Data Analysis", brought out several considerations which should be observed in the development of software for any kind of analysis. Among these considerations are: choice of programming language,
computational efficiency, portability, information retrieval, and user interface.

Although several microcomputer languages are available with individual features which are attractive, the language used in this software development effort was Applesoft basic, a "real precision" or "floating point" basic. Basic was one of the first high level languages introduced to teach programming techniques and style. The language exploits the fundamental programming concepts, permitting the user to write large, complex computer programs. Although a basic language is not structured in concept, the program was written in a modular fashion (i.e., in logical sub-packages which can be individually programmed, debugged, and validated.). The sub-packages are combined into a menu driven overall package. The program was written with five modules, each having its own sub-modules.

In spite of their impressive capabilities, microcomputers cannot compare to larger computers in computational speed and accuracy. Applesoft basic, as implemented on the Apple, will only perform computations using nine significant figures. The program written is limited and will only handle inputs, displays, or print outs to six figures; any number greater than 999999 will result in a >>>>>> display. Percentages greater than three figures will result in the same >>> display. While Applesoft basic is
relatively slow as an interpreted language, the program and microcomputer still provide immediate results, approximately one second per calculation.

A portable program can be run on a number of different computer systems. While many higher languages provide this capability, basic languages are deficient in portability. The basic languages for microcomputers are all similar, but each has syntax and commands characteristic to itself. Therefore, a basic program written for the Apple computer will not run on another computer without modification. While basic in not the best language choice for portability, it is both user and programmer friendly.

Information retrieval is an aspect of a program which permits an analyst to use it efficiently. The program was designed to provide the user with the ability to store and retrieve data files.

The last and most important consideration is a simple user interface. To utilize any program, the user must interact with the program, make numerical entries, and select desired calculation routines and options. Input or response requirements which are unfamiliar or misunderstood by the user can cause program interruptions or require reinitialization. This is undesirable. Programs should be written with the intent of establishing a dialogue with the user. The program should be as trouble free as possible for the user, and minimize the user's chances of committing
a fatal error when responding to program prompts or entering data. Procedures to accomplish this are costly in terms of computational efficiency and programming steps; however, user convenience is worth the cost. The program was written with this objective in mind.

MAN-MOD

The program, MAN-MOD, is an Apple II Plus adaptation of a Markov chain model. It was adapted from a larger computer manpower planning model called MAN-MOD, for use on the Apple computer. A Users' Manual was written to assist the user in utilizing the program. The actual program is user oriented and menu driven, prompting the user for inputs. A minimal knowledge of the microcomputer is required. The Users' Manual provides the knowledge needed to use the MAN-MOD program. It provides initialization procedures and a step by step program review. There are calculation and input examples for the new user to review, as well as general program and interface information. The Users' Manual is contained within this thesis. The modules comprising the MAN-MOD program are listed in Appendices A - E.

PROGRAM DESCRIPTION

The MAN-MOD program addresses the future determination of manpower requirements by utilizing a discrete time Markov chain with a stochastic matrix of transition
probabilities. The user may manipulate data inputs to study various outcomes. All inputs are prompted.

When the program is initialized, the user begins at the "outer level". To proceed he must press the return key which will load the main module and present the main menu, Display 2 in the User's Manual. From here he selects the option he desires and responds to the screen prompts as required. All responses and inputs are intended to be as trouble free as possible for the user. The user may return to the main menu from the sub-routines by selecting the (E), escape, key within a routine, or by selecting the return menu choice. The program and Users' Manual provide the necessary information to use MAN-MOD.

CONCLUSIONS

With the advent of the microcomputer, and its affordable role in special fields such as manpower analysis, the analyst will have increasing access to computational power in the 1980's. Providing specialized software will compliment this power.

The software package provided here gives the analyst a useful means of studying manpower requirements using the Apple II Plus microcomputer. The modules contained within the MAN-MOD package are designed to be easy for the analyst to use and to cushion, as much as possible, potential user mistakes. The calculation algorithms used are identical to those used in the larger computer MAN-MOD program, but
expressed in the Apple's basic language. The MAN-MOD adaptation has been programmed to be compatible with the microcomputer's size and computing precision.

Being written in a modular design, the MAN-MOD program may easily be enhanced by the addition of new modules, or by the modification of existing modules. For example, the MAN-MOD program module could be modified to allow utilization of the Markov vacancy model.

This package, and hopefully those to follow, can have a significant impact in manpower analysis. The analyst can be allowed to work independently, examining a greater variety of situations. Perhaps of equal importance, its use in the educational environment can accustom the analyst to the capabilities that should be available for his use in a working environment.
MAN-MOD TRANSITIONAL FLOW MODEL

USERS' MANUAL

"An Apple II Implementation of the Man-Mod Manpower Planning Model"

Programmer
James Lee Downs

Advisors
Richard S. Elster
James D. Esary
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INTRODUCTION

MAN-MOD is an Apple II adaptation of Bartholomew and Forbes' "BASEQN" - a Markov transition model. The Apple Man-Mod transitional flow matrix program is designed to permit real time manpower data analyses. The program is user interactive, prompting the user for inputs as the model develops. The following instructions and illustrations will give the user a better understanding of the computer-user interaction and the model's capabilities. A basic explanation of the underlying theory is contained within the program as a menu choice. Bartholomew and Forbes' Statistical Techniques for Manpower Planning is recommended for a more detailed explanation.

SYSTEM HARDWARE

The suggested system configuration is:
1. 48K APPLE II PLUS computer with monitor.
2. DISK II and controller card.
3. Printer and interface card.

SYSTEM SOFTWARE

MAN-MOD, written in Applesoft Basic, is modular in design. The program consists of three modules, MAN-MOD/HELLO, MAN-MOD/PROGRAM, MAN-MOD/THEORY, and utilizes two
machine language routines, MAN-MOD/LINKER and MAN-MOD/FORMATTER.

MAN-MOD/HELLO is the initialization program providing variable dimensioning, machine language routine loading, and a brief terminology review. It chains into the MAN-MOD/PROGRAM.

MAN-MOD/PROGRAM is the main module providing a menu for branching to desired options. It provides the INPUT, RECALL, and SAVE capabilities, along with the data calculations and output. It chains to the MAN-MOD/THEORY module.

The MAN-MOD/THEORY module provides basic explanations of theory, calculation options, and variable definitions. It also contains a reference and acknowledgment section. It chains back to the MAN-MOD/PROGRAM module.

The two machine language routines connect the individual modules and provide for number formatting. MAN-MOD/LINKER is a public domain routine allowing individual program interconnection or chaining. MAN-MOD/FORMATTER is a print using routine allowing real and integer numbers to be formatted. It is a modified version of PRINT II, a Computer Systems Design copyrighted program. Permission has been obtained to utilize the modified routine for MAN-MOD; any other use of the routine is prohibited. Program listings are contained in the thesis, "An Apple II Implementation of the Man-Mod Manpower Planning Model", by James L. Downs, March 1982, Naval Postgraduate School, Monterey, Ca.
STARTING UP

Starting up requires system initialization and disk booting. Booting is a term for placing the disk in the disk drive and turning the computer on. A disk is a magnetic storage device that allows the retention and recall of data.

The following steps are required to initialize the MAN-MOD program:

1. Place the MAN-MOD program disk in disk Drive 1.
2. Turn the video monitor on.
3. Turn the printer on (an Apple Silentype printer is not required to be turned on).
4. Reach behind the Apple II computer on the left side and turn the computer on.

Once the preceding initialization steps are completed, the following things will occur.

TERMINOLOGY

The red light on the disk drive will come on, the disk drive will start up, and this acknowledgment will be printed on the screen:

MAN-MOD IS
AN APPLE ADAPTATION OF
BARTHOLOMEW AND FORBES'
"BASEQN" - A MARKOV TRANSITION MODEL
There will be a pause, and the screen will then display a review of five basic terms. The list covers terms to which the user will frequently respond. The monitor screen is shown in Display 1.

**Display 1**

At the bottom of Display 1, the following line is shown:

PRESS RETURN TO CONTINUE

Once the terms have been reviewed, the user presses the key marked RETURN. The screen will go blank for a moment, then this statement will appear:

<MAN-MOD PROGRAM BEING LOADED>

**MAIN MENU**

It will take approximately 25 seconds for the MAN-MOD/PROGRAM module to load. Once loaded, the MAIN MENU will be
displayed on the screen giving the user several options from which to choose. The user will be able to select the option desired and press the corresponding number. After the option choice is pressed, the program will display the option's menu. The MAIN MENU options are shown in Display 2.

MAN-MOD THEORY & DEFINITIONS

Selecting the main menu Option (1), MAN-MOD THEORY & DEFINITIONS, will chain the user to the MAN-MOD/THEORY module. It will take approximately twenty seconds to load the module. Once loaded, a menu will provide the user with choices for a review of the basic Markov chain model, an explanation or definition of variables found in the MAN-MOD program, an overview of options available in performing
the calculations, or major references and acknowledgments. The user may choose a menu option by pressing the desired number. The theory menu is shown in Display 3.

Although the Theory and Definitions section will give a basic understanding of MAN-MOD, it is not detailed enough to provide in-depth learning. For users not familiar with Markov chain models, it is recommended that one of the manpower reference books be reviewed. MAN-MOD was programmed on the Apple II to be utilized as a basic forecasting tool for individuals familiar with manpower requirements.

To exit the theory module, the user selects Option (5). The program will then chain the user to the main menu. The main menu is the focal point from which the user selects a working option, see Display 2.
MAN-MOD OPERATIONAL MODEL

Selection (2), MAN-MOD OPERATIONAL MODEL, will place the user in the working program. A menu, Display 4, will be shown on the screen. The user will select a choice and proceed as prompted. The menu options will be discussed in detail to provide the user with a better understanding of the program's capabilities.

II MAN-MOD TRANSITION MATRIX PROGRAM X

(1) INPUT NEW DATA
(2) RECALL DATA FROM DISK
(3) CHANGE OR MODIFY PARAMETERS
(4) LIST INPUTS OR PARAMETERS
(5) CALCULATE WITH CURRENT DATA
(6) RETURN TO MENU

.................................
PRESS SELECTION

<DISPLAY 4>

INPUT NEW DATA

The INPUT NEW DATA, Option (1), allows the user to create a new data file. To create a new file, the user will begin by assigning a FILE NAME. The FILE NAME cannot be over 15 characters in length and must start with a letter of the alphabet. A FILE NAME that begins with a number will be rejected when the save routine is initiated. A
FILE NAME is needed to save the data and recall it at a later time. The user will be prompted on each data entry. After each entry the input will be displayed for verification by the user. The user will have the choice to (R), reenter the data, either correcting or changing the input; to (A), accept the input; or to (E), escape to the MAN-MOD OPERATIONAL MODEL menu, Display 4. The input sequence for new data is as follows:

FILE NAME
NUMBER (K) OF CLASSES OR GRADES
INITIAL CLASS VECTOR (N) (Stocks)
FRACTIONAL FLOW MATRIX (P)
OPTIONS CHOICE (1-5)
RECRUITMENT VECTOR (Options 1-5)
RECRUITMENT NUMBER (Options 2-5)
ADDITIVE NUMBER (Options 2 & 4)
MULTIPLICATIVE FACTOR (Options 3 & 5)
TIME (T) PERIODS TO INITIALLY CALCULATE
PERCENTAGE OPTIONS FOR PRINT OUT

Once the initial input data has been entered, the screen will display "INITIAL INPUTS COMPLETED". The user will then be given the option to save or not to save the data file entered, see Display 5 next page. It is highly recommended, to prevent the loss of data, that the user save the data at this point. If Choice (1), yes, is selected, the screen will state DATA BEING SAVED; the data
will be saved under the entered FILE NAME. Note, if data
has been previously saved under this name, it will be
erased and the new data saved. Once the data is saved, the
program will return the user to the main menu, Display 2.
Option (2) will have to be selected to return to the opera-
tional model menu. If the user selects 2, NO, not electing
to save the input data, he will automatically be returned
to the operational model menu, Display 4.

<DISPLAY 5>

The INPUT NEW DATA option allows for a systematic in-
put of data. The input routine sequence corresponds to the
suggested input sequence found in the Bartholomew and
Forbes' book. The MAN-MOD EXAMPLE shown in the example
section illustrates the data a user would input.
RECALL DATA FROM DISK

The RECALL DATA FROM DISK, Option (2) of the operational menu, allows the user to recall a data file previously saved under a FILE NAME. The user will be asked to input the FILE NAME he desires to recall. The program will display the file name on the screen and prompt the user to choose either to (A), accept the input FILE NAME and proceed; (R), reenter the name, either correcting the previous entry or inputting a new FILE NAME; or (E), escape from the recall routine to the operational menu.

If a FILE NAME has been entered and accepted for recall, the program will prompt the user as to which disk drive the data file is on. The disk drives are normally labeled Drive 1 and Drive 2. If the drives are not labeled, then the boot drive is Drive 1. The boot drive is the drive which starts up first when the computer is turned on. The user will select the drive in which the data file disk has been placed. The user normally saves his data files on the MAN-MOD program disk and uses only Drive 1. If, while entering the recall information, a mistake is made, the program will prompt the user to <REVERIFY> data entered, FILE NAME and disk drive. If the user is uncertain of the FILE NAME under which he saved his data, he may catalog the disk to verify the name. To catalog the MAN-MOD disk, see the CATALOG section.
Once the FILE NAME is entered and the disk drive has been selected, the program will indicate on the screen that the data file is being loaded. After the file has been loaded, the user will be returned to the operational menu. An illustration of data recall is shown in the example section.

CHANGE OR MODIFY PARAMETERS

Option (3) of the operational menu, Display 4, is the CHANGE OR MODIFY PARAMETERS routine. It is important in that it allows the user the flexibility to modify previously entered or recalled data, and to observe outcomes. The option is menu driven, Display 6.

<DISPLAY 6>

The user will choose the desired parameter he wishes to modify, a number selection, and press the return key.
The program will display the data that has been previously entered and query the user as to his desires. The user may (A), accept data as is and be returned to the menu, or he may press (R) which allows him to reenter that particular data. Once the new data is input, it will be displayed again for an (A), accept, or an (R), reenter user input. Definitions of the menu variables are given in the Theory and Definitions option in the MAN-MOD program.

Once an input is changed or modified, it will remain changed or modified. The user may elect to save the modified data under a new FILE NAME, or the one currently being used. If data has been recalled or previously saved using this FILE NAME, saving the new data under this name will destroy all data previously saved with this name.

The change or modify routine is a powerful means of exploring or examining different scenarios affecting man-power requirements.

LIST INPUTS OR PARAMETERS

The LIST INPUTS OR PARAMETERS, Option (4) of the operational menu, allows the user to review data in memory, either on the screen or by a paper print out. The user may select this option, as any option, at any time. Due to the number of inputs and the limited 40 column, 24 line display of the Apple II, the screen review will be shown in pages. All matrix inputs and row vectors will be listed in column format. The paper copy will list all data on one page in
normal row format. Examples of data listings are shown in the example section.

CALCULATE WITH CURRENT DATA

The last operational menu choice is Option (5), CALCULATE WITH CURRENT DATA. This option will display three choices. The choices will permit either step calculation, point calculation, or continue calculation - extending the range on data and options presently selected in memory. The option choices are shown in Display 7.

MAN-MOD TRANSITION MATRIX PROGRAM

(1) CALCULATE ALL 0 PERIODS
(2) CALCULATE LAST TIME PERIOD 0
(3) EXTEND CALCULATION RANGE
(4) RETURN TO MENU

..........................
PRESS SELECTION

<DISPLAY 7>

Calculations from a selected menu choice may be either displayed on the screen or sent to the printer for a paper copy. The user will be prompted after choosing the desired calculation as to the desired display.
By choosing calculation option 1 or 2, the MAN-MOD program will automatically reset stocks or class sizes to the original memory input and commence calculating from time period (0). Only option 3, extend calculation range, will permit the user to continue from a previously calculated time period done with option 1, 2, or 3.

An advantage in utilizing the extended range choice is, the user may calculate manpower requirements under one set of parameters to a certain time period, go to the CHANGE OR MODIFY menu and change parameters in memory, then continue calculations to a new time period with the new parameters. This would permit the user to consider future changes in recruitment policy, transitioning policy, or any policy affecting the system.

The last choice on any sub-menu will return the user to the next higher menu. Exiting the calculation menu will return the user to the operational menu. The last choice of the operational menu, Display 4, is to return the user to the main menu, which brings the user to the two remaining options to be discussed, SAVE DATA FILE TO DISK and EXIT MAN-MOD PROGRAM.

SAVE DATA FILE TO DISK

Option (3) of the main menu, SAVE DATA FILE TO DISK, provides the user a chance to save data input in memory before exiting the program or continuing on to another option. A save option is automatically provided ending the
INPUT NEW DATA routine. However, if data has been modified or the input data has not been saved and the user wishes to save it now, he may do so by selecting Option (3). The option will prompt the user as to FILE NAME to be saved and disk drive choice. An explanation of disk drives is discussed in the RECALL DATA FROM DISK section. Note, using previously saved FILE NAME could cause loss of previously saved data.

Once the user has responded to prompts and the data file has been saved, the program will return the user to the main menu.

EXIT MAN-MOD PROGRAM

Option (4), EXIT MAN-MOD PROGRAM, of the main menu will terminate the MAN-MOD program. Selecting this option will display the exit menu giving the user a last opportunity to return to the main menu before terminating. If EXIT PROGRAM is selected, the program will be terminated displaying an exit statement; all data in memory is lost.

ERROR RECOVERY

MAN-MOD was written to be robust and to protect the user from errors and program problems. However, Murphy's Law will always prevail, and if an error or program problem can happen, it will.

Rule 1, always save data first. It is best to do so as soon as possible. If an unrecoverable error occurs,
then the data is safe on a storage disk and the program can be restarted or reinitialized.

One of the most common inadvertent errors a user may make is to press the RESET key. Once pressed, the RESET key will cause a program interruption and place the user in Applesoft basic, indicated by a bracket on the screen and a flashing cursor. All data in memory will be lost. However, the user may reenter the MAN-MOD program by typing RUN, see Display 8, and pressing the return key, or by reinitializing the MAN-MOD PROGRAM.

<DISPLAY 8>

The user may reinitialize the MAN-MOD program two ways; first, by typing PR#6 and pressing the return key, or second, by turning the computer off and back on. The first method is preferred.
Program interruptions will occur. The best recommended restart is to reinitialize the program. Restarting the program with RUN could possibly work, but unless the user has an idea of why the program was interrupted, it is best to clear memory and reload by initializing.

**CATALOG**

Sooner or later the user will desire to see or verify the data file names he has saved to the disk. At present the MAN-MOD program does not provide an internal review capability. The capability does exist for the user to list the files on a standard Apple II Disk Operating System (DOS) disk from Applesoft basic. To CATALOG the disk or list the programs saved, the user must enter Applesoft basic. There are two ways to accomplish this, one is to press the RESET key, the other is to exit the program.

Pressing the RESET key will cause a program interruption and place the user in Applesoft basic. Since pressing the reset key inadvertently is not desired, Apple computer designers modified later Apple II's to give the owner a capability to disable the normal RESET function. The modification provides an internal switch within the computer, causing the RESET key function to work only in conjunction with the CONTROL key. The user must determine in which mode the system is configured. If pressing the RESET key does not interrupt the program, then try pressing the
CONTROL key and the RESET key simultaneously. One of the operations will place the user in Applesoft basic.

The other means of entering Applesoft basic is to use the EXIT MAN-MOD PROGRAM main menu option (4). This will clear the screen and place the user in Applesoft basic with a bracket and flashing cursor in the upper left corner.

Once in Applesoft basic, the user can type CATALOG and press the return key. The disk drive will initialize and all programs saved on the disk in the initializing drive will be listed on the screen, see Display 8, preceding page. If the list is longer than the screen listing capability, it will pause allowing the user to review the first part of the catalog, pressing the return key will continue the listing. Once the programs have been listed, the bracket and flashing cursor will reappear. After reviewing the CATALOG, the user may reenter the MAN-MOD program by reinitializing the program or by typing RUN and pressing the return key. To reinitialize the program, the user may type PR#6 and press return, or turn the computer off and back on. It is recommended that the user reinitialize the program to reenter. The reinitialization will take longer, approximately 30 seconds, but will clear and reload memory preventing any inadvertent memory changes which might cause program interruptions or erroneous calculations. The preferred method is typing PR#6.
DISK MAINTENANCE

The 5 1/4 inch storage disk is referred to as a "floppy" disk. MAN-MOD has been programmed and stored on a floppy disk for the user's convenience. The storage is done magnetically, similarly to storing music on a magnetic tape. The magnetic floppy disk is durable but not indestructible. The same care and concern one would give a musical tape recording should be given to a floppy storage disk. The disks are susceptible to heat, magnetic fields, and physical abuse. Any one of the three could cause total or partial loss of the MAN-MOD programs or saved data files. If data is lost or damage occurs, return the disk to the issuer. BACKUP copies of data files may be made by using the SAVE DATA TO DISK main menu option and saving the file to a second disk.

BACKUP

BACKUP is a reference term, pertaining to the saving of a second copy of a program or data file. MAN-MOD has the capability through the SAVE DATA TO DISK option to save a second copy. To utilize this capability, the user must have two disks, MAN-MOD and an initialized floppy disk or a second MAN-MOD disk. An initialized second disk may be obtained by purchasing a blank disk and asking an Apple owner to initialize it. With a BACKUP copy, if the original MAN-MOD disk is damaged, destroyed, or lost, the user will have backup data files and not all will be lost.
MAN-MOD EXAMPLE

The following example is an illustration of data input, a listing of that data, and a calculation routine performed on the data using a pre-selected calculation option, Additive (System Size). The example is called "MAN-MOD EXAMPLE". The example has been entered and stored on the MAN-MOD program disk. The user may recall the data file and experiment with various options, or may reenter the data under a new FILE NAME to simulate similar operations. MAN-MOD EXAMPLE will give the user an idea of what the input data listing will look like and an example of both a step calculation and a point calculation printout. Illustrations are found on the following pages.

In selecting a listing or calculations display, the user may choose either a screen display or a paper copy. The MAN-MOD program will not at present give both displays simultaneously. The user may utilize the screen display for manipulating calculations and once the desired output is attained, recalculate the same parameters to a paper copy.

The following are illustrations of data input, listings, and calculations. The input is for the MAN-MOD EXAMPLE. If further illustrations are desired, the Bartholomew and Forbes' book is recommended. MAN-MOD is an adaptation of those authors' BASEQN model.
MAN-MOD EXAMPLE DATA INPUT

FILE NAME: MAN-MOD EXAMPLE
NUMBER (K) CLASSES: 3
INITIAL STOCK VECTOR:
C1 70
C2 20
C3 10
MATRIX (P: R1 R2 R3 *
C1 .95 .00 .00
C2 .01 .94 .00
C3 .00 .00 .95
OPTION: (4) ADDITIVE (SYSTEM SIZE)
RECRUITMENT VECTOR:
R1 *
C1 .70
C2 .20
C3 .10
RECRUITMENT NUMBER: NOT REQUIRED
ADDITIVE NUMBER: 10
MULTIPLICATIVE FACTOR: Options 3 & 5 only
TIME (T) PERIODS: 5
PERCENTAGE OPTION: (2) PRESENT PERIOD

* INPUT OF ROW VECTORS IS VERTICAL

INPUT DATA LIST
ILLUSTRATION 1

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MAN-MOD EXAMPLE DATA LISTING

MAN-MOD DATA FILE LISTING

DATA FILE NAME IS...: MAN-MOD EXAMPLE
NUMBER (K) CLASSES...: (3)
TIME (T) PERIODS....: (5)
PERCENTAGES OPTION...: GRADE SIZE AS % OF TOTAL SIZE
OPTION SELECTED IS...: ADDITIVE (SYSTEM SIZE)
OPTION INPUTS.......: CALCULATES TOTAL NET NUMBER TO INCREASE SYSTEM BY <10>

INITIAL STOCK (N) VECTOR AND RECRUITMENT (R) VECTOR

<table>
<thead>
<tr>
<th>COL 1</th>
<th>COL 2</th>
<th>COL 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>VECTOR N:</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>RECRUIT R:</td>
<td>.7000</td>
<td>.2000</td>
</tr>
</tbody>
</table>

TRANSITIONAL FLOW MATRIX (P)

<table>
<thead>
<tr>
<th>COL 1</th>
<th>COL 2</th>
<th>COL 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROW (1)</td>
<td>.9500</td>
<td>.0100</td>
</tr>
<tr>
<td>ROW (2)</td>
<td>.0000</td>
<td>.9400</td>
</tr>
<tr>
<td>ROW (3)</td>
<td>.0000</td>
<td>.0000</td>
</tr>
</tbody>
</table>

INPUT DATA LISTING

ILLUSTRATION 2

38
### MAN-MOD EXAMPLE, STEP & POINT CALCULATIONS

**DATA FILE NAME**: (MAN-MOD EXAMPLE)

**TRANSITIONAL FLOWS**

<table>
<thead>
<tr>
<th>TIME</th>
<th>CLASS</th>
<th>STOCKS (N)</th>
<th>PERCENT</th>
<th>RECRUITMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>78</td>
<td>(78)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>20</td>
<td>(20)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>10</td>
<td>(10)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>108</td>
<td>(100)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>77</td>
<td>(70)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>22</td>
<td>(20)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>11</td>
<td>(10)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>110</td>
<td>(110)</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>83</td>
<td>(69)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>25</td>
<td>(21)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>12</td>
<td>(10)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>120</td>
<td>(120)</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>90</td>
<td>(69)</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>27</td>
<td>(21)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>13</td>
<td>(10)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>130</td>
<td>(130)</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>97</td>
<td>(69)</td>
<td>11</td>
</tr>
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<td></td>
<td>2</td>
<td>30</td>
<td>(21)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>14</td>
<td>(10)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
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<td>(140)</td>
<td>16</td>
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<tr>
<td>5</td>
<td>1</td>
<td>183</td>
<td>(69)</td>
<td>11</td>
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<tr>
<td></td>
<td>2</td>
<td>32</td>
<td>(21)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>15</td>
<td>(10)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>150</td>
<td>(150)</td>
<td>16</td>
</tr>
</tbody>
</table>

**DATA FILE NAME**: (MAN-MOD EXAMPLE)

**TRANSITIONAL FLOWS**

<table>
<thead>
<tr>
<th>TIME</th>
<th>CLASS</th>
<th>STOCKS (N)</th>
<th>PERCENT</th>
<th>RECRUITMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1</td>
<td>183</td>
<td>(69)</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>32</td>
<td>(21)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>15</td>
<td>(10)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>150</td>
<td>(150)</td>
<td>16</td>
</tr>
</tbody>
</table>

**ILLUSTRATION 3**

39
PROGRAM ACCURACY

The MAN-MOD program's accuracy is determined by the limitations of Applesoft basic. The format is based on "real precision" or "floating point" numbers. MAN-MOD will calculate stocks for display or printout to 999999, any number greater will result in a >>>>>> display. Percentages greater than 999 will result in a >>> display. Since the MAN-MOD program primarily is concerned with stocks, no fractions are listed. MAN-MOD uses an integer .5 round off routine for both class stocks and total listings. Thus, a difference may occur.
<table>
<thead>
<tr>
<th>INDEX</th>
<th>PG</th>
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<tbody>
<tr>
<td>ACCEPT (A)</td>
<td>20</td>
</tr>
<tr>
<td>ACCURACY</td>
<td>40</td>
</tr>
<tr>
<td>ACKNOWLEDGMENT</td>
<td>19,22</td>
</tr>
<tr>
<td>APPLESOT BASIC</td>
<td>17,33</td>
</tr>
<tr>
<td>BACKUP</td>
<td>35</td>
</tr>
<tr>
<td>BARTHOLOMEW, D. J.</td>
<td>17</td>
</tr>
<tr>
<td>BASEQN</td>
<td>17</td>
</tr>
<tr>
<td>BOOT DRIVE</td>
<td>26</td>
</tr>
<tr>
<td>BOOTING</td>
<td>19</td>
</tr>
<tr>
<td>CALCULATIONS</td>
<td>29</td>
</tr>
<tr>
<td>CHANGE DATA</td>
<td>27</td>
</tr>
<tr>
<td>CONTENTS</td>
<td>15</td>
</tr>
<tr>
<td>CONTROL KEY</td>
<td>33</td>
</tr>
<tr>
<td>DAMAGE</td>
<td>35</td>
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<td>DATA INPUT</td>
<td>23</td>
</tr>
<tr>
<td>DEFINITIONS</td>
<td>21</td>
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<tr>
<td>DISK</td>
<td>19</td>
</tr>
<tr>
<td>DISPLAYS</td>
<td>16</td>
</tr>
<tr>
<td>DOWNS, J. L.</td>
<td>18</td>
</tr>
<tr>
<td>DRIVE 1 &amp; 2</td>
<td>26</td>
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<tr>
<td>ERROR RECOVERY</td>
<td>31</td>
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<td>ESCAPE (E)</td>
<td>20</td>
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<tr>
<td>EXAMPLES</td>
<td>37-39</td>
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<td>EXIT</td>
<td>31</td>
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<tr>
<td>EXTEND RANGE</td>
<td>27,29,30</td>
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<tr>
<td>FILE NAME</td>
<td>23</td>
</tr>
<tr>
<td>FLOATING POINT</td>
<td>40</td>
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<tr>
<td>FLOPPY DISK</td>
<td>35</td>
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<tr>
<td>FORBES, A. F.</td>
<td>17</td>
</tr>
<tr>
<td>HARDWARE</td>
<td>17</td>
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<td>19</td>
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<td>LISTING, DATA</td>
<td>28</td>
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<tr>
<td>LISTINGS</td>
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<td>LISTINGS, FORMAT</td>
<td>28</td>
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<td>LOADING (BOOTING)</td>
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<td>LOADING TIME</td>
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<tr>
<td>MAN-MOD/FORMATER</td>
<td>18</td>
</tr>
<tr>
<td>MAN-MOD/HELLO</td>
<td>18</td>
</tr>
<tr>
<td>MAN-MOD/LINKER</td>
<td>18</td>
</tr>
<tr>
<td>MAN-MOD/PROGRAM</td>
<td>18</td>
</tr>
<tr>
<td>MAN-MOD/THEORY</td>
<td>18</td>
</tr>
<tr>
<td>MODIFY DATA</td>
<td>27</td>
</tr>
<tr>
<td>MODULES</td>
<td>17</td>
</tr>
<tr>
<td>MURPHY'S LAW</td>
<td>31</td>
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<tr>
<td>NUMERICAL DISPLAY</td>
<td>40</td>
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<tr>
<td>PARAMETERS</td>
<td>27</td>
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<tr>
<td>PR#6</td>
<td>32,34</td>
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<tr>
<td>PRESS</td>
<td>20</td>
</tr>
<tr>
<td>PRINT II</td>
<td>18</td>
</tr>
<tr>
<td>REAL PRECISION</td>
<td>40</td>
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<tr>
<td>RECALL</td>
<td>26</td>
</tr>
<tr>
<td>RECOVERY</td>
<td>31</td>
</tr>
<tr>
<td>REENTER</td>
<td>20</td>
</tr>
<tr>
<td>RESET KEY</td>
<td>32</td>
</tr>
<tr>
<td>RESET STOCKS</td>
<td>27,30</td>
</tr>
<tr>
<td>RESPONSE TERMINOLOGY</td>
<td>20</td>
</tr>
<tr>
<td>RETURN (MENU)</td>
<td>30</td>
</tr>
<tr>
<td>REVERIFY</td>
<td>26</td>
</tr>
<tr>
<td>ROUND OFF</td>
<td>40</td>
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<tr>
<td>RUN</td>
<td>32</td>
</tr>
<tr>
<td>SAVE DATA</td>
<td>23,30</td>
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<tr>
<td>SCREEN DISPLAY</td>
<td>28</td>
</tr>
<tr>
<td>SOFTWARE</td>
<td>17</td>
</tr>
<tr>
<td>STARTING UP</td>
<td>19</td>
</tr>
<tr>
<td>STOCK RESET</td>
<td>24,30</td>
</tr>
<tr>
<td>THEORY</td>
<td>17,21</td>
</tr>
<tr>
<td>VARIABLES DEFINED</td>
<td>26</td>
</tr>
</tbody>
</table>
BIBLIOGRAPHY


APPENDIX A

MAN-MOD/HELLO MODULE

PROGRAM LISTING

The MAN-MOD/HELLO module is written in Apple II Applesoft basic. The program was listed using XLISTER, a Beagle Brothers Inc. program.
MAN-MOD/HELLO (PROGRAM LISTING)

--------------------------------------------------
1000 REM MAN-MOD/HELLO PROGRAM
--------------------------------------------------
1002 D$ = CHR$ (4)
: Q$ = CHR$ (34)
: REM CTRL=D & "

--------------------------------------------------
1004 HOME
: VTab 9
 : HTAB 13
 : PRINT "MAN-MOD PROGRAM"
 : VTab 11
 : HTAB 16
 : PRINT "MARCH 1982"
 : VTab 13
 : HTAB 8
 : PRINT "NAVAL POSTGRADUATE SCHOOL"
 : VTab 15
 : HTAB 12
 : PRINT "THESIS REQUIREMENT"
 : FOR I = 1 TO 2500
 : NEXT

--------------------------------------------------
1006 TEXT
 : HOME
 : VTab 1
 : HTAB 1
 : INVERSE
 : PRINT "* MAN-MOD TRANSITION MATRIX PROGRAM * "
 : NORMAL

--------------------------------------------------
1008 VTab 23
 : HTAB 1
 : FOR I = 1 TO 39
 : PRINT ";";
 : NEXT

--------------------------------------------------
1010 SPEED = 100

--------------------------------------------------
1012 VTab 8
 : HTAB 15
 : PRINT "MAN-MOD IS"
 : PRINT
 : HTAB 9
 : PRINT "AN APPLE ADAPTATION OF"
 : PRINT
 : HTAB 9
 : PRINT "BARTHOLOMEW AND FORBES'"
PRINT HTAB 2
PRINT "BASEQ"Q$"QS" - A MARKOV TRANSITION MODEL"

1014 SPEED= 255
FOR I = 1 TO 1500
NEXT I

1016 TEXT
HOME
VTAB 1
HTAB 1
INVERSE
PRINT " * MAN-MOD TRANSITION MATRIX PROGRAM * "
NORMAL

1018 VTAB 4
HTAB 11
PRINT "<TERMINOLOGY REVIEW>"
HTAB 11
PRINT "----------------------"

1020 VTAB 7
HTAB 1
INVERSE
PRINT "(A) ACCEPT:"
NORMAL
HTAB 14
PRINT "ACCEPT SCREEN DISPLAY, PRO-"
VTAB 8
HTAB 14
PRINT "CEED TO NEXT ROUTINE"

1022 VTAB 10
HTAB 1
INVERSE
PRINT "(E) ESCAPE:"
NORMAL
HTAB 14
PRINT "ABORT PRESENT ROUTINE, RE-"
HTAB 14
PRINT "TURN TO MENU"

1024 VTAB 13
HTAB 1
INVERSE
PRINT "INPUT:"
NORMAL
HTAB 14
PRINT "CALLS FOR A DATA INPUT,"
: HTAB 14
: PRINT "ONCE ENTERED PRESS RETURN"

1026 VTAB 16
: HTAB 1
: INVERSE
: PRINT "PRESS:";
: NORMAL
: HTAB 14
: PRINT "SELECT CHOICE OF SCREEN OP-"
: VTAB 17
: HTAB 14
: PRINT "TIONS, AND PRESS CHOICE"

1028 VTAB 19
: HTAB 1
: INVERSE
: PRINT "(R) REENTER:";
: NORMAL
: HTAB 14
: PRINT "RE-INPUT VALUES DISPLAYED"
: VTAB 20
: HTAB 14
: PRINT "ON SCREEN"

1030 VTAB 23
: HTAB 1
: FOR I = 1 TO 39
 : PRINT "";
: NEXT

1032 VTAB 24
: HTAB 7
: PRINT "PRESS RETURN TO CONTINUE ";
: GET G$

2000 DIM N(9)
 : REM INITIAL CLASS VECTOR

2002 DIM P(9,9)
 : REM TRANSITION MATRIX FLOW RATES

2004 DIM R(9)
 : REM INFLOW SPECIFICATION AND OPTION

2006 DIM X(9)
 : REM TEMPOARY MATRIX VECTOR

2008 DIM Q(9)
 : REM NEW TRANSITION MATRIX
3000 TEXT
: HOME
: VTAB 11
: HTAB 5
: PRINT "<MAN-MOD PROGRAM BEING LOADED>"

3002 PRINT D$; "BRUN MAN-MOD/FORMATTER"

3004 PRINT D$; "BLOAD MAN-MOD/LINKER, A520"

3006 CALL 520"MAN-MOD/PROGRAM"
APPENDIX B

MAN-MOD/THEORY MODULE

PROGRAM LISTING

The MAN-MOD/THEORY module is written in Apple II Applesoft basic. The program was listed using XLISTER, a Beagle Brothers Inc. program.
MAN-MOD/THEORY (PROGRAM LISTING)

1000   D$ = CHR$ (4)
         : REM   CTRL-D

1002   REM   MAN-MOD/INTRODUCTION PROGRAM

1004   GOSUB 9000

1006   VTAB 5
         : HTAB 5
         : PRINT "<THEORY AND DEFINITIONS>"
         : HTAB 5
         : PRINT "--------------------"

1008   VTAB 9
         : HTAB 5
         : PRINT "(1) MAN-MOD THEORY"
         : PRINT

1010   HTAB 5
         : PRINT "(2) VARIABLE DEFINITIONS"
         : PRINT

1012   HTAB 5
         : PRINT "(3) OPTIONS AVAILABLE"
         : PRINT

1014   HTAB 5
         : PRINT "(4) REFERENCES & ACKNOWLEDGMENTS"
         : PRINT

1016   HTAB 5
         : PRINT "(5) RETURN TO MAIN MENU"
         : PRINT

1018   GOSUB 9100

1020   IF G < 1 OR G > 5 THEN 1018

1022   ON G GOTO 2000,3000,4000,5000,6000

2000   GOSUB 9000

2002   VTAB 3
         : HTAB 13
         : PRINT "MAN-MOD THEORY"
         : VTAB 6
         : HTAB 3
PRINT "A BASIC EXPLANATION OF A MARKOV CHAIN"
PRINT "MODEL IS NEEDED TO UNDERSTAND MAN-MOD. A"
PRINT "MARKOV CHAIN MODEL ASSUMES THAT AN IN-

PRINT "DIVIDUAL WILL MOVE INDEPENDENTLY FROM"
PRINT "ONE CLASS TO ANOTHER. INDIVIDUAL MOVES"
PRINT "ARE ACCOMPLISHED WITH TRANSITION PROBA-

PRINT "BILITIES THAT DO NOT VARY OVER TIME. THE"
PRINT "TRANSITION PROBABILITIES ARE ARRANGED IN"
GOSUB 9300
IF G$ = "M" GOTO 1004

PRINT "AN ARRAY KNOWN AS A TRANSITION MATRIX."
PRINT "THE ELEMENTS OF THE ARRAY ARE Labeled AS"
PRINT "FOLLOWS:"
INVERSE
PRINT ""
XX = XX + 1
NEXT
NORMAL
GOSUB 9300
IF G$ = "M" GOTO 1004

2014 VTAB 3
HTAB 1
CALL - 958
VTAB 4
HTAB 3
PRINT "THE ELEMENT P(I,J) OF THE ARRAY IS THE"
VTAB 6
PRINT "PROBABILITY THAT AN INDIVIDUAL IN CLASS"
VTAB 8
PRINT "'I' AT THE BEGINNING OF A TIME INTERVAL"

2016 VTAB 10
HTAB 3
VTAB 12
PRINT "WILL MOVE TO CLASS 'J' AT THE END OF"
VTAB 14
PRINT "THAT TIME PERIOD. THE AMOUNT W(I) IS"
VTAB 16
PRINT "THE PROBABILITY THAT THE INDIVIDUAL IN"
VTAB 18
PRINT "CLASS 'I', AT THE START OF AN INTERVAL,"

2018 VTAB 18
HTAB 3
VTAB 20
PRINT "HAS LEFT THE SYSTEM BY THE END OF THE"
VTAB 22
PRINT "INTERVAL. THE ASSUMPTIONS ARE THAT AN"
GOSUB 9300
IF G$ = "M" GOTO 1004

2020 VTAB 3
HTAB 1
CALL - 958
VTAB 4
PRINT "INDIVIDUAL MUST STAY WHERE HE IS, MOVE"
VTAB 6
PRINT "TO ANOTHER CLASS, OR LEAVE. THE SUM OF"
VTAB 8
PRINT "PROBABILITIES IN THE CLASS ROW, P(I,1)+"
VTAB 10
PRINT "...+ P(I,K) + W(I), MUST EQUAL ONE."

2022 VTAB 12
HTAB 3
PRINT "THE MATRIX (P) IS THE MATRIX OF THE"
PRINT "P(I,J)'S. THE WASTAGE VECTOR (W) IS THE"
PRINT "VECTOR W(1),...,W(K). IT IS IMPLICIT IN"
PRINT "IN MARKOV MODELS THAT TIME PERIODS ARE"
PRINT "DISCRETE AND OF EQUAL DURATION."
GOSUB 9300
IF G$ = "M" GOTO 1004
PRINT "THE FINAL INPUT IS RECRUITMENT. THE"
PRINT "RECRUITMENT VECTOR DESCRIBES THE NUMBER"
PRINT "OF INDIVIDUALS THAT WILL REPLENISH THE"
PRINT "CLASSES EACH PERIOD. THE TOTAL RECRUIT-"
PRINT "MENT IS REFERRED TO AS R, AND IS THE SUM"
PRINT "OF THE ELEMENTS OF THE RECRUITMENT VEC-
PRINT "TOR R(1),...,R(K). THE RECRUITMENT VECTOR"
PRINT "CAN BE EXPRESSED BY EITHER INTEGER NUM-
PRINT "BERS THAT AUGMENT THE CLASSES OR BY PRO-
GOSUB 9300
IF G$ = "M" GOTO 1100
PRINT "PORTIONS, THAT ADD TO ONE, OF A TOTAL"
PRINT "RECRUITMENT."
PRINT "THE MARKOV CHAIN MODEL, MAN-MOD, AL-"
PRINT "THE USER TO ANALYZE INTERCONNECTED"
PRINT "STOCKS AND FLOWS FROM ASSUMPTIONS ABOUT"
PRINT "INDIVIDUAL CLASS TRANSITIONS AND TO VARY"
PRINT "THE PROBABILITIES THAT AFFECT TRANSITION"
PRINT "TIONING. FOR A MORE DETAILED EXPLANATION"
PRINT "OF MARKOV THEORY, BARTHOLOMEW AND FORBES"
IF G$ = "M" GOTO 1004
---------------------------------------------
PRINT "" CHRS (34) "STATISTICAL TECHNIQUES FOR"
PRINT "POWER PLANNING" CHRS (34) ", IS RECOMMENDED."
---------------------------------------------
PRINT "FILE NAME";
PRINT "PERCENT (%)"
PRINT "INITIAL STKS";
PRINT "INC TIME"
PRINT "MATRIX (P)";
PRINT "(P) ELEMENT"
3006 VTAB 13
:  HTAB 3
:  PRINT "(4) RECRUITMENT";
:  HTAB 23
:  PRINT "(10) (P) ROW"
:  VTAB 15
:  HTAB 3
:  PRINT "(5) OPTIONS";
:  HTAB 23
:  PRINT "(11) RESET STKS"
:  VTAB 17
:  HTAB 3
:  PRINT "(6) TIME (T)"
:  HTAB 23
:  PRINT "(12) RETURN MENU"

3008 VTAB 23
:  HTAB 1
:  FOR I = 1 TO 39
:    PRINT "'";
:  NEXT
:  VTAB 24
:  HTAB 11
:  PRINT "INPUT SELECTION ";
:  INPUT G$ ;
:  G = VAL (G$)

3010 IF G < 1 OR G > 12 GOTO 3000

3012 ON G GOTO 3060, 3120, 3180, 3240, 3300, 3360, 3420, 3480, 3540, 3600, 3660, 1004

3060 GOSUB 9000
:  VTAB 5
:  HTAB 16
:  PRINT "FILE NAME"
:  VTAB 6
:  HTAB 3
:  PRINT "FILE NAME IS A MAXIMUM 15 CHARACTER"
:  VTAB 8
:  PRINT "NAME ASSIGNED TO THE DATA INPUT. THE IN-
:  VTAB 10
:  PRINT "PUT DATA MAY BE SAVED WITH THIS NAME TO"

3062 VTAB 12
:  PRINT "A DISK. IF THE DATA INPUT IS CHANGED OR"
:  VTAB 14
:  PRINT "MODIFIED, THE FILE NAME MAY BE CHANGED"
VTAB 16
PRINT "TO SAVE THE REVISED DATA WITHOUT DES--"

3064
VTAB 18
PRINT "TROYING THE PREVIOUSLY SAVED DATA."
GOSUB 9200
GOTO 3000

3120
GOSUB 9000
VTAB 3
HTAB 15
PRINT "INITIAL STKS"
VTAB 6
HTAB 3
PRINT "THE INITIAL STOCKS REPRESENT THE ORIG--"
VTAB 8
PRINT "INAL GRADE OR CLASS 'I' SIZES. K IS THE"
VTAB 10
PRINT "NUMBER OF CLASSES. THE INITIAL STOCKS"

3122
VTAB 12
PRINT "ARE THOSE WITHIN THE SYSTEM AT TIME PER--"
VTAB 14
PRINT "IOD ZERO, (0). THE STOCKS ARE ENTERED AS"
VTAB 16
PRINT "A ROW VECTOR (N) WITH COMPONENTS: N(1),.."

3124
VTAB 18
PRINT ",,N(K). MAN-MOD'S PROGRAM INPUT PROMPT"
VTAB 20
PRINT "FOR STOCK VECTOR (N) IS R1 FOR ROW 1 AND"
GOSUB 9300
IF G$ = "M" GOTO 3000

3126
GOSUB 9000
VTAB 4
PRINT "C1 FOR COLUMN 1. TO INPUT STOCK N(1),"
VTAB 6
PRINT "THE USER WOULD RESPOND TO (R1,C1:?B) BY"
VTAB 8
PRINT "INPUTTING THE N(1) STOCK COMPONENT. THE"
VTAB 10
PRINT "USER WOULD INPUT N(2) IN RESPONSE TO THE"

3128
VTAB 12
PRINT "(R1,C2:?B) PROMPT. CLASS STOCKS ARE INPUT"
VTAB 14
PRINT "UNTIL 'K' STOCKS HAVE BEEN REACHED. K IS"
VTAB 16
PRINT "THE NUMBER OF CLASSES IN THE SYSTEM."
GOSUB 9200
GOTO 3000

GOSUB 9200
GOTO 3000

GOSUB 9000
VTAB 3
HTAB 16
PRINT "MATRIX (P)"
VTAB 6
HTAB 3
PRINT "MATRIX (P) SUMMARIZES THE TRANSITIONAL"
VTAB 8
PRINT "FLOWS OF STOCKS WITHIN THE SYSTEM. THE"
VTAB 10
PRINT "FLOWS ARE LISTED IN A (K X K) MATRIX, K"

VTAB 12
PRINT "BEING LIMITED TO 9 CLASSES. EACH CLASS"
VTAB 14
PRINT "VECTOR REPRESENTS FLOW RATES FROM THAT"
VTAB 16
PRINT "CLASS. THE RESPONSE TO THE PROMPT R(I),"

VTAB 18
PRINT "C(J) SHOULD BE THE FLOW RATE P(I,J) FROM"
VTAB 20
PRINT "CLASS 'I' TO CLASS 'J'."
GOSUB 9200
GOTO 3000

GOSUB 9000
VTAB 3
HTAB 16
PRINT "RECRUITMENT"
VTAB 6
HTAB 3
PRINT "RECRUITMENT 'R' IS THE NUMBER OF INDI'
VTAB 8
PRINT "VIDUALS ENTERING THE SYSTEM. THE SYSTEM"
VTAB 10
PRINT "IS NORMALLY MAINTAINED AT A STEADY STATE"

VTAB 12
PRINT "THROUGH RECRUITMENT. FLUCTUATION IN RE-
VTAB 14
PRINT "CRUITMENT WILL CAUSE A SYSTEM TO CHANGE"
VTAB 16
PRINT "IN SIZE. MAN-MOD RECRUITMENT INPUTS VARY"
WITH THE CALCULATION OPTION CHOICE. IN"
PRINT "THE FIXED RECRUITMENT VECTOR, THE ACTUAL"
GOSUB 9300
IF G$ = "M" GOTO 3000

GOSUB 9000
VTAB 4
PRINT "NUMBER ENTERING EACH CLASS 'I' IS INPUT,"
VTAB 6
PRINT "I.E. (70, 20, 10); RECRUITMENT 100. IN"
VTAB 8
PRINT "THE OTHER OPTIONS, 2 - 5, RECRUITMENT IS"

VTAB 10
PRINT "A WHOLE NUMBER, I.E. 100, AND IS DISTRI-"
VTAB 12
PRINT "BUTED WITHIN THE SYSTEM BY AN HISTORICAL"
VTAB 14
PRINT "PROPORTION VECTOR, E.G. (.70, .20, .10)."

VTAB 16
PRINT "THE USER WILL BE PROMPTED BY THE APPR-
VTAB 18
PRINT "PRIATE INPUT COMMANDS. THE PROGRAM AL-
VTAB 20
PRINT "LOWS FOR GROWTH OR DECAY, DEPENDING ON"
GOSUB 9300
IF G$ = "M" GOTO 3000

GOSUB 9000
VTAB 4
PRINT "THE USER INPUT. OPTIONS 2 - 5 WILL ASK"
VTAB 6
PRINT "FOR AN ADDITIVE NUMBER OR A MULTIPLICA-
VTAB 8
PRINT "TIVE FACTOR TO ACCOMPLISH THIS. THE USER"

VTAB 10
PRINT "WILL INPUT THE DESIRED SYSTEM GROWTH OR"
VTAB 12
PRINT "CONTRACTION."
GOSUB 9200
GOTO 3000

GOSUB 9000
VTAB 3
HTAB 18
PRINT "OPTIONS"
VTAB 6
HTAB 4
PRINT "OPTIONS 1 - 5 ALLOW THE MAN-MOD USER"
VTAB 8
PRINT "TO MANIPULATE DATA ENTERED. THE EFFECTS"

3302 VTAB 10
PRINT "OF DIFFERENT TRANSITIONS AND FLOW RATES"
VTAB 12
PRINT "CAN BE OBSERVED. AN EXPLANATION OF EACH"
VTAB 14
PRINT "OPTION IS OBTAINED BY SELECTING THE MENU"

3304 VTAB 16
PRINT "CHOICE, OPTIONS AVAILABLE."
GOSUB 9200
GOTO 3000

3360 GOSUB 9000
VTAB 3
HTAB 17
PRINT "TIME (T)"
VTAB 6
HTAB 4
PRINT "TIME (T) IS A USER INPUT TO THE MAN-MOD PROGRAM. IT DETERMINES THE NUMBER OF"
VTAB 8
PRINT "PERIODS FOR WHICH CALCULATIONS ARE TO BE"
VTAB 10
PRINT "PERIODS FOR WHICH CALCULATIONS ARE TO BE"

3362 VTAB 12
PRINT "PERFORMED. CALCULATIONS MAY BE DONE REPEATEDLY, AND CHANGES OR MODIFICATIONS"
VTAB 14
PRINT "TO PARAMETERS CAN BE IMPLEMENTED THROUGH"

3364 VTAB 18
PRINT "THE MAIN MENU. THE USER MAY INCREASE THE"
VTAB 20
PRINT "NUMBER OF PERIODS EITHER BY USING 'TIME"
GOSUB 9300
IF G$ = "M" GOTO 3000

3366 GOSUB 9000
VTAB 4
PRINT "(T)' OR THE 'EXT RANGE +T' CHOICE ON THE"
VTAB 6
PRINT "THE CHANGE OR MODIFY MENU. TIME PERIOD"
PRINT "ZERO (0) IS THE INITIAL PERIOD; PERIOD"

PRINT "ONE (1) IS ONE TIME PERIOD LATER."
GOSUB 9200
GOTO 3000

GOSUB 9000
VTAB 3
HTAB 16
PRINT "PERCENT (%)"
VTAB 6
HTAB 3
PRINT "PERCENT (%) IS AN OPTION SELECTION DE-
VTAB 8
PRINT "TERMINED BY THE MAN-MOD USER. IT AFFECTS"

PRINT "ONLY THE STOCKS PRINT OUT FORMAT. THERE"
VTAB 12
PRINT "ARE THREE CHOICES FROM WHICH TO SELECT."
VTAB 14
PRINT "CHOICE 1 SHOWS NO PERCENTAGES, JUST THE"

PRINT "ACTUAL STOCKS. CHOICE 2 GIVES INDIV DUAL"
VTAB 18
PRINT "CLASS 'I' STOCK PERCENTAGES BASED ON THE"
VTAB 20
PRINT "TOTAL FOR THAT PERIOD, ALONG WITH THE"
GOSUB 9300
IF G$ = "M" GOTO 3000

GOSUB 9000
VTAB 4
PRINT "THE STOCKS. CHOICE 3 WILL SHOW THE CUR-
VTAB 6
PRINT "RENT STOCKS AS PERCENTAGES OF THE ORIG-
VTAB 8
PRINT "INAL TIME PERIOD STOCKS. THE PERCENT OP-

PRINT "TION MAY BE CHANGED AT ANY TIME THROUGH"
VTAB 12
PRINT "THE CHANGE OR MODIFY MAIN MENU."
GOSUB 9200
GOTO 3000

GOSUB 9000
PRINT "EXT RANGE +T"

PRINT "EXT RANGE +T ALLOWS THE MAN-MOD USER"

PRINT "TO INCREASE TIME (T). EXTEND RANGE +T IS"

PRINT "THE END PERIOD FOR CALCULATIONS. THE EX-

PRINT "TENDED RANGE WILL NOT BE ADDED TO TIME,"

PRINT "IT WILL REPLACE THE TIME (T). IT IS USED"

PRINT "IN CONJUNCTION WITH THE CONTINUE RANGE"

PRINT "OPTION OF THE MAIN PROGRAM'S CALCULATION"

PRINT "ROUTINE."

GOSUB 9200

GOTO 3000

GOSUB 9000

GOTO 3000

GOSUB 9000

PRINT "(P) ELEMENT"

PRINT "THE (P) ELEMENT VARIABLE CHOICE ALLOWS"

PRINT "THE MAN-MOD USER TO CHANGE OR CORRECT"

PRINT "PARTICULAR ELEMENTS OF THE MATRIX (P)."

PRINT "THE USER CAN CHANGE AN ELEMENT THROUGH"

PRINT "THE 'CHANGE OR MODIFY' MENU OPTION. THE"

PRINT "OPTION CAN BE USED TO MANIPULATE STOCKS"

PRINT "AND TRANSITIONAL FLOWS."

GOSUB 9200

GOTO 3000

GOSUB 9000

GOTO 3000
PRINT "(P) ROW"
: VTAB 6
: HTAB 3
: PRINT "THE (P) ROW OPTION IS SIMILAR TO THE"
: VTAB 8
: PRINT "(P) ELEMENT OPTION. THE ONLY DIFFERENCE"

GOSUB 9200
: GOTO 3000

GOSUB 9000
: VTAB 3
: HTAB 16
: PRINT "RESET STKS"
: VTAB 6
: HTAB 3
: PRINT "THE RESET STKS OPTION ALLOWS THE USER"

GOSUB 9200
: GOTO 3000

GOSUB 9000
: VTAB 3
: HTAB 16
: PRINT "OPTIONS' REVIEW"

GOSUB 9200
: GOTO 3000

GOSUB 9000
: VTAB 4
: HTAB 13
: PRINT "OPTIONS' REVIEW"

GOSUB 9200
: GOTO 3000

GOSUB 9000
: VTAB 7
: HTAB 3
: PRINT "(1) FIXED RECRUITMENT VECTOR"
: VTAB 9
PRINT "(2) ADDITIVE (RECRUIT SIZE)"

PRINT "(3) MULTIPLICATIVE (RECRUIT SIZE)"

PRINT "(4) ADDITIVE (SYSTEM SIZE)"

PRINT "(5) MULTIPLICATIVE (SYSTEM SIZE)"

PRINT "(6) RETURN TO MENU"

GOSUB 9100

IF G < 1 OR G > 6 GOTO 4008

ON G GOTO 4100, 4200, 4300, 4400, 4500, 1004

CALL - 958

PRINT "FIXED RECRUITMENT VECTOR"

PRINT "THE FIXED RECRUITMENT VECTOR PERMITS"

PRINT "THE USER TO ENTER IN CLASS 'I' A CONSTANT RECRUITMENT NUMBER 'R', E.G.,"

PRINT "(52, 15, 3), EACH PERIOD. THE OPTION OUT-

PRINT "PUT YIELDS PREDICTED STOCK VECTORS FOR"

PRINT "FUTURE PERIODS BASED ON THIS FIXED RE-

PRINT "CRUITMENT."

GOSUB 9200

GOTO 4000

CALL - 958

PRINT "ADDITIVE (RECRUIT SIZE)"
PRINT "THE ADDITIVE RECRUIT SIZE OPTION PER-"
PRINT "MITS ONE TO INCREASE THE RECRUITMENT IN"

PRINT "CLASS 'I' EACH PERIOD BY A CONSTANT NUM-
PRINT "BER. EXAMPLE: TO INCREASE CLASS 'I' RE-
PRINT "CRUITMENT BY 7, STARTING WITH A RECRUIT-
PRINT "MENT OF 70; RECRUITMENT FOR PERIOD 1"

PRINT "WOULD BE 77, FOR PERIOD 2 WOULD BE 84,
PRINT "AND SO ON. THE PROGRAM WILL ASK THE USER"
GOSUB 9300
IF GS$ = "M" GOTO 4000

PRINT "FOR A TOTAL RECRUITMENT 'R', E.G. 100, A"
PRINT "PERIOD ADDITIVE NUMBER, E.G. 10, AND A"

PRINT "PROPORTIONAL RECRUITMENT DISTRIBUTION"
PRINT "VECTOR, I.E. (.70,.20,.10). THE PROPORT-
PRINT "TIONAL VECTOR WILL DISTRIBUTE THE TOTAL"

PRINT "'R' IN THE CLASSES. EXAMPLE, PERIOD 0,
PRINT "IF TOTAL 'R' IS 100, DISTRIBUTION WILL"
PRINT "BE 70, 20, 10. BY ADDING 10 TO TOTAL"

PRINT "'R' EACH PERIOD, RECRUITMENT FOR PERIOD"
GOSUB 9300
IF GS$ = "M" GOTO 4000

HTAB 3
PRINT "THE ADDITIVE RECRUIT SIZE OPTION PER-
PRINT "MITS ONE TO INCREASE THE RECRUITMENT IN"

PRINT "CLASS 'I' EACH PERIOD BY A CONSTANT NUM-
PRINT "BER. EXAMPLE: TO INCREASE CLASS 'I' RE-
PRINT "CRUITMENT BY 7, STARTING WITH A RECRUIT-
PRINT "MENT OF 70; RECRUITMENT FOR PERIOD 1"

PRINT "WOULD BE 77, FOR PERIOD 2 WOULD BE 84,
PRINT "AND SO ON. THE PROGRAM WILL ASK THE USER"
GOSUB 9300
IF GS$ = "M" GOTO 4000

PRINT "FOR A TOTAL RECRUITMENT 'R', E.G. 100, A"
PRINT "PERIOD ADDITIVE NUMBER, E.G. 10, AND A"

PRINT "PROPORTIONAL RECRUITMENT DISTRIBUTION"
PRINT "VECTOR, I.E. (.70,.20,.10). THE PROPORT-
PRINT "TIONAL VECTOR WILL DISTRIBUTE THE TOTAL"

PRINT "'R' IN THE CLASSES. EXAMPLE, PERIOD 0,
PRINT "IF TOTAL 'R' IS 100, DISTRIBUTION WILL"
PRINT "BE 70, 20, 10. BY ADDING 10 TO TOTAL"

PRINT "'R' EACH PERIOD, RECRUITMENT FOR PERIOD"
GOSUB 9300
IF GS$ = "M" GOTO 4000

HTAB 3

63
CALL 958
VTAB 4
PRINT "I WILL BE 77, 22, 11, AND SO ON.  SYSTEM"

4216 VTAB 6
PRINT "RECRUITMENT CAN BE HELD CONSTANT BY USE-
VTAB 8
PRINT "ING ZERO AS THE ADDITIVE NUMBER."
GOSUB 9200
GOTO 4000

4300 VTAB 3
CALL 958
HTAB 7
PRINT "MULTIPLICATIVE (RECRUIT SIZE)"
VTAB 6
HTAB 3
PRINT "MULTIPLICATIVE RECRUIT SIZE IS SIMILAR"
VTAB 8
PRINT "TO ADDITIVE RECRUIT SIZE.  THE DIFFER-

4302 VTAB 10
PRINT "ENCE IS IN HOW THE RECRUITMENT IS IN-
VTAB 12
PRINT "CREASED EACH PERIOD.  THE TOTAL NUMBER"
VTAB 14
PRINT "OF RECRUITS IS FIXED AND AN HISTORICAL"

4304 VTAB 16
PRINT "PROPORTION VECTOR IS USED.  RECRUITMENT"
VTAB 18
PRINT "IS THEN INCREASED EACH PERIOD BY A MUL-
VTAB 20
PRINT "TIPLICATIVE FACTOR, E.G., 1.2.  THE TOTAL"
GOSUB 9300
IF G$ = "M" GOTO 4000

4306 VTAB 3
HTAB 1
CALL 958
VTAB 4
PRINT "RECRUITMENT 'R', E.G. 100, MULTIPLIED BY"
VTAB 6
PRINT "1.2 WILL GIVE A RECRUITMENT OF 120 FOR"

4308 VTAB 8
PRINT "PERIOD 1.  A REVIEW OF THE ADDITIVE RE-
VTAB 10
PRINT "CRUIT SIZE IS RECOMMENDED.  THE RECRUIT-
VTAB 12
MENTS SIZE CAN BE HELD CONSTANT BY USING

4310 VTAB 14
: PRINT "1.0 AS THE MULTIPLICATIVE FACTOR."
: GOSUB 9200
: GOTO 4000

4400 VTAB 3
: CALL - 958
: HTAB 10
: PRINT "ADDITIVE (SYSTEM SIZE)"
: VTAB 6
: HTAB 4
: PRINT "THE ADDITIVE SYSTEM SIZE OPTION PER-

4402 VTAB 12
: PRINT "MENTS SIZE. THE USER MAY ELECT TO INCREASE"
: VTAB 14
: PRINT "OR DECREASE THE SYSTEM BY A FIXED ADDI-
: VTAB 16
: PRINT "ITIVE NUMBER EACH PERIOD, I.E. 10 OR -10."
: VTAB 18
: PRINT "THE OPTION REQUIRES A HISTORICAL PROPOR-

4404 VTAB 20
: PRINT "TION VECTOR TO DISTRIBUTE RECRUITMENT."
: GOSUB 9300
: IF G$ = "M" GOTO 4000

4406 VTAB 3
: HTAB 1
: CALL - 958
: VTAB 4
: PRINT "AN EXAMPLE VECTOR IS: (.70, .20, .10)."
: VTAB 6
: PRINT "THE SYSTEM MAY BE HELD CONSTANT BY EN-
: VTAB 8
: PRINT "TERING ZERO FOR THE ADDITIVE NUMBER."
: GOSUB 9200 GOTO 4000

4500 VTAB 3
: CALL - 958
: HTAB 8
: PRINT "MULTIPlicative (SYSTEM SIZE)"
: VTAB 6
: HTAB 3
PRINT "THE MULTIPLICATIVE SYSTEM OPTION SIZE"
PRINT "IS SIMILAR TO ADDITIVE SYSTEM SIZE. THE"
PRINT "DIFFERENCE IS IN HOW THE SYSTEM IS IN-
CREASED OR DECREASED. THE OPTION USES A"
PRINT "MULTIPLICATIVE FACTOR INSTEAD OF AN ADD-
ITIVE NUMBER, I.E. 1.2 OR .9. TO HOLD"
PRINT "THE SYSTEM CONSTANT THE USER MAY USE 1.0"
PRINT "AS A FACTOR. RECRUITMENT IS DISTRIBUTED"
GOSUB 9300
IF GS = "M" GOTO 4000

PRINT "BY AN HISTORICAL PROPORTION VECTOR, I.E.
(.70, .20, .10)."
GOSUB 9200
GOTO 4000

PRINT "REFERENCES & ACKNOWLEDGMENTS"
PRINT "(1) REFERENCES"
PRINT "(2) ACKNOWLEDGMENTS"
PRINT "(3) RETURN TO MENU"
GOSUB 91000
IF G < 1 OR G > 3 GOTO 5004
ON G GOTO 5100, 5200, 1004

GOSUB 9000
:   VTAB 4
:   HTAB 13
:   PRINT "MAJOR REFERENCES"
:   VTAB 8
:   PRINT "APPLE COMPUTER INC., BASIC PROGRAMMING"
:   VTAB 10
:   PRINT "REFERENCE MANUAL, 1978"

GOSUB 9000
:   VTAB 14
:   PRINT "BARTHOLOMEW, D. J., AND FORBES, A. F.,"
:   VTAB 16
:   PRINT "STATISTICAL TECHNIQUES FOR MANPOWER, 2ND"
:   VTAB 18
:   PRINT "ED., WILEY 1979."
:   GOSUB 9200
:   GOTO 5000

GOSUB 9000
:   VTAB 3
:   HTAB 14
:   PRINT "ACKNOWLEDGMENT"
:   VTAB 6
:   HTAB 3
:   PRINT "MAN-MOD/FORMATTER IS A PRINT USING"
:   VTAB 8
:   PRINT "ROUTINE ALLOWING REAL OR INTEGER NUMBERS"
:   VTAB 10
:   PRINT "TO BE FORMATTED. IT IS A MODIFIED VER-"

GOSUB 9000
:   VTAB 12
:   PRINT "SION OF 'PRINT II', A COMPUTER SYSTEMS"
:   VTAB 14
:   PRINT "DESIGN COPYRIGHTED PROGRAM. PERMISSION"
:   VTAB 16
:   PRINT "HAS BEEN OBTAINED TO UTILIZE THE MODI-"

GOSUB 9000
:   VTAB 18
:   PRINT "FIED ROUTINE FOR MAN-MOD; ANY OTHER AP-"
:   VTAB 20
:   PRINT "PLICATION OF THE ROUTINE IS PROHIBITED."
:   GOSUB 9300
:   IF G$ = "M" GOTO 5000

GOSUB 9000
:   VTAB 3
:   HTAB 14

67
PRINT "ACKNOWLEDGMENT"
VTAB 6
HTAB 3
PRINT "THE AUTHOR WOULD LIKE TO THANK PROFES-
VTAB 8
PRINT "ORS RICHARD ELSTER AND JAMES ESARY FOR"

5208 VTAB 10
PRINT "THEIR ASSISTANCE AND SUPPORT WITH THE"
VTAB 12
PRINT "MAN-MOD ADAPTATION. A SPECIAL THANKS TO"
VTAB 14
PRINT "THE AUTHOR'S WIFE, SANDRA, WHOSE UNDER-

5210 VTAB 16
PRINT "STANDING WAS STRETCHED TO THE LIMITS,"
VTAB 18
PRINT "BUT WITHOUT WHOSE HELP THIS THESIS WOULD"
VTAB 20
PRINT "NOT HAVE BEEN COMPLETED."
GOSUB 9200
GOTO 5000

6000 HOME
VTAB 11
HTAB 8
PRINT "<RETURNING TO MAIN MENU>"

6002 PRINT D$;"BLOAD MAN-MOD/LINKER, A520"

6004 CALL 520"MAN-MOD/PROGRAM"

9000 TEXT
HOME
VTAB 1
HTAB 1
INVERSE
PRINT "* MAN-MOD TRANSITION MATRIX PROGRAM *
NORMAL
RETURN

9100 VTAB 23
HTAB 1
FOR I = 1 TO 39
PRINT ";
NEXT
VTAB 24
HTAB 12
PRINT "PRESS SELECTION ";
GET G$
: G = VAL (G$)
: RETURN

9200 VTAB 23
: FOR I = 1 TO 39
: PRINT "";
: NEXT
: VTAB 24
: HTAB 10
: PRINT "PRESS RETURN FOR MENU ";
: GET G$
: RETURN

9300 VTAB 23
: HTAB 1
: FOR I = 1 TO 39
: PRINT "";
: NEXT
: VTAB 24
: HTAB 2
: PRINT "PRESS (C) TO CONTINUE, (M) FOR MENU ";
: GET G$
: RETURN
APPENDIX C

MAN-MOD/PROGRAM MODULE

PROGRAM LISTING

The MAN-MOD/PROGRAM module is written in Apple II Applesoft basic. The program was listed using XLISTER, a Beagle Brothers Inc. program.
MAN-MOD/PROGRAM (PROGRAM LISTING)

1000 REM MAN-MOD/PROGRAM PROGRAM: "FOR" IS IN QUOTES IN LINES 1004, 10518, 10520, 10524, 10526, 10528, 10722, 10724, 10728, 10730, 10732 FOR PRINT LISTING ONLY

1002 D$ = CHR$(4) : REM CTRL-D

1004 PRINT "FOR"6,0;
 : Q$ = CHR$(34)

1006 GOSUB 20100

1008 V TAB 5
 : H TAB 13
 : PRINT "<MAN-MOD MENU>"

1010 H TAB 13
 : PRINT "------------------------"

1012 V TAB 10
 : H TAB 4
 : PRINT "(1) MAN-MOD THEORY & DEFINITIONS"

1014 V TAB 12
 : H TAB 4
 : PRINT "(2) MAN-MOD OPERATIONAL MODEL"

1016 V TAB 14
 : H TAB 4
 : PRINT "(3) SAVE DATA FILE TO DISK"

1018 V TAB 16
 : H TAB 4
 : PRINT "(4) EXIT MAN-MOD PROGRAM"

1020 GOSUB 20200

1022 IF G < 1 OR G > 4 GOTO 1020

1024 ON G GOTO 2000, 3000, 9000, 9200

2000 HOME
 : V TAB 11
 : H TAB 8
 : PRINT "<THEORY AND DEFINITIONS>"

2002 PRINT D$;"LOAD MAN-MOD/LINKER,A520"
4006 VTAB 18
    : HTAB 19
    : PRINT "---------------------"

4008 VTAB 17
    : HTAB 6
    : INPUT "FILE NAME IS ";NF$

4010 VTAB 4
    : CALL - 958
    : VTAB 9
    : HTAB 10
    : PRINT "NEW DATA FILE NAME IS:"

4012 VTAB 13
    : HTAB (19 - INT (LEN (NF$) / 2))
    : PRINT Q$;NF$;Q$

4014 GOSUB 20300

4016 IF G$ = "A" GOTO 4100

4018 IF G$ = "R" GOTO 4004

4020 IF G$ = "E" GOTO 3000

4022 GOTO 4014

4100 ONERR GOTO 4104

4102 GOSUB 20100

4104 VTAB 9
    : CALL - 958
    : HTAB 3
    : PRINT "INPUT NUMBER (K) OF CLASSES (MAX 9)"
    : PRINT
    : HTAB 14
    : PRINT "PRESS RETURN"

4106 VTAB 16
    : HTAB 13
    : INPUT "INPUT NUMBER ";K

4108 IF K < 1 OR K > 9 GOTO 4104

4110 VTAB 9
    : CALL - 958
    : HTAB 4

73
PRINT "NUMBER (K) OF CLASSES ENTERED IS:"
VTAB 12
HTAB 19
PRINT 
( "K")'
GOSUB 20300
IF G$ = "A" GOTO 4200
IF G$ = "R" GOTO 4100
IF G$ = "E" GOTO 3000
GOTO 4112
ONERR GOTO 4204
GOSUB 20100
VTAB 4
CALL 958
HTAB 3
PRINT "CLASS SIZES VECTOR (N) \(\rightarrow\) \(1 \text{ BY } K\)"
VTAB 7
HTAB 2
PRINT "INPUT ROW (R1) AND COLUMN (C1 TO C"K")"
VTAB 10
HTAB 12
PRINT "R1, ";
II = 9
FOR I = 1 TO K
HTAB 16
PRINT "C"I": ";
INPUT N(I)
IF N(I) < 0 GOTO 4214
NEXT
DO = .0000001
FOR I = 1 TO K
M(I) = N(I)
DO = DO + N(I)
NEXT
GOTO 4216
VTAB (II + I)
HTAB 21
FLASH
PRINT "INVALID NUMBER"
NORMAL
II = II + 1
GOTO 4208

4216 GOSUB 20100

4218 VTAB 5
CALL - 958
HTAB 3
PRINT "CLASS SIZES VECTOR (N) ENTERED IS:"

4220 VTAB 8
HTAB 13
PRINT "RI, FOR I = 1 TO K
HTAB 17
PRINT "C"I": ;#M(I)
NEXT

4222 GOSUB 20300

4224 IF G$ = "A" GOTO 4300

4226 IF G$ = "R" GOTO 4200

4228 IF G$ = "E" GOTO 3000

4230 GOTO 4222

4300 ONERR GOTO 4308

4302 GOSUB 20100
I = 1

4304 VTAB 4
CALL - 958
HTAB 3
PRINT "INITIAL FRACTIONAL FLOW MATRIX (P)"
HTAB 16
PRINT "("K" BY "K")"
PRINT

4306 HTAB 3
PRINT "INPUT ROW (R(I)) AND COLUMN (C(J))"
HTAB 9
PRINT "FOR THE P(I,J) ELEMENT"
II = 9

4308 VTAB 10
: HTAB 1
: CALL -958
: HTAB 13
: PRINT "R"I", ";
: FOR J = 1 TO K

4310  HTAB 17
: PRINT "C"J": ";
: INPUT P(I,J)

4312  IF P(I,J) < 0 OR P(I,J) > 1 GOTO 4318

4314  NEXT J
: ST = 0
: FOR IP = 1 TO K
: ST = ST + P(I,IP)
: NEXT
: IF ST > 1 GOTO 4320

4316  GOTO 4324

4318  VTAB (II + J)
: HTAB 21
: FLASH
: PRINT "INVALID NUMBER"
: NORMAL
: II = II + 1
: GOTO 4310

4320  GOSUB 20500
: IF G$ = "E" GOTO 3000

4322  GOTO 4304

4324  VTAB 4
: CALL -958
: VTAB 7
: HTAB 13
: PRINT "ROW ", " INPUT IS:

4326  VTAB 10
: HTAB 13
: PRINT "R"I", ";
: FOR L = 1 TO K
: HTAB 17
: PRINT "C"L": ";
: P1 = P(I,L)
: GOSUB 20000
: NEXT
4328 GOSUB 20300

4330 IF G$ = "A" GOTO 4338

4332 IF G$ = "R" GOTO 4304

4334 IF G$ = "E" GOTO 3000

4336 GOTO 4328

4338 I = I + 1
: IF I > K GOTO 4400

4340 GOTO 4304

4400 ONERR GOTO 4404

4402 GOSUB 20100

4404 VTab 5
: CALL - 958
: HTab 5
: PRINT "RECRUITMENT OPTIONS INPUT MENU"

4406 VTab 9
: HTab 3
: PRINT "(1) FIXED RECRUITMENT VECTOR"
: PRINT
: HTab 3
: PRINT "(2) ADDITIVE (RECRUIT SIZE)"
: PRINT
: HTab 3
: PRINT "(3) MULTIPLICATIVE (RECRUIT SIZE)"
: PRINT

4408 HTab 3
: PRINT "(4) ADDITIVE (SYSTEM SIZE)"
: PRINT
: HTab 3
: PRINT "(5) MULTIPLICATIVE (SYSTEM SIZE)"

4410 GOSUB 20200
: OP = G

4412 IF OP < 1 OR OP > 5 GOTO 4410

4414 IF OP = > 2 GOTO 4448

4416 ONERR GOTO 4422
4418  A = 1
   :  B$ = "O"
   :  C = 0

4420  GOSUB 20100

4422  VTAB 5
   :  CALL - 958
   :  HTAB 2
   :  PRINT "RECRUITMENT VECTOR (R) FOR OPTION (1)"
   :  HTAB 4
   :  PRINT "INPUT ACTUAL RECRUITMENT NUMBERS"
   :  HTAB 12
   :  PRINT "(I.E., 52, 15, 3)"

4424  VTAB 10
   :  HTAB 2
   :  PRINT "INPUT ROW (RI) AND COLUMN (C1 TO C"K")"
   :  VTAB 12
   :  HTAB 12
   :  PRINT "RI, "
   :  II = 11
   :  FOR I = 1 TO K

4426  HTAB 16
   :  PRINT "C"I" : ";
   :  INPUT R(I)

4428  IF R(I) < 0 GOTO 4432

4430  NEXT
   :  GOTO 4434

4432  VTAB (II + I)
   :  HTAB 21
   :  FLASH
   :  PRINT "INVALID NUMBER"
   :  NORMAL
   :  II = II + 1
   :  GOTO 4426

4434  VTAB 5
   :  CALL - 958
   :  HTAB 3
   :  PRINT "RECRUITMENT VECTOR (R) ENTERED IS:"

4436  VTAB 9
   :  HTAB 13
   :  PRINT "R1, ";
   :  FOR I = 1 TO K
: HTAB 17
: PRINT "C"I": ";#R(I)
: NEXT

4438 GOSUB 20300

4440 IF G$ = "A" GOTO 4600

4442 IF G$ = "R" GOTO 4416

4444 IF G$ = "E" GOTO 3000

4446 GOTO 4438

4448 IF OP = 2 OR OP = 4 THEN B$ = "+"

4450 IF OP = 3 OR OP = 5 THEN B$ = "*"

4452 IF OP = 4 OR OP = 5 THEN A = -1

4454 ONERR GOTO 4460

4456 IF A = -1 THEN GOSUB 20900

4458 GOSUB 20100

4460 VTAB 5
: CALL - 958
: PRINT "RECRUITMENT VECTOR (R) FOR OPTIONS (2-5)"
: VTAB 6
: HTAB 7
: PRINT "INPUT HISTORICAL PROPORTIONS"
: HTAB 10
: PRINT "(I.E., .74, .21, .05)"

4462 VTAB 10
: HTAB 2
: PRINT "INPUT ROW (R1) AND COLUMN (C1 TO C"K")"
: VTAB 12
: HTAB 12
: PRINT "R1, ";
: II = 11
: FOR I = 1 TO K

4464 HTAB 16
: PRINT "C"I": ";
: INPUT R(I)

4466 IF R(I) < 0 OR R(I) > 1 GOTO 4472
4468 NEXT
: RR = 0
: FOR I = 1 TO K
: RR = RR + R(I)
: NEXT
: IF RR < 1 OR RR > 1 GOTO 4474

4470 GOTO 4476

4472 VTAB (II + I)
: HTAB 21
: FLASH
: PRINT "INVALID NUMBER"
: NORMAL
: II = II + 1
: GOTO 4464

4474 GOSUB 20100
: VTAB 11
: HTAB 3
: FLASH
: PRINT "RECRUITMENT VECTOR MUST EQUAL ONE"
: NORMAL
: PRINT
: HTAB 5
: PRINT "PRESS RETURN TO REENTER VECTOR"
: VTAB 24
: HTAB 13
: PRINT "PRESS RETURN ";
: GET G$
: GOTO 4454

4476 VTAB 5
: CALL - 958
: HTAB 3
: PRINT "RECRUITMENT VECTOR (R) ENTERED IS:"

4478 VTAB 9
: HTAB 13
: PRINT "R1, ";
: FOR I = 1 TO K
: HTAB 17
: PRINT "C"I": ";
: F' = R(I)
: GOSUB 20000
: NEXT

4480 GOSUB 20300

4482 IF G$ = "A" GOTO 4490
4484 IF G$ = "R" GOTO 4454
4486 IF G$ = "E" GOTO 3000
4488 GOTO 4480
4490 IF OP = 4 OR OP = 5 THEN 4514
4492 ONERR GOTO 4496
4494 GOSUB 20100
4496 VTAB 5
: CALL - 958
: HTAB 3
: PRINT "NUMBER (A) RECRUITS ENTERING SYSTEM"
4498 VTAB 7
: CALL - 958
: HTAB 13
: INPUT "INPUT (A) "; A
4500 IF A < 0 GOTO 4498
4502 VTAB 5
: CALL - 958
: HTAB 4
: PRINT "TOTAL NUMBER (A) ENTERING SYSTEM"
: PRINT
: HTAB 19
: PRINT "IS"
: VTAB 12
: A$ = STR$(A)
: HTAB (20 - INT ((LEN (A$) + 2) / 2))
: PRINT "("A")"
4504 GOSUB 20300
4506 IF G$ = "A" GOTO 4514
4508 IF G$ = "R" GOTO 4494
4510 IF G$ = "E" GOTO 3000
4512 GOTO 4504
4514 IF OP = 3 OR OP = 5 GOTO 4536
4516 ONERR GOTO 4520
4518 GOSUB 20100

4520 VTAB 5
   : HTAB 1
   : CALL - 958
   : HTAB 7
   : PRINT "NUMBER TO ADDITIVELY CHANGE"
   : PRINT
   : HTAB 9
   : PRINT "RECRUITS OR SYSTEM SIZE"

4522 VTAB 11
   : HTAB 13
   : INPUT "INPUT (C): "; C

4524 VTAB 5
   : CALL - 958
   : HTAB 6
   : PRINT "TOTAL NUMBER (C) TO INCREASE"
   : PRINT
   : HTAB 10
   : PRINT "RECRUITS OR SYSTEM IS"
   : VTAB 12
   : C$ = STR$ (C)
   : HTAB (20 - INT (( LEN (C$) + 2 ) / 2))
   : PRINT "(C)"

4526 GOSUB 20300

4528 IF G$ = "A" GOTO 4600

4530 IF G$ = "R" GOTO 4520

4532 IF G$ = "E" GOTO 3000

4534 GOTO 4526

4536 ONERR GOTO 4540

4538 GOSUB 20100

4540 VTAB 5
   : CALL - 958
   : HTAB 4
   : PRINT "MULTIPLICATIVE FACTOR TO INCREASE"
   : PRINT
   : HTAB 9
   : PRINT "RECRUITS OR SYSTEM SIZE"
4542 VTAB 11
: HTAB 13
: INPUT "INPUT (C): "; C

4544 VTAB 5
: CALL - 958
: HTAB 2
: PRINT "MULTIPLICATIVE FACTOR (C) TO INCREASE"
: PRINT
: HTAB 10
: PRINT "RECRUITS OR SYSTEM IS"
: VTAB 12
: C$ = STR$ (C)
: HTAB (20 - INT (( LEN (C$) + 2) / 2))
: PRINT "("C")"

4546 GOSUB 20300

4548 IF G$ = "A" GOTO 4600

4550 IF G$ = "R" GOTO 4540

4552 IF G$ = "E" GOTO 3000

4554 GOTO 4546

4600 ONERR GOTO 4604

4602 GOSUB 20100

4604 VTAB 4
: CALL - 958
: VTAB 6
: HTAB 4
: PRINT "INPUT NUMBER (T) OF TIME PERIODS"
: PRINT
: HTAB 14
: PRINT "PRESS RETURN"

4606 VTAB 15
: HTAB 13
: INPUT "INPUT NUMBER "; T

4608 IF T < 1 GOTO 4604

4610 VTAB 5
: CALL - 958
: VTAB 9
: HTAB 2
: PRINT "NUMBER (T) OF TIME PERIODS ENTERED IS:"
PRINT
PRINT
HTAB 19
PRINT "("T")"

4612 GOSUB 20300

4614 IF G$ = "A" GOTO 4700

4616 IF G$ = "R" GOTO 4600

4618 IF G$ = "E" GOTO 3000

4620 GOTO 4612

4700 ONERR GOTO 4704

4702 GOSUB 20100

4704 VTAB 4
CALL -958
VTAB 6
HTAB 8
PRINT "SELECT PERCENTAGES OPTION"
PRINT
HTAB 14
PRINT "FOR PRINTOUT"

4706 VTAB 12
HTAB 2
PRINT "(1) NO CLASS PERCENTAGES (%)"
PRINT
HTAB 2
PRINT "(2) GRADE SIZE AS % OF TOTAL SIZE"
PRINT
HTAB 2
PRINT "(3) GRADE SIZE AS % OF ORIGINAL SIZE"

4708 GOSUB 20200
Z$ = G$

4710 IF Z$ = "1" OR Z$ = "2" OR Z$ = "3" GOTO 4714

4712 GOTO 4708

4714 HOME
VTAB 11
HTAB 8
PRINT "INITIAL INPUTS COMPLETED"
FOR I = 1 TO 1500
5000 GOSUB 20100

5002 VTAB 4
   : HTAB 12
   : PRINT "<RECALL OLD DATA>"
   : HTAB 12
   : PRINT "------------------"

5004 VTAB 9
   : CALL - 958
   : HTAB 3
   : PRINT "ENTER DATA FILE NAME TO BE RECALLED"
   : PRINT
   : HTAB 13
   : PRINT "(PRESS RETURN)"

5006 VTAB 18
   : HTAB 19
   : PRINT "------------------"

5008 VTAB 17
   : INPUT "FILE NAME IS ";NF$

5010 VTAB 4
   : CALL - 958
   : VTAB 9
   : HTAB 7
   : PRINT "RECALLED DATA FILE NAME IS"

5012 VTAB 13
   : HTAB (19 - INT (LEN (NF$) / 2))
   : PRINT Q$;NF$;Q$

5014 GOSUB 20300

5016 IF G$ = "A" GOTO 5024

5018 IF G$ = "R" GOTO 5000

5020 IF G$ = "E" GOTO 3000

5022 GOTO 5014

5024 GOSUB 20100

5026 VTAB 8
PRINT "INPUT DISK DRIVE NUMBER"
PRINT
HTAB 12
PRINT "(1) DISK DRIVE 1"
PRINT
HTAB 12
PRINT "(2) DISK DRIVE 2"
PRINT
HTAB 12
PRINT "(3) ESCAPE TO MENU"

5028 GOSUB 20200

5030 IF G < 1 OR G > 3 GOTO 5028

5032 DN = G

5034 IF G = 3 THEN 3000

5100 HOME
: VTAB 11
: HTAB 7
: PRINT "<DATA FILE IS BEING LOADED>"

5102 ONERR GOTO 5200

5104 PRINT
: PRINT D$; "OPEN"NF$", D$; DN

5106 PRINT D$; "READ"; NF$

5108 INPUT K
: FOR I = 1 TO 9
: INPUT NN(I)
: NEXT
: FOR I = 1 TO 9
: FOR J = 1 TO 9
: INPUT PP(I, J)
: NEXT
: NEXT
: FOR I = 1 TO 9
: INPUT RR(I)
: NEXT
: INPUT A
: INPUT B$
: INPUT C
: INPUT T
: INPUT Z$
: INPUT OP
: INPUT DO
: PRINT D$

5110 FOR I = 1 TO K
: N(I) = NN(I)
: M(I) = N(I)
: NEXT
: FOR I = 1 TO K
: FOR J = 1 TO K
: P(I,J) = PP(I,J)
: NEXT
: NEXT
: FOR I = 1 TO K
: R(I) = RR(I)
: NEXT

5112 PRINT D$; "CLOSE"

5114 GOSUB 20900
: GOTO 3000

5200 HOME
: VTAB 1
: HTAB 2
: FLASH
: PRINT "ERROR IN FILE NAME OR DISK SELECTION"
: NORMAL
: PRINT
: HTAB 15
: PRINT "<REVERIFY>"
: GOTO 5010

6000 GOSUB 20100

6002 VTAB 5
: HTAB 9
: PRINT "<CHANGE OR MODIFY DATA>"
: HTAB 9
: PRINT "---------------------------------
: PRINT
: HTAB 9
: PRINT "(1) FILE NAME";
: HTAB 23
: PRINT "(7) PERCENT (%)"
: HTAB 3
: PRINT "(2) INITIAL STKS";
: HTAB 23
PRINT "(8) EXT RANGE +T"
: HTAB 3
: PRINT "(3) MATRIX (P)");
: HTAB 23
: PRINT "(9) (P) ELEMENT"

6006 HTAB 3
: PRINT "(4) RECRUITMENT";
: HTAB 23
: PRINT "(10) (P) ROW"
: HTAB 3
: PRINT "(5) OPTIONS";
: HTAB 23
: PRINT "(11) RESET STKS"
: HTAB 3
: PRINT "(6) TIME (T)"
: HTAB 23
: PRINT "(12) RETURN MENU"
: PRINT

6008 VTAB 18
: HTAB 5
: PRINT "* GOTO THEORY FOR EXPLANATIONS *"

6010 VTAB 23
: HTAB 1
: FOR I = 1 TO 39
: PRINT "";
: NEXT
: VTAB 24
: HTAB 11
: PRINT "INPUT SELECTION ";
: INPUT G$
: G = VAL (G$)

6012 IF G < 1 OR G > 12 GOTO 6000

6014 ON G GOTO 6100,6200,6300,6436,6400,6600,6700,6800,6900,7000,7100,7200

6016 GOTO 6000

6100 GOSUB 20100

6102 VTAB 5
: CALL - 958
: VTAB 09
: HTAB 12
: PRINT "DATA FILE NAME IS:"
6104 VTAB 13
    : HTAB (19 - INT ( LEN (NF$) / 2))
    : PRINT Q$;NF$;Q$

6106 GOSUB 20400

6108 IF G$ = "A" GOTO 6000

6110 IF G$ = "R" GOTO 61:4

6112 GOTO 6106

6114 VTAB 5
    : CALL -958
    : HTAB 2
    : PRINT "INPUT NEW DATA FILE NAME (MAX 15 CHRS)"
    : PRINT
    : HTAB 14
    : PRINT "PRESS RETURN"

6116 VTAB 16
    : HTAB 19
    : PRINT "-------------------"

6118 VTAB 15
    : HTAB 6
    : INPUT "FILE NAME IS ";NF$

6120 GOTO 6100

6200 GOSUB 20100

6202 VTAB 5
    : CALL -958
    : HTAB 3
    : PRINT "CLASS SIZES VECTOR (N) ENTERED IS:

6204 VTAB 9
    : HTAB 13
    : PRINT "R1, ";
    : FOR I = 1 TO K
    :    HTAB 17
    :    PRINT "C"I": ";#M(I)
    : NEXT

6206 GOSUB 20400

6208 IF G$ = "A" GOTO 6000

6210 IF G$ = "R" GOTO 6214

89
6212 GOTO 6206
6214 ONERR GOTO 6216

6216 Vtab 5
   : CALL -958
   : Htab 3
   : PRINT "CLASS SIZES VECTOR (N) -> (1 BY "K")"

6218 Vtab 9
   : Htab 3
   : PRINT "INPUT ROW (R1) AND COLUMN (1 TO "K")"
   : PRINT
   : Htab 12
   : PRINT "R1, ";
   : FOR I = 1 TO K
   : Htab 16
   : PRINT "C"I": ";
   : INPUT N(I)
   : NEXT
   : FOR I = 1 TO K
   : M(I) = N(I)
   : NEXT

6220 GOTO 6200

6300 GOSUB 20100
   : I = 1

6302 Vtab 4
   : CALL -958
   : Vtab 5
   : Htab 13
   : PRINT "ROW "I" INPUT IS:"

6304 Vtab 8
   : Htab 13
   : PRINT "R"I", ";
   : FOR L = 1 TO K
   : Htab 17
   : PRINT "C"L": ";
   : P1 = P(I,L)
   : GOSUB 20000
   : NEXT

6306 GOSUB 20300

6308 IF G$ = "A" GOTO 6316
6310 IF G$ = "E" GOTO 6000

6312 IF G$ = "R" GOTO 6320

6314 GOTO 6306

6316 I = I + 1
    : IF I > K GOTO 6000

6318 GOTO 6302

6320 ONERR GOTO 6326

6322 VTAB 4
    : CALL - 958
    : HTAB 3
    : PRINT "INITIAL FRACTIONAL FLOW MATRIX (P)"
    : HTAB 16
    : PRINT "("K" BY "K")"
    : PRINT

6324 HTAB 3
    : PRINT "INPUT ROW (R(I)) AND COLUMN (C(J))"
    : HTAB 9
    : PRINT "FOR THE P(I,J) ELEMENT"
    : II = 9

6326 VTAB 10
    : HTAB 1
    : CALL - 958
    : HTAB 13
    : PRINT "R"I", ";
    : FOR J = 1 TO K

6328 HTAB 17
    : PRINT "C"J": ";
    : INPUT P(I,J)

6330 IF P(I,J) < 0 OR P(I,J) > 1 GOTO 6336

6332 NEXT
    : ST = 0
    : FOR IP = 1 TO K
    :   ST = ST + P(I,IP)
    : NEXT
    : IF ST > 1 GOTO 6338

6334 GOTO 6302

6336 VTAB (II + J)
HTAB 21
FLASH
PRINT "INVALID NUMBER"
NORMAL
II = II + 1
GOTO 6328

6338 GOSUB 20500
: IF G$ = "E" GOTO 6000

6340 GOTO 6300

6400 GOSUB 20100

6402 V TAB 8
: CALL 958
: HTAB 11
: PRINT "OPTION SELECTED IS:"
: V TAB 13

6404 IF OP = 1 THEN PRINT TAB(8)"FIXED RECRUITMENT VECTOR"

6406 IF OP = 2 THEN PRINT TAB(9)"ADDITIVE (RECRUIT SIZE)"

6408 IF OP = 3 THEN PRINT TAB(6)"MULTIPLICATIVE (RECRUIT SIZE)"

6410 IF OP = 4 THEN PRINT TAB(9)"ADDITIVE (SYSTEM SIZE)"

6412 IF OP = 5 THEN PRINT TAB(6)"MULTIPLICATIVE (SYSTEM SIZE)"

6414 V TAB 22
: HTAB 2
: PRINT "(PRESS (M) MENU, (R) CHANGE OPTION)"
: PRINT
: HTAB 6
: PRINT "((C) TO CHANGE PARAMETERS)";
: GET G$

6416 IF G$ = "M" GOTO 6000

6418 IF G$ = "R" GOTO 6424

6420 IF G$ = "C" GOTO 6436

5422 GOTO 6414
6424 ONERR GOTO 6428
6426 GOSUB 20100
6428 VTab 5
  : CALL - 958
  : HTAB 5
  : PRINT "RECRUITMENT OPTIONS INPUT MENU"
6430 VTab 9
  : HTAB 3
  : PRINT "(1) FIXED RECRUITMENT VECTOR"
  : PRINT
  : HTAB 3
  : PRINT "(2) ADDITIVE (RECRUIT SIZE)"
  : PRINT
  : HTAB 3
  : PRINT "(3) MULTIPLICATIVE (RECRUIT SIZE)"
  : PRINT
  : HTAB 3
  : PRINT "(4) ADDITIVE (SYSTEM SIZE)"
  : PRINT
  : HTAB 3
  : PRINT "(5) MULTIPLICATIVE (SYSTEM SIZE)"
6434 GOSUB 20200
  : OP = G
6436 IF OP < 1 OR OP > 5 GOTO 6424
6438 IF OP = > 2 GOTO 6470
6440 ONERR GOTO 6458
6442 A = 1
  : B$ = "0"
  : C = 0
6444 GOSUB 20100
6446 VTab 5
  : CALL - 958
  : HTAB 3
  : PRINT "RECRUITMENT VECTOR (R) ENTERED IS:"
6448 VTab 9
  : HTAB 13
  : PRINT "R1, "
  : FOR I = 1 TO K
: HTAB 17
: PRINT "C""I": ";#R(I)
: NEXT

6450 GOSUB 20400

6452 IF G$ = "A" GOTO 6000

6454 IF G$ = "R" GOTO 6458

6456 GOTO 6450

6458 VTAB 5
: CALL 958
: HTAB 2
: PRINT "RECRUITMENT VECTOR (R) FOR OPTION (1)"
: HTAB 4
: PRINT "INPUT ACTUAL RECRUITMENT NUMBERS"
: HTAB 12
: PRINT "(I.E., 52, 15, 3)"

6460 VTAB 10
: HTAB 2
: PRINT "INPUT ROW (R1) AND COLUMN (C1 TO C""K")"
: VTAB 12
: HTAB 12
: PRINT "R1, ";
: II = 11
: FOR I = 1 TO K

6462 HTAB 16
: PRINT "C""I": ";
: INPUT R(I)

6464 IF R(I) < 0 GOTO 6468

6466 NEXT
: GOTO 6444

6468 VTAB (II + I)
: HTAB 21
: FLASH
: PRINT "INVALID NUMBER"
: NORMAL
: II = II + 1
: GOTO 6462

6470 IF OP = 2 OR OP = 4 THEN B$ = "+"

6472 IF OP = 3 OR OP = 5 THEN B$ = "*"
6474 IF OP = 4 OR OP = 5 THEN A = -1
6476 ONERR GOTO 6496
6478 IF A = -1 THEN GOSUB 20900
6480 GOSUB 20100
6482 VTAH 5
   CALL -958
   HTAB 3
   PRINT "RECRUITMENT VECTOR (R) ENTERED IS:"
6484 VTAH 9
   HTAB 13
   PRINT "R", ";
   FOR I = 1 TO K
   HTAB 17
   PRINT "C", I; "
   P1 = R(I)
   GOSUB 20000
   NEXT
6486 GOSUB 20300
6488 IF G$ = "A" GOTO 6512
6490 IF G$ = "R" GOTO 6496
6492 IF G$ = "E" GOTO 6000
6494 GOTO 6486
6496 VTAH 5
   HTAB 1
   CALL -958
   PRINT "RECRUITMENT VECTOR (R) FOR OPTIONS (2-5)"
   VTAH 6
   HTAB 7
   PRINT "INPUT HISTORICAL PROPORTIONS"
   HTAB 10
   PRINT "(I.E., .74, .21, .05)"
6498 VTAH 10
   HTAB 2
   PRINT "INPUT ROW (R1) AND COLUMN (C1 TO C"K")"
   VTAH 12
   HTAB 12
   PRINT "R", ";
AN APPLE II IMPLEMENTATION OF MAN-MOD MANPOWER PLANNING MODEL. (U)
MAR 82 J L DOWNS
II = 11
FOR I = 1 TO K

6500 HTAB 16
: PRINT "C"I": "
: INPUT R(I)

6502 IF R(I) < 0 OR R(I) > 1 GOTO 6508

6504 NEXT
: RR = 0
: FOR I = 1 TO K
: RR = RR + R(I)
: NEXT
: IF RR < 1 OR RR > 1 GOTO 6510

6506 GOTO 6482

6508 VTAB (II + I)
: HTAB 21
: FLASH
: PRINT "INVALID NUMBER"
: NORMAL
: II = II + 1
: GOTO 6500

6510 GOSUB 20100
: VTAB 11
: HTAB 5
: FLASH
: PRINT "RECRUITMENT VECTOR MUST EQUAL ONE"
: NORMAL
: PRINT
: HTAB 5
: PRINT "PRESS RETURN TO REENTER VECTOR"
: VTAB 24
: HTAB 13
: PRINT "PRESS RETURN ";
: GET GS
: GOTO 6496

6512 IF OP = 4 OR OP = 5 GOTO 6538

6514 GOSUB 20100

6516 VTAB 5
: CALL - 958
: HTAB 4
: PRINT "TOTAL NUMBER (A) ENTERING SYSTEM"
: PRINT
HTAB 19
PRINT "IS"
VTAB 12
A$ = STR$ (A)
HTAB (20 - INT ((LEN (A$) + 2) / 2))
PRINT "("A")"

6518 GOSUB 20300
---------------------------------------
6520 IF G$ = "A" GOTO 6538
---------------------------------------
6522 IF G$ = "R" GOTO 6530
---------------------------------------
6524 IF G$ = "E" GOTO 6000
---------------------------------------
6526 GOTO 6518
---------------------------------------
6528 ONERR GOTO 6530
---------------------------------------
6530 VTAB 5
: CALL - 958
: HTAB 3
: PRINT "NUMBER (A) RECRUITS ENTERING SYSTEM"
---------------------------------------
6532 VTAB 7
: CALL - 958
: HTAB 13
: INPUT "INPUT (A) ";A
---------------------------------------
6534 IF A < 0 GOTO 6532
---------------------------------------
6536 GOTO 6514
---------------------------------------
6538 IF OP = 3 OR OP = 5 THEN 6560
---------------------------------------
6540 ONERR GOTO 6554
---------------------------------------
6542 GOSUB 20100
---------------------------------------
6544 VTAB 5
: CALL - 958
: HTAB 6
: PRINT "TOTAL NUMBER (C) TO INCREASE"
: PRINT
: HTAB 10
: PRINT "RECRUITS OR SYSTEM IS"
: VTAB 12
: C$ = STR$ (C)
: HTAB (20 - INT ((LEN (C$) + 2) / 2))
: PRINT "("C")"
6546  GOSUB 20400
6548  IF  G$ = "A"  GOTO 6000
6550  IF  G$ = "R"  GOTO 6554
6552  GOTO 6546
6554  VTAB 5
      :  HTAB 1
      :  CALL -958
      :  HTAB 7
      :  PRINT "NUMBER TO ADDITIVELY CHANGE"
      :  PRINT
      :  HTAB 9
      :  PRINT "RECRUITS OR SYSTEM SIZE"
      :  PRINT
      :  HTAB 15
      :  PRINT "(I.E., 123)"
6556  VTAB 14
      :  HTAB 13
      :  INPUT "INPUT (C): ";C
6558  GOTO 6542
6560  ONERR  GOTO 6574
6562  GOSUB 20100
6564  VTAB 5
      :  CALL -958
      :  HTAB 4
      :  PRINT "MULTIPLICATIVE FACTOR TO INCREASE"
      :  PRINT
      :  HTAB 10
      :  PRINT "RECRUITS OR SYSTEM IS"
      :  VTAB 12
      :  C$ = STR$ (C)
      :  HTAB (20 - INT (((LEN (C$) + 2) / 2)))
      :  PRINT "("C")"
6566  GOSUB 20400
6568  IF  G$ = "A"  GOTO 6000
6570  IF  G$ = "R"  GOTO 6574
6572  GOTO 6566
6574 VTAB 5
: CALL - 958
: HTAB 2
: PRINT "MULTIPLICATIVE FACTOR (C) TO INCREASE"
: PRINT
: HTAB 9
: PRINT "RECRUITS OR SYSTEM SIZE"
: PRINT
: HTAB 15
: PRINT "(I.E., 1.2)"

6576 VTAB 14
: HTAB 13
: INPUT "INPUT (C): “; C

6578 GOTO 6562

6600 GOSUB 20100

6602 VTAB 4
: CALL - 958
: VTAB 9
: HTAB 2
: PRINT "NUMBER (T) OF TIME PERIODS ENTERED IS:"
: PRINT
: PRINT
: HTAB 19
: PRINT "("T")"

6604 GOSUB 20400

6606 IF G$ = "A" GOTO 6000

6608 IF G$ = "R" GOTO 6612

6610 GOTO 6604

6612 ONERR GOTO 6614

6614 VTAB 4
: CALL - 958
: VTAB 5
: HTAB 4
: PRINT "INPUT NUMBER (T) OF TIME PERIODS"
: PRINT
: HTAB 14
: PRINT "PRESS RETURN"

6616 VTAB 16
INPUT "INPUT NUMBER "; T

IF T < 1 GOTO 6614

GOTO 6600

ONERR GOTO 6704

GOSUB 20100

VTAB 4
CALL 958
VTAB 6
HTAB 8
PRINT "SELECT PERCENTAGES OPTION"
PRINT
HTAB 14
PRINT "FOR PRINTOUT"

VTAB 12
HTAB 2
PRINT "(1) NO CLASS PERCENTAGES (%)"
PRINT
HTAB 2
PRINT "(2) GRADE SIZE AS % OF TOTAL SIZE"
PRINT
HTAB 2
PRINT "(3) GRADE SIZE AS % OF ORIGINAL SIZE"

GOSUB 20200
Z$ = G$

IF Z$ = "1" OR Z$ = "2" OR Z$ = "3" GOTO 6000

GOTO 6708

ONERR GOTO 6804

GOSUB 20100

VTAB 5
CALL 958
HTAB 2
PRINT "NUMBER (T) OF TIME PERIODS ENTERED IS:" 
PRINT
HTAB 19
PRINT "("T")"

VTAB 12
CALL - 958
HTAB 10
PRINT "EXTEND RANGE ("TA") TO :

-------------------
6808 VTAB 22
HTAB 4
PRINT "(CANNOT BE LESS THAN "T" PERIODS)"

-------------------
6810 VTAB 14
HTAB 14
PRINT "INPUT +T: ";
INPUT TA
IF TA < T GOTO 6806

-------------------
6812 VTAB 4
CALL - 958
VTAB 11
HTAB 5
PRINT "TIME (+T) PERIODS EXTENDED TO:
PRINT
PRINT
HTAB 18
PRINT "("TA")"

-------------------
6814 GOSUB 20400

-------------------
6816 IF G$ = "A" GOTO 6000

-------------------
6818 IF G$ = "R" GOTO 6800

-------------------
6820 GOTO 6814

-------------------
6900 IF K = < 0 GOTO 6000

-------------------
6902 GOSUB 20100

-------------------
6904 VTAB 4
CALL - 958
PRINT
HTAB 6
PRINT "CHANGE INDIVIDUAL ELEMENT OF"
PRINT
HTAB 8
PRINT "THE TRANSITION MATRIX (P)"
PRINT
HTAB 17
PRINT "P(I,J)"

-------------------
6906 ONERR GOTO 6908
6908  VTAB 14
    : CALL - 958
    : HTAB 11
    : PRINT "INPUT ROW NUMBER: ";
    : INPUT I
    : IF I < 1 OR I > K GOTO 6908
---
6910  ONERR GOTO 6912
---
6912  VTAB 17
    : CALL - 958
    : HTAB 11
    : PRINT "INPUT COL NUMBER: ";
    : INPUT J
    : IF J < 1 OR J > K GOTO 6912
---
6914  GOSUB 20100
---
6916  VTAB 6
    : CALL - 958
    : PRINT "THE PRESENT TRANSITION MATRIX ELEMENT IS"
    : VTAB 11
    : P1 = P(I,J)
    : HTAB 17
    : GOSUB 20000
---
6918  GOSUB 20400
---
6920  IF G$ = "A" GOTO 6000
---
6922  IF G$ = "R" GOTO 6926
---
6924  GOTO 6918
---
6926  ONERR GOTO 6930
---
6928  GOSUB 20100
---
6930  VTAB 6
    : CALL - 958
    : HTAB 2
    : PRINT "INPUT NEW ROW "I", COL "J" MATRIX ELEMENT"
    : II = 11
---
6932  VTAB (II)
    : HTAB 7
    : PRINT "INPUT P("I","J") ELEMENT: ";
    : INPUT P(I,J)
---
6934  IF P(I,J) > 0 AND P(I,J) < 1 GOTO 6942
6936 GOSUB 20500
  : IF G$ = "E" GOTO 6000

6938 GOTO 6914

6940 VTAB II
  : HTAB 29
  : FLASH
  : PRINT "INVALID NO."
  : NORMAL
  : II = II + 1
  : GOTO 6932

6942 ST = 0
  : FOR IP = 1 TO K
  : ST = ST + P(I,IP)
  : NEXT
  : IF ST > 1 GOTO 6936

6944 GOSUB 20100

6946 VTAB 7
  : HTAB 7
  : PRINT "THE NEW ROW "I", COL "J" ELEMENT"
  : PRINT
  : HTAB 17
  : PRINT "P("I","J") IS"
  : VTAB 13
  : P1 = P(I,J)
  : HTAB 17
  : GOSUB 20000

6948 GOSUB 20400

6950 IF G$ = "A" GOTO 6000

6952 IF G$ = "R" GOTO 6926

6954 GOTO 6948

7000 IF K < 0 GOTO 6000

7002 GOSUB 20100

7004 VTAB 4
  : CALL 958
  : PRINT
  : HTAB 5
  : PRINT "CHANGE WHOLE ROW OF ELEMENTS OF"
PRINT "THE TRANSITION MATRIX (P)"

7006 ONERR GOTO 7008

7008 VTAB 17
: CALL - 958
: HTAB 11
: PRINT "INPUT ROW NUMBER: ";
: INPUT I
: IF I < 1 OR I > K GOTO 7008

7010 GOSUB 20100

7012 VTAB 6
: CALL - 958
: PRINT "THE PRESENT TRANSITION MATRIX ROW "I" IS"
: VTAB 9
: HTAB 17
: PRINT "ROW ";I
: VTAB 11
: FOR J = 1 TO K
: P1 = P(I,J)
: HTAB 14
: PRINT "COL "J" ";
: GOSUB 20000
: NEXT

7014 GOSUB 20400

7016 IF G$ = "A" GOTO 6000

7018 IF G$ = "R" GOTO 7022

7020 GOTO 7014

7022 ONERR GOTO 7026

7024 GOSUB 20100

7026 VTAB 5
: CALL - 958
: HTAB 2
: PRINT "INITIAL FRACTIONAL FLOW MATRIX ROW ";I
: II = 9

7028 VTAB 10
: HTAB 1
: CALL - 958

104
HTAB 13
PRINT "R"I", ";
FOR J = 1 TO K

7030 HTAB 17
PRINT "C"J": ";
INPUT P(I,J)

7032 IF P(I,J) < 0 OR P(I,J) > 1 GOTO 7038

7034 NEXT
ST = 0
FOR IP = 1 TO K
ST = ST + P(I, IP)
NEXT
IF ST > 1 GOTO 7040

7036 GOTO 7010

7038 VTab (II + J)
HTAB 21
FLASH
PRINT "INVALID NUMBER"
NORMAL
II = II + 1
GOTO 7030

7040 GOSUB 20500
IF G$ = "E" GOTO 6000

7042 GOTO 7010

7100 GOSUB 20100

7102 VTab 5
CALL - 958
HTAB 6
PRINT "PRESENT CLASS VECTOR (N) IS:"

7104 VTab 8
HTAB 13
PRINT "R1", ";
FOR I = 1 TO K
HTAB 17
PRINT "C"I": ";#N(I)
NEXT

7106 VTab 19
HTAB 1
PRINT "PRESS (R) TO CHANGE VECTOR BACK TO THE"
: HTAB 8
: PRINT "ORIGINAL CLASS VECTOR (N)"

7108 GOSUB 20400

7110 IF GS = "A" GOTO 6000

7112 IF GS = "R" GOTO 7116

7114 GOTO 7108

7116 ONERR GOTO 7120

7118 FOR I = 1 TO K
: N(I) = M(I)
: NEXT

7120 GOTO 6000

7200 GOTO 3000

8000 GOSUB 20700

8002 IF G < 1 OR G > 3 GOTO 8000

8004 ON G GOTO 8100, 8300, 3000

8100 ONERR GOTO 8102

8102 GOSUB 20100

8104 VTAB 3
: HTAB 12
: PRINT "FILE DATA LISTING"

8106 FOR I = 1 TO 39
: PRINT ".";
: NEXT

8108 VTAB 6
: HTAB 1
: INVERSE
: PRINT "DATA FILE NAME:";
: NORMAL
: HTAB 18
: PRINT NFS

8110 VTAB 9
: HTAB 1
: INVERSE
PRINT "NUMBER K CLASSES:"
NORMAL
HTAB 19
PRINT K;
INVERSE
HTAB 22
PRINT "TIME T PERIODS:"
NORMAL
HTAB 38
PRINT T

S112 VTAB 12
: HTAB 1
: INVERSE
: PRINT "INITIAL STOCKS:"
: HTAB 22
: PRINT "RECRUITMENT VECTOR:"
: NORMAL

S114 VTAB 14
: HTAB 1
: PRINT "R1, ";
: FOR I = 1 TO K
: HTAB 5
: PRINT "C"I": ";#M(I)
: NEXT

S116 VTAB 14
: HTAB 24
: PRINT "R1, ";

S118 IF OP = > 2 AND OP < = 5 GOTO 8122

S120 FOR I = 1 TO K
: HTAB 28
: PRINT "C"I": ";#R(I)
: NEXT
: GOTO 8124

S122 FOR I = 1 TO K
: HTAB 28
: PRINT "C"I": ";
: P1 = R(I)
: GOSUB 20000
: NEXT

S124 INVERSE
: VTAB 24
: HTAB 1
: PRINT "PRESS (C) TO CONTINUE, (E) TO ESCAPE ";
8126 IF G$ = "C" GOTO 8132
8128 IF G$ = "E" GOTO 3000
8130 GOTO 8124
8132 GOSUB 20100
8134 VTAB 3
: HTAB 7
: PRINT "FILE DATA LISTING CONTINUED"
8136 FOR I = 1 TO 39
: PRINT ".";
: NEXT
8138 VTAB 6
: HTAB 1
: INVERSE
: PRINT "PRINTOUT PERCENTAGES OPTION:";
: NORMAL
: VTAB 8
: HTAB 3
8140 GOSUB 20860
8146 VTAB 11
: HTAB 1
: INVERSE
: PRINT "OPTION SELECTED:";
: NORMAL
: VTAB 13
: HTAB 3
8148 GOSUB 20800
8158 VTAB 16
: HTAB 1
: INVERSE
: PRINT "OPTION INPUTS:";
: NORMAL
: VTAB 18
: HTAB 3
8160 GOSUB 20820
8166 VTAB 20
: HTAB 3

8168 GOSUB 20840

8178 VTAB 24
 : HTAB 1
 : INVERSE
 : PRINT "PRESS (C) TO CONTINUE, (E) TO ESCAPE ";
 : GET G$
 : NORMAL

8180 IF G$ = "C" GOTO 8186

8182 IF G$ = "E" GOTO 3000

8184 GOTO 8178

8186 GOSUB 20100

8188 VTAB 3
 : HTAB 7
 : PRINT "FILE DATA LISTING CONTINUED"

8190 FOR I = 1 TO 39
 : PRINT ".";
 : NEXT

8192 VTAB 7
 : INVERSE
 : HTAB 10
 : PRINT "TRANSITION MATRIX (P)"
 : NORMAL

8194 K1 = K
 : IF K1 > 5 THEN K1 = 5

8196 VTAB 9
 : HTAB 5
 : FOR I = 1 TO K1
 : PRINT "ROW ";I; SPC( 2);
 : NEXT

8198 VTAB 11
 : FOR I = 1 TO K
 : HTAB 1
 : PRINT "C";I
 : NEXT I

S200 II = 4
 : FOR I = 1 TO K1

109
VTAB 11
FOR J = 1 TO K
P1 = P(I, J)
HTAB (II)
GOSUB 20000
NEXT
II = II + 7
NEXT

S202 K2 = K - 5
IF K2 > 0 GOTO S206

S204 VTAB 24
HTAB 8
INVERSE
PRINT "PRESS RETURN FOR MENU ";
GET G$
NORMAL
GOTO 3000

S206 VTAB 24
HTAB 1
INVERSE
PRINT "PRESS (C) TO CONTINUE, (E) TO ESCAPE ";
GET G$
NORMAL

S208 IF G$ = "C" GOTO S214

S210 IF G$ = "E" GOTO 3000

S212 GOTO 8206

S214 GOSUB 20100

S216 VTAB 3
HTAB 7
PRINT "FILE DATA LISTING CONTINUED"

S218 FOR I = 1 TO 39
PRINT ".";
NEXT

S220 VTAB 7
INVERSE
HTAB 5
PRINT "TRANSITION MATRIX (P) CONTINUED"
NORMAL

S222 VTAB 9
HTAB 5
FOR I = 6 TO K
PRINT "ROW ";I; SPC(2);
NEXT

VTAB 11
FOR I = 1 TO K
HTAB 1
PRINT "C";I
NEXT

II = 4
FOR I = 6 TO K
VTAB 11
FOR J = 1 TO K
P1 = P(I,J)
HTAB (II)
GOSUB 20000
NEXT
II = II + 7
NEXT

VTAB 24
HTAB 8
INVERSE
PRINT "PRESS RETURN FOR MENU ";
GET G$
NORMAL
GOTO 3000

ONERR GOTO 8304
GOSUB 20100

VTAB 6
HTAB 4
PRINT "DATA LISTING PAPER PRINT ROUTINE"

VTAB 12
HTAB 6
PRINT "(1) PAPER COPY ";
INVERSE
PRINT "(PRINTER ON)"
NORMAL
VTAB 14
HTAB 6
PRINT "(2) RETURN TO MENU"

GOSUB 20200
8310 IF G < 1 OR G > 2 GOTO 8308
8312 IF G = 2 GOTO 8000
8314 HOME
: VTAB 10
: HTAB 4
: PRINT "PAPER DATA LISTING BEING PRINTED"
8316 GOSUB 20600
: GOTO 3000
9000 GOSUB 20100
9002 VTAB 7
: HTAB 6
: PRINT "DO YOU WISH TO SAVE DATA FILE"
: PRINT
: HTAB (19 - INT (LEN (NF$) / 2))
: PRINT Q$;NF$;Q$
9004 VTAB 14
: HTAB 17
: PRINT "(1) YES"
: PRINT
: HTAB 17
: PRINT "(2) NO"
9006 GOSUB 20200
9008 IF G < 1 OR G > 2 GOTO 9006
9010 ON G GOTO 9100,3000
9100 GOSUB 20100
9102 VTAB 8
: HTAB 9
: PRINT "INPUT DISK DRIVE NUMBER"
: PRINT
: PRINT
: HTAB 12
: PRINT "(1) DISK DRIVE 1"
: PRINT
: HTAB 12
: PRINT "(2) DISK DRIVE 2"
: PRINT
: HTAB 12
: PRINT "(3) ESCAPE TO MENU"
9104  GOSUB 20200

9106  IF G < 1 OR G > 3 GOTO 9104

9108  DN = G

9110  IF G = 3 THEN 1006

9112  HOME
   : VTAB 11
   : HTAB 7
   : PRINT "DATA FILE IS BEING SAVED;"

9114  FOR I = 1 TO K
   : N(I) = M(I)
   : NN(I) = N(I)
   : NEXT
   : FOR I = 1 TO K
   : FOR J = 1 TO K
   : PP(I,J) = P(I,J)
   : NEXT
   : NEXT
   : FOR I = 1 TO K
   : RR(I) = R(I)
   : NEXT

9116  ONERR GOTO 9100

9118  PRINT
   : PRINT D$; "OPEN"NF$ , D$; DN

9120  PRINT D$; "DELETE"NF$

9122  PRINT D$; "OPEN"NF$

9124  PRINT D$; "WRITE"NF$

9126  PRINT K
   : FOR I = 1 TO 9
   : PRINT NN(I)
   : NEXT
   : FOR I = 1 TO 9
   : FOR J = 1 TO 9
   : PRINT PP(I,J)
   : NEXT
   : NEXT
   : FOR I = 1 TO 9
   : PRINT RR(I)
   : NEXT
   : PRINT A
PRINT B$
PRINT C
PRINT T
PRINT Z$
PRINT OP
PRINT DO
PRINT D$;"CLOSE"

9128 GOTO 1006

9200 GOSUB 20100

9202 VTAB 5
HTAB 13
PRINT "<EXIT ROUTINE>"
HTAB 13
PRINT "-----------"

9204 VTAB 11
HTAB 8
PRINT "(1) RETURN TO MAIN MENU"
PRINT

9206 HTAB 8
PRINT "(2) EXIT PROGRAM"

9208 GOSUB 20200

9210 IF G < 1 OR G > 2 GOTO 9208

9212 ON G GOTO 1006, 9214

9214 HOME
VTAB 11
HTAB 7
PRINT "MAN-MOD ANALYSIS COMPLETED"
PRINT
HTAB 5
PRINT "TURN OFF COMPUTER AND FILE DISK"
FOR I = 1 TO 5000
NEXT
HOME
END

10000 ONERR GOTO 1000

10002 GOSUB 20100

10004 VTAB 8
HTAB 4
PRINT "(1) CALCULATE ALL "T" PERIODS"
PRINT HTAB 4
PRINT "(2) CALCULATE LAST TIME PERIOD "T"
PRINT HTAB 4
PRINT "(3) EXTEND CALCULATION RANGE"
PRINT HTAB 4
PRINT "(4) RETURN TO MENU"

10006 GOSUB 20200
PR = G
IF G < 1 OR G > 4 GOTO 10006

10008 IF G = 4 GOTO 3000

10009 IF PR = 3 GOTO 10200

10010 GOSUB 20700
PO = G
IF G < 1 OR G > 3 GOTO 10010

10012 IF PO = 3 GOTO 10000

10014 IF PR = 1 OR PR = 2 THEN FOR I = 1 TO K
* : N(I) = M(I)
* : NEXT

10016 IF PR = 2 THEN SP = T

10018 IF PR = 3 GOTO 10027

10020 IF PO = 2 GOTO 10032

10022 GOTO 10300

10024 IF TA ≤ T GOTO 10030

10025 TT = TA - T - 1
: T = TA

10026 IF PR = 3 GOTO 10010

10027 IF PO = 1 THEN PR = 2
*: GOTO 10304

10028 GOTO 10032

10030 HOME
PRINT "INVALID +T VALUE"
NORMAL
FOR I = 1 TO 1500
NEXT
GOTO 10000

GOSUB 20100
VTAB 5
HTAB 13
PRINT "TURN PRINTER ON"
PRINT
HTAB 6
PRINT "(NOT REQUIRED WITH SILENTYPE)"
VTAB 10
HTAB 15
PRINT "ALIGN PAPER"
VTAB 14
HTAB 7
PRINT "PRINTOUT DEFAULTS TO SLOT 1"

VTAB 23
FOR I = 1 TO 39
PRINT "\n"
NEXT
VTAB 24
HTAB 7
PRINT "PRESS RETURN TO CONTINUE "; GET GS

HOME
VTAB 9
HTAB 7
PRINT "<PRINT ROUTINE IN PROCESS>"
VTAB 11
HTAB 2
PRINT "<PRESS (E) TO ESCAPE PRINTING ROUTINE>"
GOSUB 10600

IF PR = 2 OR PR = 3 THEN HOME

IF PR = 3 GOTO 10306

GOTO 10300

GOSUB 20100
VTAB 4
HTAB 4
PRINT "PRESENT TIME (T) PERIODS ARE: "T

10204 VTAB 6
HTAB 4
PRINT "EXTENDED RANGE (+T) INPUT IS: "TA

10206 VTAB 9
INVERSE
HTAB 1
PRINT "(+T CANNOT BE LESS THAN OR EQUAL TO T)"
NORMAL

10208 VTAB 12
HTAB 4
PRINT "(1) CONTINUE FLOWS TO "TA
PRINT
HTAB 4
PRINT "(2) CONTINUE FLOW, PRINT ONLY "TA
PRINT
HTAB 4
PRINT "(3) +T CHANGE ROUTINE"
PRINT
HTAB 4
PRINT "(4) RETURN TO MENU"

10210 GOSUB 20200
IF G < 1 OR G > 4 GOTO 10210

10212 IF G = 2 THEN SP = TA

10214 ON G GOTO 10024,10024,6000,10000

10300 T1 = -1
T2 = 0
TT = T

10302 IF PO = 2 GOTO 10306

10304 GOSUB 10400

10306 IF PR = 2 OR PR = 3 THEN VTAB 11
* : HTAB 13
* : FLASH
* : PRINT "PROGRAM WORKING"
* : NORMAL

10308 POKE -16368,0

10310 FOR S = 0 TO TT

117
10312  IF T1 = -1 THEN R1 = 0
* : GOTO 10320

10314  GOSUB 10800

10316  FOR I = 1 TO K
   : XM(I) = 0
   : FOR J = 1 TO K
   : XM(I) = N(J) * P(J,I) + XM(I)
   : NEXT
   : NEXT

10318  FOR I = 1 TO K
   : N(I) = XM(I) + RM(I)
   : NEXT

10320  D = .00000001
   : FOR I = 1 TO K
   : D = D + N(I)
   : NEXT
   : T1 = T1 + 1
   : IF T1 = T2 GOTO 10324

10322  GOTO 10338

10324  T2 = T2 + 1

10326  IF SP > T1 GOTO 10338

10328  IF PO = 2 GOTO 10700

10330  GOSUB 10500

10332  VTAB 24
   : HTAB 1
   : PRINT "PRESS (C) TO CONTINUE, (E) TO ESCAPE ";
   : GET G$
   : IF G$ = "E" GOTO 3000

10334  GOTO 10338

10336  X = PEEK (-16384)
   : IF X = 197 GOTO 3000

10338  NEXT S
   : SP = 0

10340  GOTO 10000
10400 GOSUB 20100
: VTAB 5
: HTAB 11
: PRINT "TRANSITIONAL FLOWS"

10402 IF Z$ = "2" OR Z$ = "3" GOTO 10408

10404 VTAB 7
: HTAB 2
: PRINT "TIME";
: HTAB 8
: PRINT "CLASS";
: HTAB 15
: PRINT "STOCKS-N";
: HTAB 25
: PRINT "RECRUITMENT"

10406 VTAB 8
: HTAB 1
: FOR I = 1 TO 39
: PRINT "-";
: NEXT
: PRINT
: RETURN

10408 VTAB 7
: HTAB 2
: PRINT "TIME";
: HTAB 8
: PRINT "CLASS";
: HTAB 15
: PRINT "STOCKS(PERCENT)";
: HTAB 32
: PRINT "RECRUIT"

10410 VTAB 8
: FOR I = 1 TO 39
: PRINT "-";
: NEXT
: PRINT
: RETURN

10500 IF Z$ = "2" GOTO 10516

10502 IF Z$ = "3" GOTO 10522

10504 IF OP > 2 GOTO 10508

10506 VTAB 10
: CALL 958
HTAB 2
PRINT T1;
FOR J = 1 TO K
HTAB 10
PRINT J;
HTAB 16
JJ = N(J) + .5
PRINT # INT (JJ);
HTAB 28
PRINT #R(J)
NEXT
VTAB (11 + K)
HTAB 8
PRINT "TOTAL";
HTAB 16
PRINT #(D + .5);
GOTO 10512

10508 VTAB 10
CALL - 958
HTAB 2
PRINT T1;
FOR J = 1 TO K
HTAB 10
PRINT J;
HTAB 16
JJ = N(J) + .5
PRINT # INT (JJ);
HTAB 28
RX = R1 * R(J)
PRINT # INT (RX + .5)
NEXT

10510 VTAB (11 + K)
HTAB 8
PRINT "TOTAL";
HTAB 16
PRINT #(D + .5);

10512 HTAB 28
PRINT #(R1 + .5)

10514 VTAB (13 + K)
HTAB 1
FOR I = 1 TO 36
PRINT "-";
NEXT
RETURN

10516 IF OP = > 2 GOTO 10520
10518 VTAB 10
  : CALL - 958
  : HTAB 2
  : PRINT T1;
  : FOR J = 1 TO K
  : HTAB 10
  : PRINT J;
  : HTAB 14
  : JJ = N(J) + .5
  : PRINT "FOR"6,O;# INT (JJ); SPC( 3);
  : N1 = 100 * N(J) / D
  : PRINT "FOR"3,O;"("# INT (N1 + .5)")";
  : HTAB 32
  : PRINT "FOR"6,O;#R(J)
  : NEXT
  : GOTO 10528

10520 VTAB 10
  : CALL - 958
  : HTAB 2
  : PRINT T1;
  : FOR J = 1 TO K
  : HTAB 10
  : PRINT J;
  : HTAB 14
  : JJ = N(J) + .5
  : PRINT "FOR"6,O;# INT (JJ); SPC( 3);
  : N1 = 100 * N(J) / D
  : PRINT "FOR"3,O;"("# INT (N1 + .5)")";
  : HTAB 32
  : RX = R(J)
  : PRINT "FOR"6,O;# INT (RX + .5)
  : NEXT
  : GOTO 10528

10522 IF OP = > 2 GOTO 10526

10524 VTAB 10
  : CALL - 958
  : HTAB 2
  : PRINT T1;
  : FOR J = 1 TO K
  : HTAB 10
  : PRINT J;
  : HTAB 14
  : JJ = N(J) + .5
  : PRINT "FOR"6,O;# INT (JJ); SPC( 3);
  : N1 = 100 * N(J) / M(J)
  : PRINT "FOR"3,O;"("# INT (N1 + .5)")";
HTAB 32
PRINT "FOR"6,0;#R(J)
NEXT
GOTO 10528

10526 VTab 10
CALL - 958
HTAB 2
PRINT T1;
FOR J = 1 TO K
HTAB 10
PRINT J;
HTAB 14
JJ = N(J) + .5
PRINT "FOR"6,0;# INT (JJ); SPC( 3);
N1 = 100 * N(J) / M(J)
PRINT "FOR"5,0;"("# INT (N1 + .5")");
HTAB 32
RX = R1 * R(J)
PRINT "FOR"6,0;# INT (RX + .5)
NEXT

10528 VTab (11 + K)
HTAB 8
PRINT "TOTAL";
HTAB 14
N1 = 100 * D / DO
PRINT #D + .5); SPC( 3);"FOR"3,0;"("# INT (N1 + .5 ")");
HTAB 32
PRINT "FOR"6,0;#(R1 + .5)

10530 VTab (13 + K)
HTAB 1
FOR I = 1 TO 39
PRINT ";
NEXT
RETURN

10600 PR# 1
PRINT
PRINT

10602 HTAB 10
PRINT "DATA FILE NAME...:";
POKE 36,40
PRINT "(""mps")"
PRINT
PRINT

122
10604 HTAB 10
    PRINT "TRANSITIONAL FLOWS"
    PRINT
    PRINT
------------------------
10606 IF Z$ = "2" OR Z$ = "3" GOTO 10612
------------------------
10608 HTAB 10
    PRINT "TIME"
    HTAB 20
    PRINT "CLASS"
    HTAB 30
    PRINT "STOCKS (N)"
    POKE 36,46
    PRINT "RECRUITMENT"
------------------------
10610 HTAB 10
    FOR I = 1 TO 48
    PRINT ";";
    NEXT
    PRINT
    GOTO 10616
------------------------
10612 HTAB 10
    PRINT "TIME"
    HTAB 20
    PRINT "CLASS"
    HTAB 30
    PRINT "STOCKS (N)"
    POKE 36,43
    PRINT "(PERCENT)"
    POKE 36,57
    PRINT "RECRUITMENT"
------------------------
10614 HTAB 10
    FOR I = 1 TO 59
    PRINT ";";
    NEXT
    PRINT
------------------------
10616 VC = 10
    PR# 0
    RETURN
------------------------
10700 PR# 1
    IF Z$ = "2" GOTO 10720
------------------------
10702 IF Z$ = "3" GOTO 10726
------------------------
10704 IF OP > 2 GOTO 10708
10706 HTAB 10
: PRINT TI;
: FOR J = 1 TO K
: HTAB 23
: PRINT J;
: HTAB 31
: JJ = N(J) + .5
: PRINT # INT (JJ);
: POKE 36,49
: PRINT #R(J)
: NEXT
: PRINT
: GOTO 10710

10708 HTAB 10
: PRINT TI;
: FOR J = 1 TO K
: HTAB 23
: PRINT J;
: HTAB 31
: JJ = N(J) + .5
: PRINT # INT (JJ);
: POKE 36,49
: RX = R1 * R(J)
: PRINT # INT (RX + .5)
: NEXT
: PRINT

10710 HTAB 20
: PRINT "TOTAL";
: HTAB 31
: PRINT #(D + .5);
: POKE 36,49
: PRINT #(R1 + .5)

10712 HTAB 10
: FOR I = 1 TO 48
: PRINT "-";
: NEXT
: PRINT

10714 VC = VC + (K + 3)
: IF VC < 54 GOTO 10720

10716 FOR I = 1 TO (66 - VC)
: PRINT
: NEXT

10718 GOSUB 10600
: PR# O
: GOTO 10336

10720 IF OP = > 2 GOTO 10724

10722 HTAB 10
    PRINT T1;
    FOR J = 1 TO K
    HTAB 22
    PRINT J;
    HTAB 31
    JJ = N(J) + .5
    PRINT "FOR"6,0;# INT (JJ);
    POKE 36,45
    N1 = 100 * N(J) / D
    PRINT "FOR"3,0;"("# INT (N1 + .5)")";
    POKE 36,59
    PRINT "FOR"6,0;#R(J)
    NEXT
    PRINT
    GOTO 10732

10724 HTAB 10
    PRINT T1;
    FOR J = 1 TO K
    HTAB 22
    PRINT J;
    HTAB 31
    JJ = N(J) + .5
    PRINT "FOR"6,0;# INT (JJ);
    POKE 36,45
    N1 = 100 * N(J) / D
    PRINT "FOR"3,0;"("# INT (N1 + .5)")";
    POKE 36,59
    RX = R1 * R(J)
    PRINT "FOR"6,0;# INT (RX + .5)
    NEXT
    PRINT
    GOTO 10732

10726 IF OP = > 2 GOTO 10730

10728 HTAB 10
    PRINT T1;
    FOR J = 1 TO K
    HTAB 22
    PRINT J;
    HTAB 31
    JJ = N(J) + .5
    PRINT "FOR"6,0;# INT (JJ);
POKE 36,45
N1 = 100 * N(J) / M(J)
PRINT "FOR"3,0;"("# INT (N1 + .5)")"
POKE 36,59
PRINT "FOR"6,0;#R(J)
NEXT
PRINT
GOTO 10732

10730 HTAB 10
PRINT T1;
FOR J = 1 TO K
HTAB 22
PRINT J;
HTAB 31
JJ = N(J) + .5
PRINT "FOR"6,0;# INT (JJ);
POKE 36,45
N1 = 100 * N(J) / M(J)
PRINT "FOR"3,0;"("# INT (N1 + .5)")"
POKE 36,59
RX = R*R(J)
PRINT "FOR"6,0;# INT (RX + .5)
NEXT
PRINT

10732 HTAB 20
PRINT "TOTAL";
HTAB 31
PRINT "FOR"6,0;#(D + .5);
N1 = 100 * D / DO
POKE 36,45
PRINT "FOR"3,0;"("# INT (N1 + .5)")";"FOR"6,0;
POKE 36,59
PRINT #(R1 + .5)

10734 HTAB 10
FOR I = 1 TO 58
PRINT "-");
NEXT
PRINT

10736 VC = VC + (K + 3)
IF VC < 54 GOTO 10742

10738 FOR I = 1 TO (66 - VC)
PRINT
NEXT

10740 GOSUB 10600
10742 PR# 0
   : GOTO 10336

10800 IF A = -1 GOTO 10806

10802 IF B$ = "0" GOTO 10828

10804 GOTO 10816

10806 R1 = 0
   : FOR J = 1 TO K
   :   R1 = R1 + N(J) * W(J)
   : NEXT

10808 IF B$ = "*" GOTO 10812

10810 R1 = R1 + C
   : GOTO 10814

10812 R1 = R1 + D * (C - 1)

10814 FOR J = 1 TO K
   :   RM(J) = R1 * R(J)
   : NEXT
   : GOTO 10830

10816 IF A = 0 THEN A = 1

10818 R1 = A

10820 FOR J = 1 TO K
   :   RM(J) = R1 * R(J)
   : NEXT

10822 IF B$ = "*" GOTO 10826

10824 A = A + C
   : GOTO 10830

10826 A = A * C
   : GOTO 10830

10828 FOR J = 1 TO K
   :   RM(J) = R(J)
   : NEXT
   : R1 = 0
   : FOR J = 1 TO K
   :   R1 = R1 + RM(J)
   : NEXT
10830 RETURN

20000 P1 = P1 * 10000
: PBD = INT (P1)
: PAD = P1 - PBD
: ROUND = INT (PAD + .5)
: PBD = PBD + ROUND

20002 IF PBD = 10000 GOTO 20014

20004 IF PBD = 0 GOTO 20016

20006 PBDS$ = STR$ (PBD)
: LS = LEN (PBDS$)

20008 IF LS = 4 GOTO 20018

20010 LZ = 4 - LS
: ZERO$ = "0000"
: ZERO$ = LEPTS (ZEROS, LZ)

20012 PRINT " .";ZERO$;PBDS$ : GOTO 20020

20014 PRINT "1.0000" : GOTO 20020

20016 PRINT " .0000" : GOTO 20020

20018 PRINT " .";PBDS$ : GOTO 20020

20020 RETURN

20050 P1 = P1 * 10000
: PBD = INT (P1)
: PAD = P1 - PBD
: ROUND = INT (PAD + .5)
: PBD = PBD + ROUND

20052 IF PBD = 10000 GOTO 20064

20054 IF PBD = 0 GOTO 20066

20056 PBDS$ = STR$ (PBD)
: LS = LEN (PBDS$)

20058 IF LS = 4 GOTO 20068
20060 LZ = 4 - LS
  : ZEROS$ = "0000"
  : ZEROS$ = LEFT$(ZEROS$, LZ)

20062 PRINT ";ZEROS;PBD$;
  : GOTO 20070

20064 PRINT "1.0000";
  : GOTO 20070

20066 PRINT ".0000";
  : GOTO 20070

20068 PRINT ";PBD$;
  : GOTO 20070

20070 RETURN

20100 TEXT
  : HOME
  : INVERSE
  : VTAB 1
  : HTAB 1
  : PRINT "* MAN-MOD TRANSITION MATRIX PROGRAM *"
  : NORMAL
  : RETURN

20200 V TAB 23
  : HTAB 1
  : FOR I = 1 TO 39
  : PRINT "'";
  : NEXT
  : PRINT
  : HTAB 12
  : PRINT "PRESS SELECTION ";
  : GET G$
  : G = VAL (G$)
  : RETURN

20300 V TAB 22
  : HTAB 2
  : PRINT "(PRESS (A) TO ACCEPT, (R) TO REENTER)"
  : PRINT
  : V TAB 24
  : HTAB 12
  : PRINT "((E) TO ESCAPE) ";
  : GET G$
  : RETURN
20400 VTAB 24
  : HTAB 1
  : PRINT "(PRESS (A) TO ACCEPT, (R) TO REENTER)";
  : GET G$
  : RETURN

20500 VTAB 4
  : HTAB 1
  : CALL 958
  : VTAB 5
  : HTAB 2
  : FLASH
  : PRINT "ROW PROBABILITIES SUM GREATER THAN 1"
  : NORMAL
  : VTAB 12
  : HTAB 8
  : PRINT "VERIFY INPUTS AND REENTER"

20502 VTAB 10
  : HTAB 3
  : PRINT "(C) TO CONTINUE AND REENTER INPUT"
  : PRINT
  : HTAB 3
  : PRINT "(E) ESCAPE INPUT ROUTINE TO MENU"

20504 VTAB 16
  : HTAB 3
  : PRINT "(WITH ESCAPE (E) ALL PREVIOUS INPUTS"
  : HTAB 3
  : PRINT "ARE ACCEPTED, REMAINING INPUTS MAY BE"
  : HTAB 3
  : PRINT "ENTERED THROUGH THE CHANGE ROUTINE)"

20506 VTAB 24
  : HTAB 1
  : PRINT "PRESS (C) TO CONTINUE, (E) TO ESCAPE ";
  : GET G$

20508 IF G$ = "C" OR G$ = "E" GOTO 20512

20510 GOTO 20506

20512 RETURN

20600 PR# 1
  : PRINT
  : PRINT
  : PRINT
  : HTAB 5
  : FOR I = 1 TO 25
: PRINT "-";
: NEXT
: PRINT

20602 HTAB 5
: PRINT "MAN-MOD DATA FILE LISTING"
: HTAB 5
: FOR I = 1 TO 25
: PRINT "-";
: NEXT
: PRINT

20604 HTAB 5
: PRINT "DATA FILE NAME IS...:"
: HTAB 35
: PRINT NF$;
: PRINT
: PRINT
: HTAB 5
: PRINT "NUMBER (K) CLASSES...:"
: HTAB 35
: PRINT "("K")"
: PRINT

20606 HTAB 5
: PRINT "TIME (T) PERIODS....:"
: HTAB 35
: PRINT "("T")"
: PRINT
: PRINT
: HTAB 5
: PRINT "PERCENTAGES OPTION...:"
: HTAB 35
: GOSUB 20860
: PRINT
: PRINT

20608 HTAB 5
: PRINT "OPTION SELECTED IS...:"
: HTAB 35
: GOSUB 20800
: PRINT
: PRINT
: HTAB 5
: PRINT "OPTION INPUTS.........:"
: HTAB 35
: GOSUB 20820

131
PRINT HTAB 35
GOSUB 20840
PRINT PRINT

20610 HTAB 5
PRINT "INITIAL STOCK (N) VECTOR AND RECRUITMENT (R) VECTOR"
PRINT PRINT

20612 HTAB 16
FOR I = 1 TO K
PRINT SPC(1);"COL ";I; SPC(1);
NEXT
PRINT PRINT

20614 HTAB 5
PRINT "VECTOR N:"
HTAB 16
FOR I = 1 TO K
PRINT #M(I); SPC(1);
NEXT
PRINT PRINT

20616 HTAB 5
PRINT "RECRUIT R:"

20618 IF OP = 1 GOTO 20622

20620 HTAB 16
FOR I = 1 TO K
P1 = R(I)
GOSUB 20050
PRINT SPC(1);
NEXT
PRINT PRINT PRINT
GOTO 20624

20622 HTAB 16
FOR I = 1 TO K
PRINT #R(I); SPC(1);
NEXT
PRINT PRINT PRINT

132
PRINT "TRANSITIONAL FLOW MATRIX (P)"
PRINT
PRINT

FOR I = 1 TO K
PRINT SPC(1); "COL "; I; SPC(1);
NEXT
PRINT
PRINT

FOR I = 1 TO K
HTAB 5
PRINT "ROW ("I")";
HTAB 16
FOR J = 1 TO K
P1 = P(I, J)
GOSUB 20050
PRINT SPC(1);
NEXT
PRINT
NEXT
PRINT
PRINT

K3 = 9 - K
K4 = 11 + K3
FOR I = 1 TO K4
PRINT
NEXT

PR# 0
RETURN

GOSUB 20100

VTAB 6
HTAB 7
PRINT "CHOOSE DESIRED DATA LISTING"

VTAB 11
HTAB 10
PRINT "(1) SCREEN DISPLAY"
VTAB 13
HTAB 10
PRINT "(2) PAPER COPY"
20708 GOSUB 20200
20710 RETURN
20800 IF OP = 1 THEN PRINT "FIXED RECRUIT VECTOR"
20802 IF OP = 2 THEN PRINT "ADDITIVE (RECRUIT SIZE)"
20804 IF OP = 3 THEN PRINT "MULTIPLICATIVE (RECRUIT SIZE)"
20806 IF OP = 4 THEN PRINT "ADDITIVE (SYSTEM SIZE)"
20808 IF OP = 5 THEN PRINT "MULTIPLICATIVE (SYSTEM SIZE)"
20810 RETURN
20820 IF OP = 1 THEN PRINT "NOT APPLICABLE"
20822 IF OP = 2 OR OP = 3 THEN PRINT "NUMBER ENTERING (";A
20824 IF OP = 4 OR OP = 5 THEN PRINT "CALCULATES TOTAL NET NUMBER"
20826 RETURN
20840 IF OP = 1 THEN PRINT "ALL ENTER CLASS 1"
20842 IF OP = 2 THEN PRINT "NUMBER TO INCREASE (";C")"
20844 IF OP = 3 OR OP = 5 THEN PRINT "MULTIPLICATIVE FACTOR (";C")"
20846 IF OP = 4 THEN PRINT "TO INCREASE SYSTEM BY (";C;")"
20848 RETURN
20860 IF Z$ = "1" THEN PRINT "NO CLASS PERCENTAGES (%)"
20862 IF Z$ = "2" THEN PRINT "GRADE SIZE AS % OF TOTAL SIZE"
20864 IF Z$ = "3" THEN PRINT "GRADE SIZE AS % OF ORIGINAL SIZE"
20866 RETURN
20900 FOR I = 1 TO K
    :   W(I) = 1
    :   FOR J = 1 TO K
    :       W(I) = W(I) - P(I,J)
    :   NEXT
    :   NEXT
    :   RETURN
The MAN-MOD/LINKER module is a public domain machine language routine. It allows module chaining. The program listing was done by a memory listing routine.
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30D0- 2E 20 20 54 49 4D 45 20
30DB- 50 45 52 49 4F 44 22 3A
30E0- A2
APPENDIX E

MAN-MOD/FORMATTER MODULE

PROGRAM LISTING

The MAN-MOD/FORMATTER module is a print using routine allowing for real and integer numbers to be formatted. It is a modified version of PRINT II, a Computer Systems Design copyrighted program. Permission has been obtained to utilize the modified routine for MAN-MOD; any other use of the routine is prohibited. The program listing was done by a memory listing routine.
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