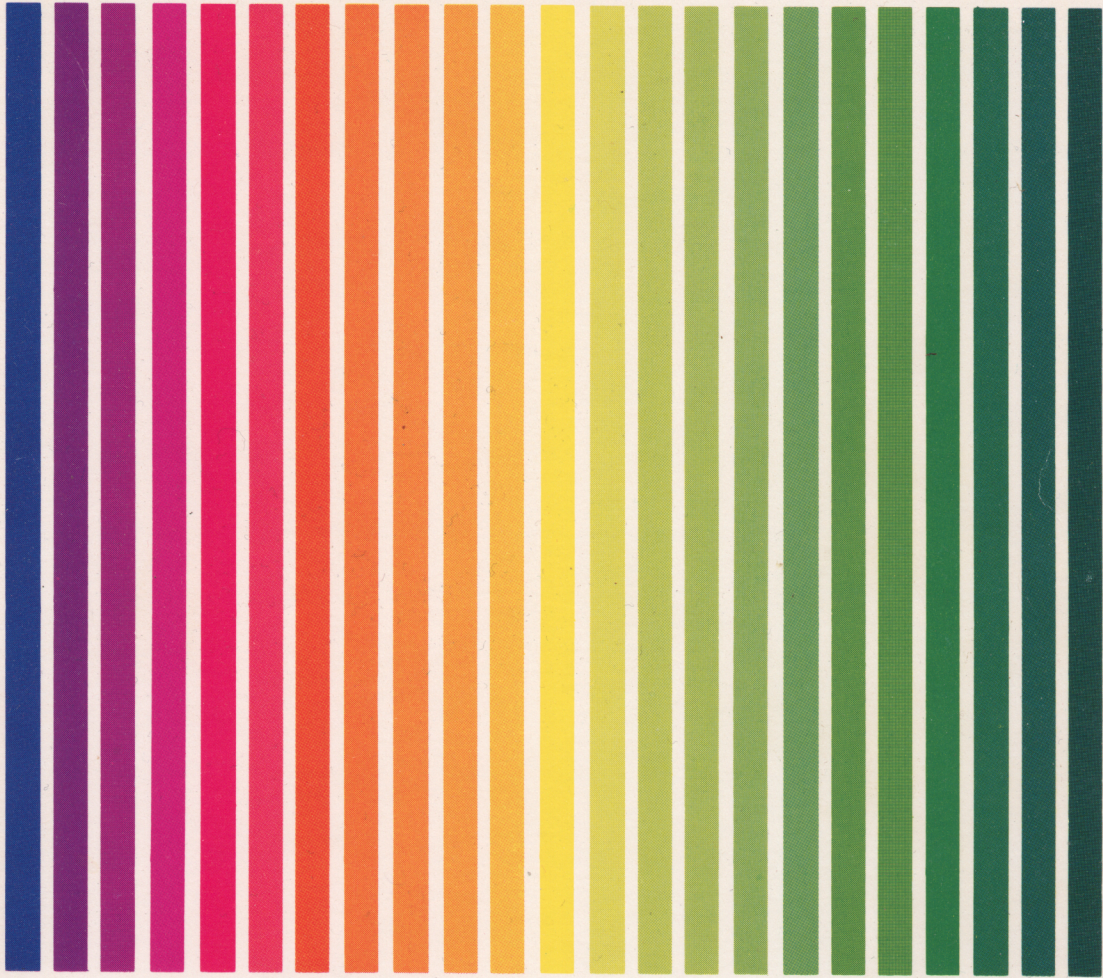


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Harry Koons and Art Prag

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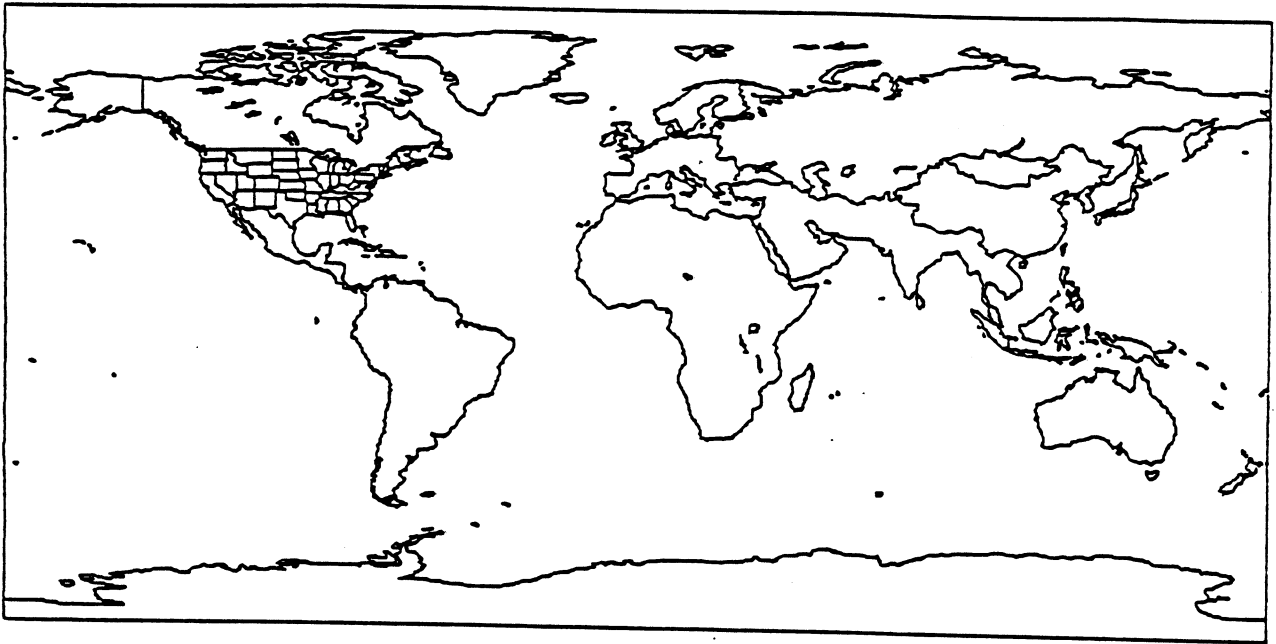
APX-20055

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MAPWARE



by

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and

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Version 1.0

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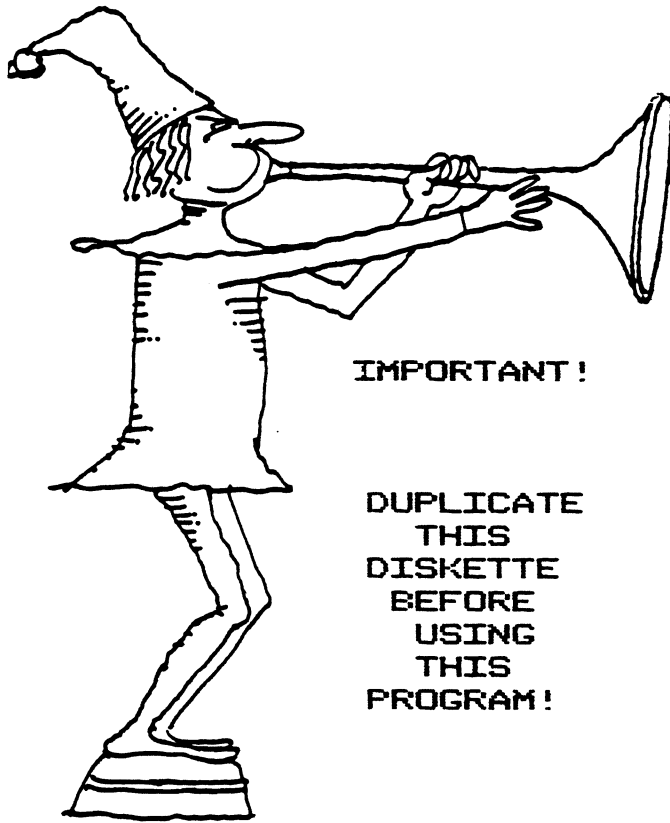
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This APX diskette is unnotched to protect the software against accidental erasure. However, this protection also prevents a program from storing information on the diskette. The program you've purchased involves storing information. Therefore, before you can use the program, you must duplicate the contents of the diskette onto a notched diskette that doesn't have a write-protect tab covering the notch.

To duplicate the diskette, call the Disk Operating System (DOS) menu and select option J, Duplicate Disk. You can use this option with a single disk drive by manually swapping source (the APX diskette) and destination (a notched diskette) until the duplication process is complete. You can also use this option with multiple disk drive systems by inserting source and destination diskettes in two separate drives and letting the duplication process proceed automatically. (Note. This option copies sector by sector. Therefore, when the duplication is complete, any files previously stored on the destination diskette will have been destroyed.)

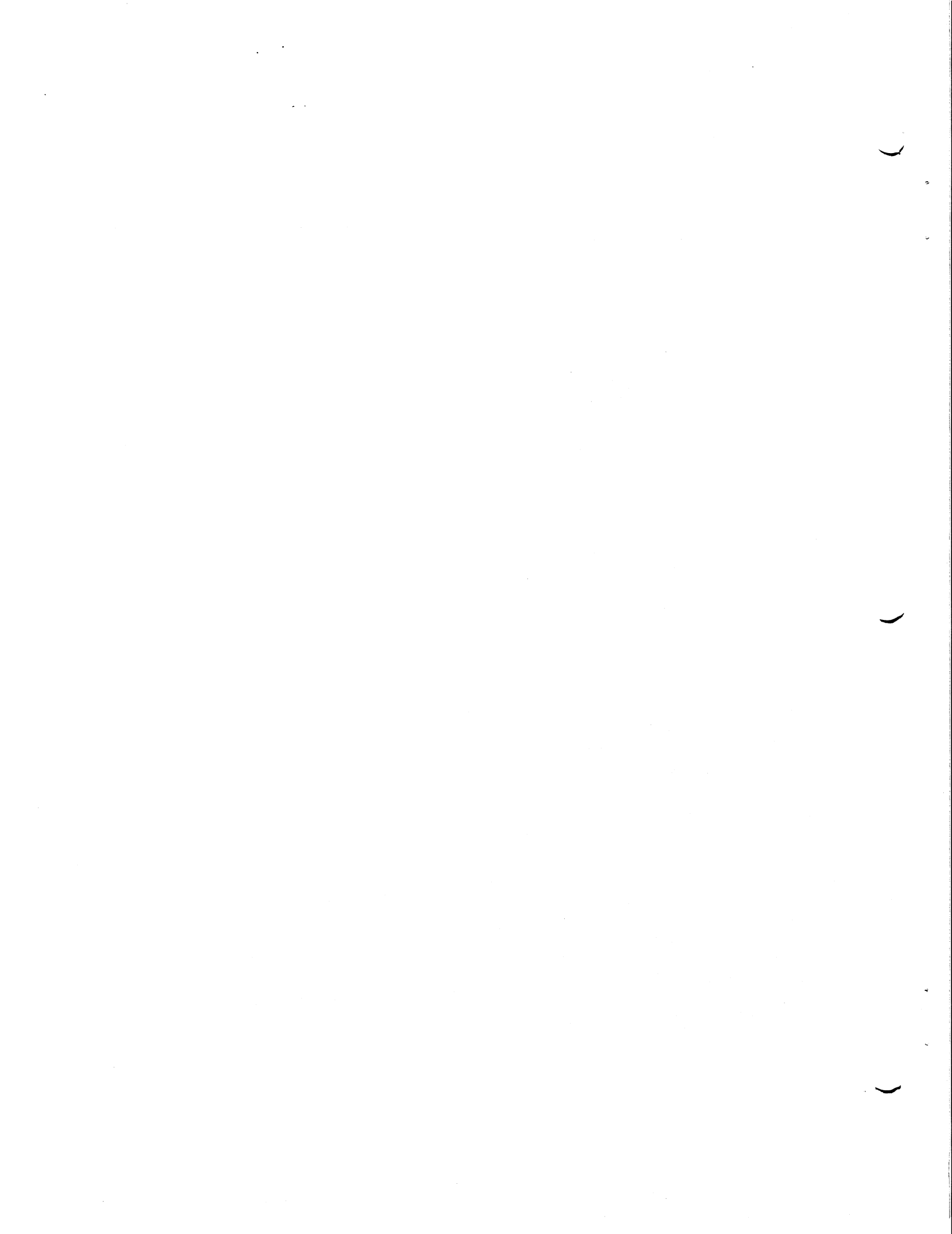
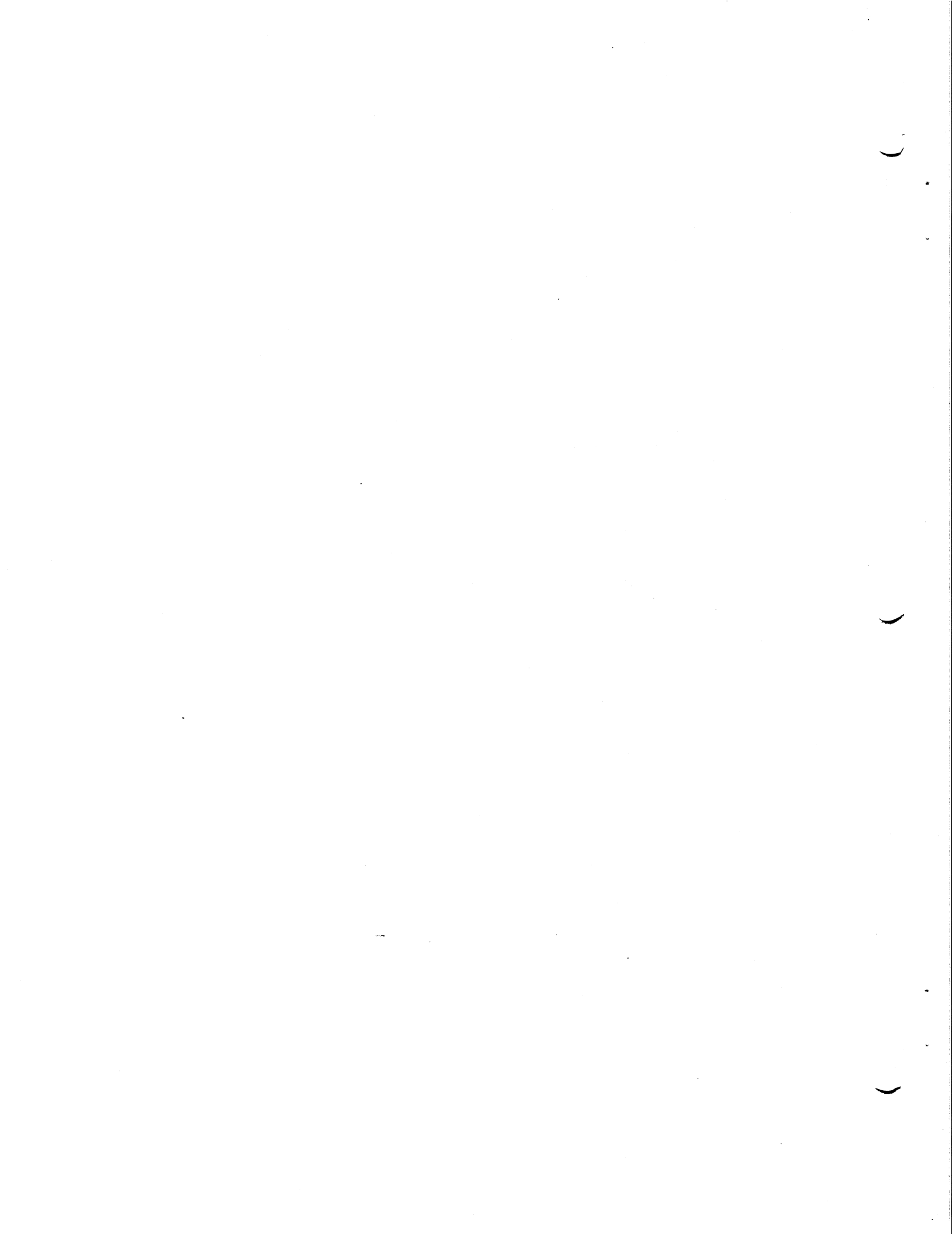


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1 INTRODUCTION

Overview

With the MAPWARE programs you can generate a wide variety of world maps with your personal computer. A data diskette contains approximately 9000 pairs of geographic coordinates which locate the main land masses and islands on Earth. With the programs on the program diskette you can draw high resolution maps on your video screen. You can use these maps for games and simulations, for tracking satellites, for pointing amateur radio antennas, for overlays for satellite weather maps, and for teaching geography and cartography. You can draw the Earth as you would see it from any distance above your home town. It takes about two hours to generate a high resolution perspective projection map of that type. It takes much less time to draw a simple cylindrical projection. You can save all of the maps that you generate on data diskettes and display them later on the screen in a couple of minutes. The programs are written in the ATARI BASIC language so that intermediate programmers can modify them. For example you might want to generate map projections that are not included in the MAPWARE programs. You might also modify a program to call it as a subroutine to overlay satellite ground tracks or fields of view. The following projections are included in the MAPWARE programs: cylindrical (rectangular equal-spaced), orthographic equatorial, azimuthal equidistant, and general perspective (global). The program prompts you for the input data that is needed for each map.

Minimum RAM and accessories

To use the MAPWARE programs, you will need the following ATARI equipment:

REQUIRED ACCESSORIES

- 40K RAM
- ATARI 810 Disk Drive
- ATARI BASIC Language Cartridge

2 GETTING STARTED

Set up your equipment and load the program as follows:

1. Install an ATARI BASIC (Computing Language) Cartridge into the LEFT cartridge slot in the computer console.
2. Insure that the computer power is OFF.
3. Turn-on disk drive and wait for the disk-drive, busy indicator light to go off.
4. Turn-on TV or monitor.
5. Insert the MAPWARE PROGRAM diskette into the disk drive and close the disk

drive door.

6. Switch the POWER switch on the computer console to ON. After a short period of loading the disk operating system, the READY prompt will appear on the television screen.
7. Shortly a logo will appear on the screen giving the program name - MAPWARE, the author, and the version number. The logo will remain on the screen while the MAPWARE program loads into computer memory.
8. After the MAPWARE program is loaded, a program selection menu will appear on the screen.
9. You are now ready to begin to use the MAPWARE programs.

Selecting a program

The MAPWARE programs consist of five individual programs. Each individual program is listed on your selection menu with a letter preceding the program name. The main MAPWARE MENU is the first menu to appear on the screen and it looks like this:

*** MAPWARE MENU ***

D - DISPLAY SAVED MAP
C - CYLINDRICAL
A - AZIMUTHAL EQUIDISTANT
O - ORTHOGRAPHIC EQUATORIAL
P - PERSPECTIVE

ENTER SELECTION?

Choose your program selection, and type its designated letter. The selected program will be loaded from disk. There is a short loading period before the prompts for the input data appear on the screen.

Entering data

The MAPWARE programs will prompt you for the data. Data is requested by a ? at the end of a line. When data is requested, type the data then press the [RETURN] key. In these instructions we will use the symbol [RETURN] to remind you that this is one key. The computer will not act on any data entered until the [RETURN] key is pressed. The only exception to this rule occurs when you save a map that you have generated. That exception is described in Section 8 - SAVE MAP.

Latitudes and longitudes

Distance north and south of the Earth's equator is measured along a meridian. It is

expressed in degrees and is called latitude. A circle around the world at constant latitude is called a parallel. Distance along a parallel is also measured in degrees, and is called longitude. By international agreement the meridian that passes through the Royal Observatory in Greenwich, England, is used as the prime meridian. The longitude of any place on that meridian is 0(zero) degrees. For the MAPWARE programs the longitudes required to set up the map scales must be entered as east longitudes, i.e. the longitude measured in degrees east from Greenwich. This will range from 0 to 360 degrees. Many maps, especially those of the Western Hemisphere, are labeled in west longitude. This may be entered into the programs as a negative east longitude. To do that you type a minus sign in front of the west longitude. Most atlases have maps labeled with longitudes and latitudes. You can use such an atlas to obtain the input data you need for your maps.

Diskette information

Three diskettes are needed to run the MAPWARE programs - the MAPWARE PROGRAM diskette provided, the MAP COORDINATES diskette provided, and an initially blank formatted diskette. This data diskette is only used to save the maps you generate with your MAPWARE programs. Refer to your DOS manual for information on formatting a new diskette.

Diskettes have a write protect notch in their upper right hand corner. Do not cover the notch with a write protect label on the diskette that you use to save your maps. A write protect label prevents all write operations onto a diskette. The MAPWARE programs perform write operations to store your maps. Covering this notch will stop the program and cause an error message to be displayed on the screen. You should keep write protect labels on both the MAPWARE PROGRAM diskette and the MAP COORDINATES diskette. The programs do not write onto these diskettes.

Error messages

You may occasionally get an error message on the screen in the form:

ERROR nnn

where nnn is a number. These error messages come from the BASIC LANGUAGE program running the MAPWARE program. They mean that the program is unable to perform an instruction. The reason for each ERROR message is described in Appendix B of the ATARI BASIC REFERENCE MANUAL. If you see an ERROR displayed on the screen you should check the disk drive to be sure it is on. You will have to begin again by typing:

RUN "D:MAPMENU" [RETURN]

A common error that you may encounter is ERROR 141 - Cursor out of range. This means you are trying to draw a map that is too big for your screen. You should check to be sure that the map size that you input is no bigger than allowed. The size limits for each projection are given in the section describing that projection.

3 DISPLAY SAVED MAP

The DISPLAY SAVED MAP program allows you to display on the screen a map that you have previously generated and saved on a data diskette.

When you enter D as your choice under the MAPWARE MENU, the DISPLAY SAVED MAP program loads from the MAPWARE program diskette.

After it has loaded into your computer's memory you will see the following at the top of your screen:

```
*** DISPLAY MAP FROM DISK ***
```

Below that appears the prompt:

```
WHAT IS THE MAP NUMBER?
```

You must enter the number of the map that you wish to display. The number must be between 1 and 99. After you enter the number and type [RETURN], the program will then remind you to put the diskette with the map data into the disk drive. The following message is displayed:

```
INSERT DATA DISKETTE  
INTO THE DISK DRIVE  
AND TYPE [RETURN]?
```

You must open the disk drive door, take out the MAPWARE PROGRAM diskette, put the data diskette into the disk drive and close the door. When you type [RETURN] the TV or monitor screen will go blank and the map data will begin to load from the diskette. As the data is loaded into your computer's memory, the map will begin to appear near the top of the screen. It will take about three minutes for the entire map to be displayed. (Note: See the next page for instructions to display the five sample maps.)

If the disk drive is not turned on or if the map number is not located on the diskette, the following message will be displayed:

```
MAP NUMBER nn  
WAS NOT FOUND.  
CHECK DISK  
THEN TYPE [RETURN]?
```

When that message appears, check that the correct diskette is in the disk drive and make sure that the disk drive is turned on. After the problem is corrected you simply type [RETURN] to try again.

When your map is completed on the screen the word FINI will appear in the lower

left hand corner of the screen. When you are finished with the map you must type [BREAK]. This key is located in the upper right hand corner of the keyboard. After you type [BREAK] the following message from the ATARI BASIC LANGUAGE program will appear on the screen:

STOPPED AT LINE 230

If you want to display another map type:

RUN [RETURN]

This will rerun the DISPLAY SAVED MAP program.

If you want to generate a new map, remove the map data diskette from the disk drive, insert the MAPWARE PROGRAM diskette into the disk drive and type:

RUN "D:MAPMENU" [RETURN]

This will load the MAPMENU program and display the MAPWARE MENU on the screen.

Display sample maps

Five sample maps are provided on the MAPWARE PROGRAM diskette. These maps were generated by the MAPWARE programs.

Use this selection to display the sample maps. The sample maps are numbered from 1 to 5 and are described and shown in Section 11.

At the prompt:

WHAT IS THE MAP NUMBER?

Type the number that you have chosen from the data in Section 11, then type [RETURN].

In this case because the map data is on the MAPWARE PROGRAM diskette, leave the MAPWARE PROGRAM diskette in the disk drive when the following message is displayed:

INSERT DATA DISKETTE
INTO THE DISK DRIVE
AND TYPE [RETURN]?

Simply type [RETURN] to display the sample map you have selected. When the map is completed on the screen the word FINI will appear in the lower left hand corner of the screen. When you are finished with the map you must type [BREAK]. This key is located in the upper right hand corner of the keyboard. After you type [BREAK]

the following message from the ATARI BASIC LANGUAGE program will appear on the screen:

STOPPED AT LINE 230

If you want to display another map type:

RUN [RETURN]

This will rerun the DISPLAY SAVED MAP program.

If you want to generate a new map type:

RUN "D:MAPMENU" [RETURN]

This will load the MAPMENU program and display the MAPWARE MENU on the screen.

4 CYLINDRICAL PROJECTION

The cylindrical projection provided with the MAPWARE programs is the Rectangular Even-spaced Projection. This is perhaps the most simple projection. It has evenly spaced horizontal parallels and evenly spaced vertical meridians. By entering different latitude and longitude ranges for your cylindrical projections you can greatly magnify small areas of the world. Magnifications with this projection will show you the high accuracy of the map coordinates. Each coordinate is specified to one-tenth of a degree. That is approximately 11 kilometers.

The CYLINDRICAL PROJECTION program is also the fastest to run because it directly converts the map coordinate data to screen coordinates without using trigonometric functions.

To generate a cylindrical projection map, you must be prepared to enter the following data:

- * Map number for saving the map
- * Geographic east longitude at the left hand and right hand limits of the map
- * Geographic north latitude at the bottom and top limits of the map
- * Map length in columns
- * Map height in rows

When you enter C as your choice under the MAPWARE MENU, the CYLINDRICAL PROJECTION program loads into your computer's memory from the MAPWARE PROGRAM diskette.

After it has loaded into your computer's memory you will see the following at the top of your screen:

```
*** CYLINDRICAL PROJECTION ***
```

Below that appears the prompt:

```
MAP NUMBER FOR SAVING?
```

You must enter a number between 1 and 99 that will be used to identify the map on the data diskette. You will use this number in the DISPLAY SAVED MAP program to display the map on the screen again at a later time. After you enter the number and type [RETURN], the following prompts will be displayed on the screen one after another:

```
GEOGRAPHIC EAST LONGITUDE AT THE  
LEFT-HAND LIMIT OF THE MAP?
```

As an example we will show the data used to generate Sample Map 1 on the MAPWARE PROGRAM diskette. At the above prompt you enter the east longitude in

the form:

-180 [RETURN]

Notice that a west longitude was entered with a minus sign in front of it to change it into an east longitude.

then:

GEOGRAPHIC EAST LONGITUDE AT THE
RIGHT-HAND LIMIT OF THE MAP?

You then enter this east longitude in the form:

180 [RETURN]

then:

GEOGRAPHIC LATITUDE AT THE BOTTOM
LIMIT OF THE MAP?

Latitudes must be entered as north latitudes. South latitudes are entered as negative north latitudes. For example the South Pole is at -90 north latitude. This is the input needed for Sample Map 1. You enter the latitude in the form:

-90 [RETURN]

then:

GEOGRAPHIC LATITUDE AT THE
TOP LIMIT OF THE MAP?

Enter the data in the form:

90 [RETURN]

then:

MAP LENGTH IN COLUMNS (<=320)?

In the high-resolution graphics mode used for these maps, the screen is a maximum of 320 columns wide. You must enter the width in columns for your map. You can make this smaller than 320 columns but you must not make it larger. You enter the map length in the form:

320 [RETURN]

then:

MAP HEIGHT IN ROWS (<=160)?

In the high-resolution graphics mode used for these maps, the screen is a maximum of 160 rows high. You must enter the height in rows of your map. You can make this smaller than 160 rows but you must not make it larger. You enter the map height in the form:

160 [RETURN]

The program is now ready to begin drawing the map. The following prompt appears on the screen:

INSERT MAP COORDINATES
DATA DISKETTE
AND TYPE [RETURN]?

You must open the disk drive door, take out the MAPWARE PROGRAM diskette, put the MAP COORDINATES diskette into the disk drive and type [RETURN].

When you type [RETURN] the screen will go blank and data will begin to load into your computer's memory from the MAP COORDINATES diskette. The number 1 will appear in the lower left hand corner of the screen. The data on the MAP COORDINATES diskette is contained in five files. The number in the lower corner of the screen will tell you the file that is currently being used. This number will increase by one each time a new set of 2000 coordinates are read in from the diskette. After all five files have been completed and the entire map is drawn on the screen the word FINI will appear in the lower left hand corner of the screen. This tells you that the map is done.

If you want to save the map, read the special instructions below in Section 8 - SAVE MAP.

When you are finished with the map you must type [BREAK]. After you type [BREAK] the following message from the ATARI BASIC LANGUAGE program will appear on the screen:

STOPPED AT LINE 230

If you want to generate a new map, make sure the MAPWARE PROGRAM diskette is in the disk drive and type:

RUN "D:MAPMENU" [RETURN]

This will load the MAPMENU program into your computer's memory and display the MAPWARE MENU on the screen.

5 AZIMUTHAL EQUIDISTANT PROJECTION

The azimuthal equidistant projection is the only projection in which every point is shown at both the correct distance and the correct direction (azimuth) from the center point. All other distances and directions are distorted. This projection is used to determine great circle directions. If you place your home town at the center of the map, you can easily determine the azimuth for pointing shortwave antennas for reception of distant radio stations. Straight lines away from your home at the center of the map will be the great circle routes flown by airplanes on international flights from an airport near your home.

The AZIMUTHAL EQUIDISTANT program is among the slowest to run because it must convert all of the map coordinates to screen coordinates using trigonometric functions.

To generate an azimuthal equidistant projection map, you must be prepared to enter the following data:

- * Map number for saving the map
- * Radius of the map in column widths
- * Geographic east longitude at the center of the map
- * Geographic north latitude at the center of the map

When you enter A as your choice under the MAPWARE MENU, the AZIMUTHAL EQUIDISTANT program loads into your computer's memory from the MAPWARE PROGRAM diskette.

After it has loaded into your computer's memory you will see the following at the top of your screen:

```
*** AZIMUTHAL EQUIDISTANT ***  
***      PROJECTION      ***
```

Below that appears the prompt:

```
MAP NUMBER FOR SAVING?
```

You must enter a number between 1 and 99 that will be used to identify the map on the MAP DATA diskette. You will use this number in the DISPLAY SAVED MAP program to display the map on the screen again at a later time. After you enter the number and type [RETURN], the following prompts will be displayed on the screen one after another:

```
RADIUS OF THE FINAL MAP  
IN COLUMN WIDTHS (<=95)?
```

In the high-resolution graphics mode used for this projection, the screen is a maximum of 191 rows high. Since the map is drawn inside a circle it can be no wider than it is high. You must enter the radius of your map. The radius must be no bigger than one half of the screen height, i.e. no bigger than 95. You can make this smaller than 95 columns but you must not make it larger.

As an example we will show the data used to generate Sample Map 2 on the MAPWARE PROGRAM diskette. At the above prompt you enter the map radius in the form:

95 [RETURN]

then:

REFERENCE LONGITUDE
AT CENTER OF MAP
IN DEGREES?

You then enter this east longitude in the form:

-77 [RETURN]

Notice that a west longitude was entered with a minus sign in front of it to change it into an east longitude.

then:

REFERENCE LATITUDE
AT CENTER OF MAP
IN DEGREES?

Latitudes must be entered as north latitudes. South latitudes are entered as negative north latitudes. For example the South Pole is at -90 north latitude. Sample Map 2 is centered near Washington, DC. You enter the latitude in the form:

39[RETURN]

The program is now ready to begin drawing the map. The following prompt appears on the screen:

INSERT MAP COORDINATES
DATA DISKETTE
AND TYPE [RETURN]?

You must open the disk drive door, take out the MAPWARE PROGRAM diskette, put the MAP COORDINATES diskette into the disk drive and type [RETURN].

When you type [RETURN] the screen will go blank, the program will draw the

circular outline of the map, and then the data will begin to load into your computer's memory from the MAP COORDINATES diskette. The number 1 will appear in the lower left-hand corner of the screen. The data on the MAP COORDINATES diskette is contained in five files. The number in the lower corner of the screen will tell you the file that is currently being used. This number will increase by one each time a new set of 2000 coordinates are read in from the diskette. After all five files have been completed and the entire map is drawn on the screen the word FINI will appear in the lower left-hand corner of the screen. This tells you that the map is done.

If you want to save the map, read the special instructions below in Section 8 - SAVE MAP.

When you are finished with the map, you must type [BREAK]. After you type [BREAK] the following message from the ATARI BASIC LANGUAGE program will appear on the screen:

```
STOPPED AT LINE 230
```

If you want to generate a new map, make sure the MAPWARE PROGRAM diskette is in the disk drive and type:

```
RUN "D:MAPMENU" [RETURN]
```

This will load the MAPMENU program into your computer's memory and display the MAPWARE MENU on the screen.

6 ORTHOGRAPHIC EQUATORIAL PROJECTION

Orthographic projections are a special case of perspective projections. In orthographic projections the point of view is at infinity. With the ORTHOGRAPHIC EQUATORIAL PROJECTION program you can draw an orthographic projection of the Earth from any point above the Earth's equator.

This program is included as a separate program because this projection can be drawn much faster than the same projection can be drawn with the PERSPECTIVE PROJECTION program.

To generate an orthographic equatorial projection map, you must be prepared to enter the following data:

- * Map number for saving the map
- * Radius of the map in column widths
- * Geographic east longitude at the center of the map

When you enter 0 as your choice under the MAPWARE MENU, the ORTHOGRAPHIC EQUATORIAL PROJECTION program loads into your computer's memory from the MAPWARE PROGRAM diskette.

After it has loaded into your computer's memory you will see the following at the top of your screen:

* ORTHOGRAPHIC EQUATORIAL PROJECTION *

Below that appears the prompt:

MAP NUMBER FOR SAVING?

You must enter a number between 1 and 99 that will be used to identify the map on the data diskette. You will use this number in the DISPLAY SAVED MAP program to display the map on the screen again at a later time. After you enter the number and type [RETURN], the following prompts will be displayed on the screen one after another:

REFERENCE LONGITUDE AT CENTER OF MAP
IN DEGREES?

As an example we will show the data used to generate Sample Map 3 on the MAPWARE PROGRAM diskette. You enter the reference longitude as an east longitude in the form:

90 [RETURN]

A west longitude can be entered with a minus sign in front of it to change it into an east longitude.

then:

RADIUS OF THE FINISHED MAP IN COLUMN
WIDTHS?

In the high-resolution graphics mode used for this projection, the screen is a maximum of 191 rows high. Since the map is drawn inside of a circle it can be no wider than it is high. You must enter the radius of your map. The radius must be no bigger than one half of the screen height, i.e. no bigger than 95. You can make this smaller than 95 columns but you must not make it larger.

At the above prompt you enter the map radius in the form:

95 [RETURN]

The program is now ready to begin drawing the map. The following prompt appears on the screen:

INSERT MAP COORDINATES
DATA DISKETTE
AND TYPE [RETURN]?

You must open the disk drive door, take out the MAPWARE PROGRAM diskette, put the MAP COORDINATES diskette into the disk drive and type [RETURN].

When you type [RETURN] the screen will go blank, the program will draw the circular outline of the map, and then the data will begin to load into your computer's memory from the MAP COORDINATES diskette. The number 1 will appear in the lower left hand corner of the screen. The data on the MAP COORDINATES diskette is contained in five files. The number in the lower corner of the screen will tell you the file that is currently being used. This number will increase by one each time a new set of 2000 coordinates are read in from the diskette. After all five files have been completed and the entire map is drawn on the screen the word FINI will appear in the lower left-hand corner of the screen. This tells you that the map is done.

If you want to save the map, read the special instructions below in Section 8 - SAVE MAP.

When you are finished with the map you must type [BREAK]. After you type [BREAK] the following message from the ATARI BASIC LANGUAGE program will appear on the screen:

STOPPED AT LINE 250

If you want to generate a new map, make sure the MAPWARE PROGRAM diskette is

in the disk drive and type:

```
RUN "D:\MAPMENU" [RETURN]
```

This will load the MAPMENU program into your computer's memory and display the MAPWARE MENU on the screen.

7 PERSPECTIVE PROJECTION

Prospective projections are those which show the Earth exactly as it appears when viewed from some point in space above the surface. This is one of the best projections to use for games and space war simulations. Although it takes a long time to generate a map using this program, the maps can be displayed from disk in a couple of minutes.

To generate a perspective projection map, you must be prepared to enter the following data:

- * Map number for saving the map
- * Radius of the map in column widths
- * Geographic east longitude at the center of the map
- * Geographic north latitude at the center of the map
- * Height of the observer in kilometers above the surface
- * Azimuth that the observer is facing from true north

When you enter P as your choice under the MAPWARE MENU, the PERSPECTIVE PROJECTION program loads into your computer's memory from the MAPWARE PROGRAM diskette.

After it has loaded into your computer's memory you will see the following at the top of your screen:

* PERSPECTIVE PROJECTION *

Below that appears the prompt:

MAP NUMBER FOR SAVING?

You must enter a number between 1 and 99 that will be used to identify the map on the data diskette. You will use this number in the DISPLAY SAVED MAP program to display the map on the screen again at a later time. After you enter the number and type [RETURN], the following prompts will be displayed on the screen one after another:

RADIUS OF THE FINISHED MAP
IN COLUMN WIDTHS(<=95)?

In the high-resolution graphics mode used for this projection, the screen is a maximum of 191 rows high. Since the map is drawn inside a circle it can be no wider than it is high. You must enter the radius of your map. The radius must be no bigger than one half of the screen height, i.e. no bigger than 95. You can make this smaller than 95 columns but you must not make it larger.

At the above prompt you enter the map radius in the form:

95 [RETURN]

then:

REFERENCE LONGITUDE
AT CENTER OF MAP
IN DEGREES?

As an example we will show the data used to generate Sample Map 4 on the MAPWARE PROGRAM diskette. You enter the reference longitude as an east longitude in the form:

-77 [RETURN]

Notice that a west longitude was entered with a minus sign in front of it to change it into an east longitude.

then:

REFERENCE LATITUDE
AT CENTER OF MAP
IN DEGREES?

You enter the north latitude in the form:

39 [RETURN]

then:

HEIGHT OF THE OBSERVER
IN KILOMETERS?

You enter the height above the surface from which you want to view the Earth in the form:

5000 [RETURN]

If you enter a very large number here you will get an orthographic projection. In practice a good height to use for an orthographic projection is 1000000 (one million) kilometers.

You might enjoy putting in a low height to see a "birds eye" view of the area around your home town. A good number to use is 250 kilometers. That is about the altitude of the Space Shuttle orbit. The map coordinates for the state boundaries have not been used for this projection. If you make a low altitude perspective projection over the United States, it's fun to include the state boundaries. The view can seem very distorted from low altitudes. Your state will take up much of the field of view. If

you want to include state boundaries you can do so by making a very simple change to the program before you run it. This change is described in Section 9. Map 4 on the MAPWARE PROGRAM diskette was drawn without state boundaries. The same map shown in Section 11 was drawn with state boundaries.

then:

```
AZIMUTH THAT THE OBSERVER IS FACING  
FROM 0 TO 360 DEGREES  
CLOCKWISE FROM TRUE NORTH?
```

You enter the azimuth in degrees in the form:

```
45 [RETURN]
```

As an example if you are looking north the azimuth is 0 (zero). If you are looking east the azimuth is 90. In Sample Map 4 then the observer is looking to the north-east.

The program is now ready to begin drawing the map. The following prompt appears on the screen:

```
INSERT MAP COORDINATES  
DATA DISKETTE  
AND TYPE [RETURN]?
```

You must open the disk drive door, take out the MAPWARE PROGRAM diskette, put the MAP COORDINATES diskette into the disk drive and type [RETURN].

When you type [RETURN] the screen will go blank, the program will draw the circular outline of the map, and then the data will begin to load into your computer's memory from the MAP COORDINATES diskette. The number 1 will appear in the lower left-hand corner of the screen. The data on the MAP COORDINATES diskette is contained in five files. The number in the lower corner of the screen will tell you the file that is currently being used. This number will increase by one each time a new set of 2000 coordinates are read in from the diskette. After all five files have been completed and the entire map is drawn on the screen the word FINI will appear in the lower left-hand corner of the screen. This tells you that the map is done.

If you want to save the map, read the special instructions below in Section 8 - SAVE MAP.

When you are finished with the map you must type [BREAK]. After you type [BREAK] the following message from the ATARI BASIC LANGUAGE program will appear on the screen:

```
STOPPED AT LINE 900
```

If you want to generate a new map, make sure the MAPWARE PROGRAM diskette is in the disk drive and type:

```
RUN "D:MAPMENU" [RETURN]
```

This will load the MAPMENU program into your computer's memory and display the MAPWARE MENU on the screen.

8 SAVE MAP

When your new map is finished, the word FINI appears in the lower left hand corner of the screen. If you want to save the map on a data diskette, follow these instructions carefully. You will not be prompted by the computer because the map is on the screen.

First:

Remove the MAP COORDINATES diskette from the disk drive and insert the map data diskette on which you want to save the map. Remember to close the disk drive door.

Second:

Type [CTRL] S. The [CTRL] key is the third key from the top on the left side of the keyboard. While holding the [CTRL] key down, type S. This lets the computer know that you want to save the map. The computer will immediately begin to save the map on the data diskette. The map will have the number that you entered for this map when you began generating the map. Be sure that this number is not the same as the number of a map that is already on the same diskette. A new map with the same number as a map that is already on the diskette replaces the old map with that number. If the number you entered was 0 (zero) the map will not be saved.

When the map has been completely saved on the diskette, an exclamation point will appear beside the word FINI like this:

FINI!

The program is now completed. If you want to generate or display another map, you now type [BREAK]. The computer will respond with the message:

STOPPED AT LINE nnn

Here nnn is a number that depends upon the projection program that you were using. The number is not important to you here. To continue using the MAPWARE programs, make sure that the MAPWARE PROGRAM diskette is in the disk drive and type:

RUN "D:MAPMENU [RETURN]

This will load the MAPMENU program into your computer's memory and display the MAPWARE MENU on the screen.

Disk Error

After you type [CTRL] S, the message DISK ERROR may appear in the lower right-hand corner of the screen. This means that the program was not able to save

the map on that try. Be sure that the disk drive is turned on and that the data disk in the drive does not have a write-protect label over the write-protect notch on the disk. Each diskette can hold eleven complete maps. You will also get a DISK ERROR message if the program starts to save a twelfth map on the disk and finds that the disk is full.

After you correct the problem, type [CTRL] S again. If the program can now save the map, the DISK ERROR message will be erased and the map will be saved.

When the exclamation point appears beside the word FINI, the map has been saved and you may continue with the MAPWARE programs or end your work by typing [BREAK] as described above.

9 NOTES FOR TEACHERS AND PROGRAMMERS

The MAPWARE programs are an excellent tool for teaching geography and elementary cartography. Since the maps generally do not show political boundaries or place names, students like to compare the maps with maps in atlases. This leads to easy recognition of land mass shapes. These shapes are often overlooked by beginning students who are more interested in the colors, boundaries, and names on a map. Teachers can generate maps for each area of the world covered in their lessons. Ask the students to identify as many of the features on each map as they can. Also ask them to locate political boundaries on the maps. To do this they should first look them up on a regular globe or atlas.

Intermediate programmers that are interested in cartography can make simple modifications to the CYLINDRICAL PROJECTION program to generate Mercator, Sinusoidal, or Eckert projections.

In that program the subprogram that computes the map coordinates is located at line numbers 390 to 510. You can modify the X (horizontal) and Y (vertical) computation on line 500 to generate other cylindrical projections.

The following parameters are contained on that line:

- L - East longitude
- P - Colatitude
- C1 - Center of the map in longitude
- C2 - Center of the map in latitude
- F1 - Horizontal map scale factor
- F2 - Vertical map scale factor

For the Mercator projection the horizontal, X, term remains the same. The vertical, Y, term becomes:

$$Y=INT(F2*LOG(SIN(45+(90-P)/2)/COS(45+(90-P)/2)))$$

You will also have to include a comparison statement to make sure that you do not try to plot a point outside of the range of the screen. The screen coordinates C and R are computed on line 310. If C is greater than 320 or less than 0 (zero), the point is off the screen. Similarly if R is greater than 160 or less than 0 (zero), the point is off the screen. The equation above for Y is only correct for maps that are centered on the Earth's equator. For that case C2=0

Subroutines

The following subroutines are included in each program. They are identified by a REM statement at the beginning and a RETURN statement at the end. They perform functions that you might find useful in other programs.

```
*** READ INPUT DATA ***
*** COMPUTE MAP COORDINATES ***
*** SETUP MAP SCALES ***
*** ADD TEXT TO GRAPHICS MODE 8 ***
*** SAVE DATA ON DISK ***
```

The line numbers differ from program to program. However you can find them by reading the REMARKS when you list the program.

MAP COORDINATES disk format

The MAP COORDINATES disk contains 8917 coordinate pairs (longitude and colatitude). They are stored in five files named WMAP1.DAT through WMAP5.DAT. The first four contain 2000 coordinate pairs. The fifth contains 917. The coordinate pairs are stored in strings that are 180 bytes long. Each string contains 20 coordinate pairs. Thus each pair consists of 9 bytes. The nine bytes are made up as follows. The first byte is either a 0 (zero) or a 1 (one). This byte tells the computer to plot the point (0) or draw to the point (1). The next four bytes are the east longitude of the point in degrees multiplied by ten. The points are accurate to 0.1 degrees. The multiplication by ten saves storing the decimal point. The last four points are the colatitude of the point multiplied by ten. Using the colatitude rather than the latitude means that all numbers are entered as positive numbers and multiplying by ten again saves storing the decimal point. The data is read from the disk using the READ INPUT DATA subroutine in each program. The data is placed into a string called D\$. This string has a dimension of 18000. That is sufficient to hold the 2000 coordinate pairs plus the corresponding plot or drawto data. In the CYLINDRICAL PROJECTION program the PLOT DATA subroutine starting on line 240 reads the coordinate pairs from D\$ one at a time and calls the COMPUTE MAP COORDINATES subroutine starting on line 390 to compute the X and Y coordinate of the point. This is scaled to the Atari screen and plotted in the main program between lines 290 and 350.

The compact form of storage described above is needed to get all 8917 coordinate pairs on one Atari diskette.

If you want to plot other coordinates, you can generate a file with this same structure and save it on another diskette. After the five files on the MAP COORDINATE diskette are completed, you can have the program call your file and plot your points. Considerable programming experience will be needed to make the required modifications to the programs to do this.

State boundaries

The state boundaries have only been used in the CYLINDRICAL PROJECTION program. They make an impressive map when they are included in low altitude perspective projections of the United States.

The following simple change in the PERSPECTIVE PROJECTION program will display the state boundaries.

After the PERSPECTIVE PROJECTION program has loaded into your computer's memory, you will see the following on the screen:

```
* PERSPECTIVE PROJECTION *
```

```
MAP NUMBER FOR SAVING?
```

Now type [BREAK]. This key is in the upper right-hand corner of the keyboard. The following message will appear on the screen:

```
STOPPED AT LINE 1030
```

Now carefully type:

```
560 KS=1 [RETURN]
```

then:

```
RUN [RETURN]
```

By setting KS to one you will include the state boundaries in the map.

You must make this change each time you want to include the state boundaries.

10 REFERENCES

A good introduction to maps and cartography can be found in an encyclopaedia. For example:

"Maps and Mapping," in the New Encyclopaedia Britannica, Helen Hemingway Benton, Chicago, 1974.

Computer generated maps for a microcomputer are described by W.D. Johnston in:

"Computer Generated Maps," Part 1, Byte, 4, 10, May 1979.

and

"Computer Generated Maps," Part 2, Byte, 4, 100, June 1979.

The techniques described by W.D. Johnston were adapted for the Atari in the MAPWARE programs.

11 SAMPLE MAPS

MAP 1

Cylindrical Projection - C

GEOGRAPHIC EAST LONGITUDE AT THE
LEFT-HAND LIMIT OF THE MAP?180

GEOGRAPHIC EAST LONGITUDE AT THE
RIGHT-HAND LIMIT OF THE MAP?180

GEOGRAPHIC LATITUDE AT THE
BOTTOM LIMIT OF THE MAP?90

GEOGRAPHIC LATITUDE AT THE
TOP LIMIT OF THE MAP?90

MAP LENGTH IN COLUMNS(<=320)?320

MAP HEIGHT IN ROWS(<=160)?160

MAP 2

Azimuthal Equidistant Projection - A

RADIUS OF THE FINAL MAP
IN COLUMN WIDTHS (<=95)?95

REFERENCE LONGITUDE
AT CENTER OF MAP
IN DEGREES?77

REFERENCE LATITUDE
AT CENTER OF MAP
IN DEGREES?39

MAP 3

Orthographic Equatorial Projection - O

REFERENCE LONGITUDE
AT CENTER OF MAP
IN DEGREES?90

RADIUS OF THE FINISHED MAP
IN COLUMN WIDTHS (<=95)?95

MAP 4

Perspective Projection - P

RADIUS OF THE FINAL MAP
IN COLUMN WIDTHS (<=95)?95

REFERENCE LONGITUDE
AT CENTER OF MAP
IN DEGREES?-77

REFERENCE LATITUDE
AT CENTER OF MAP
IN DEGREES?39

HEIGHT OF THE OBSERVER
IN KILOMETERS?5000

AZIMUTH THAT THE OBSERVER IS FACING
FROM 0 TO 360 DEGREES
CLOCKWISE FROM TRUE NORTH?45

MAP 5

Cylindrical Projection - C

GEOGRAPHIC EAST LONGITUDE AT THE
LEFT-HAND LIMIT OF THE MAP?-15

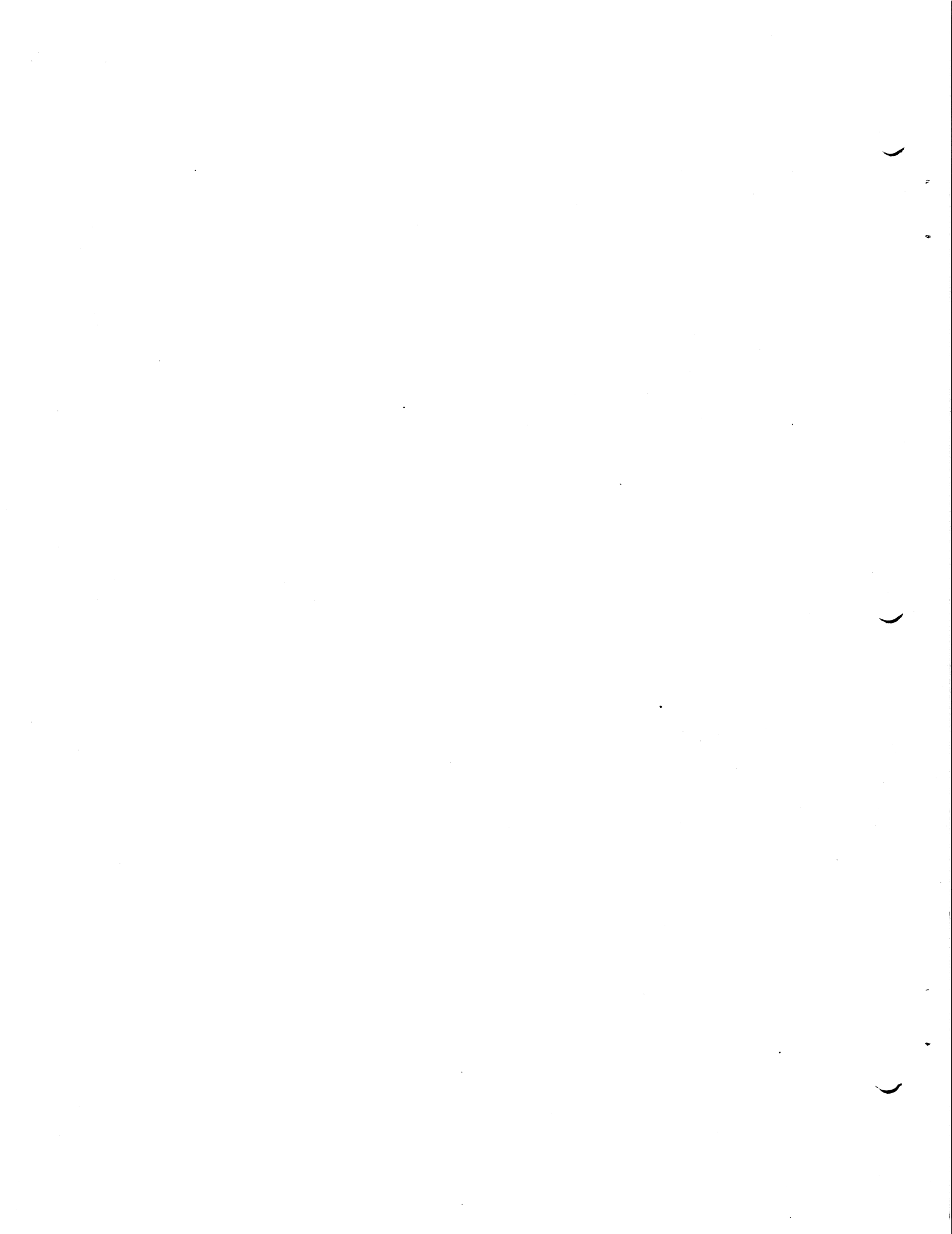
GEOGRAPHIC EAST LONGITUDE AT THE
RIGHT-HAND LIMIT OF THE MAP?45

GEOGRAPHIC LATITUDE AT THE
BOTTOM LIMIT OF THE MAP?30

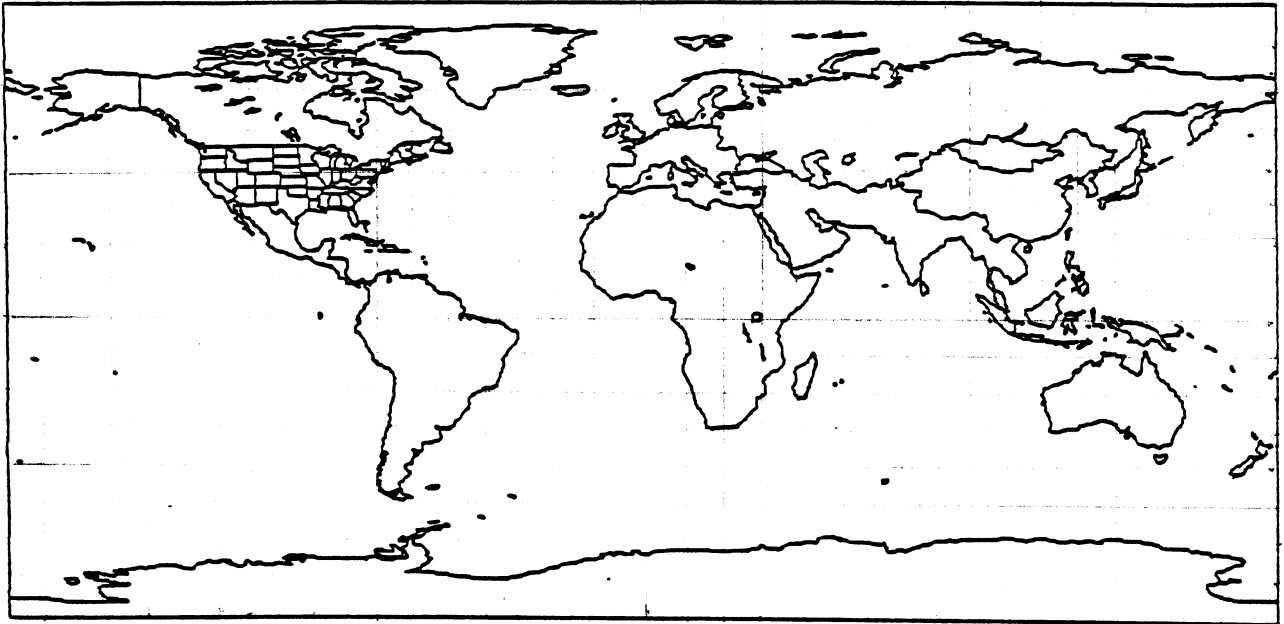
GEOGRAPHIC LATITUDE AT THE
TOP LIMIT OF THE MAP?60

MAP LENGTH IN COLUMNS(<=320)?320

MAP HEIGHT IN ROWS(<=160)?160



MAP 1



MAP 2



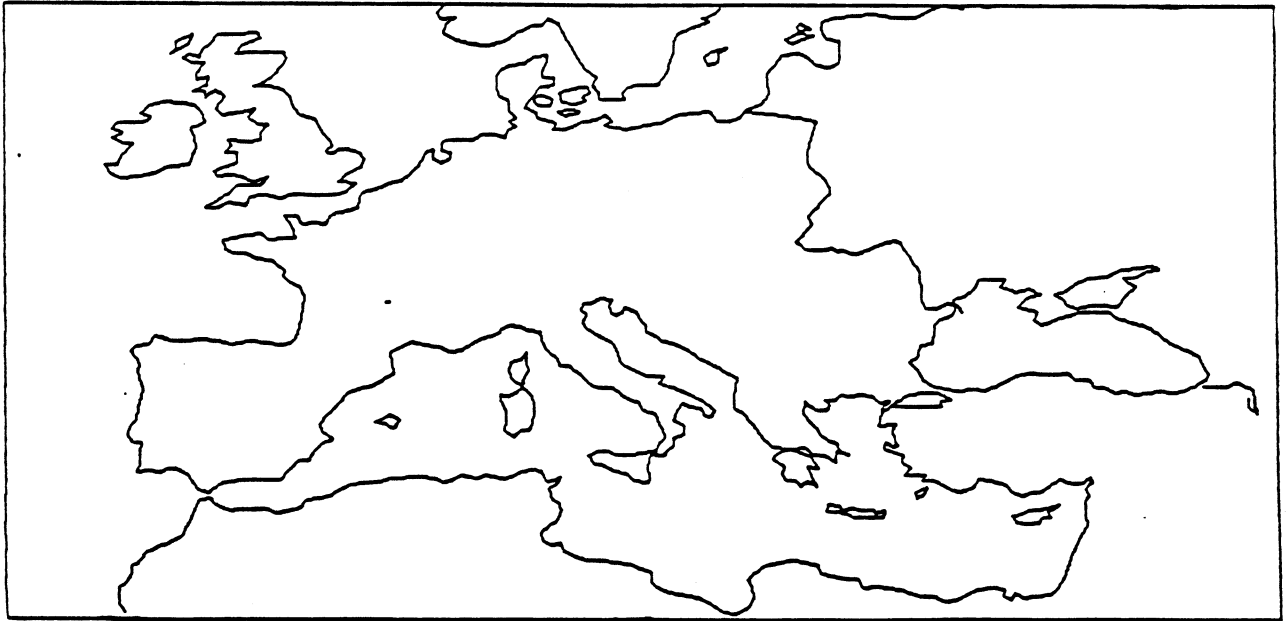
MAP 3

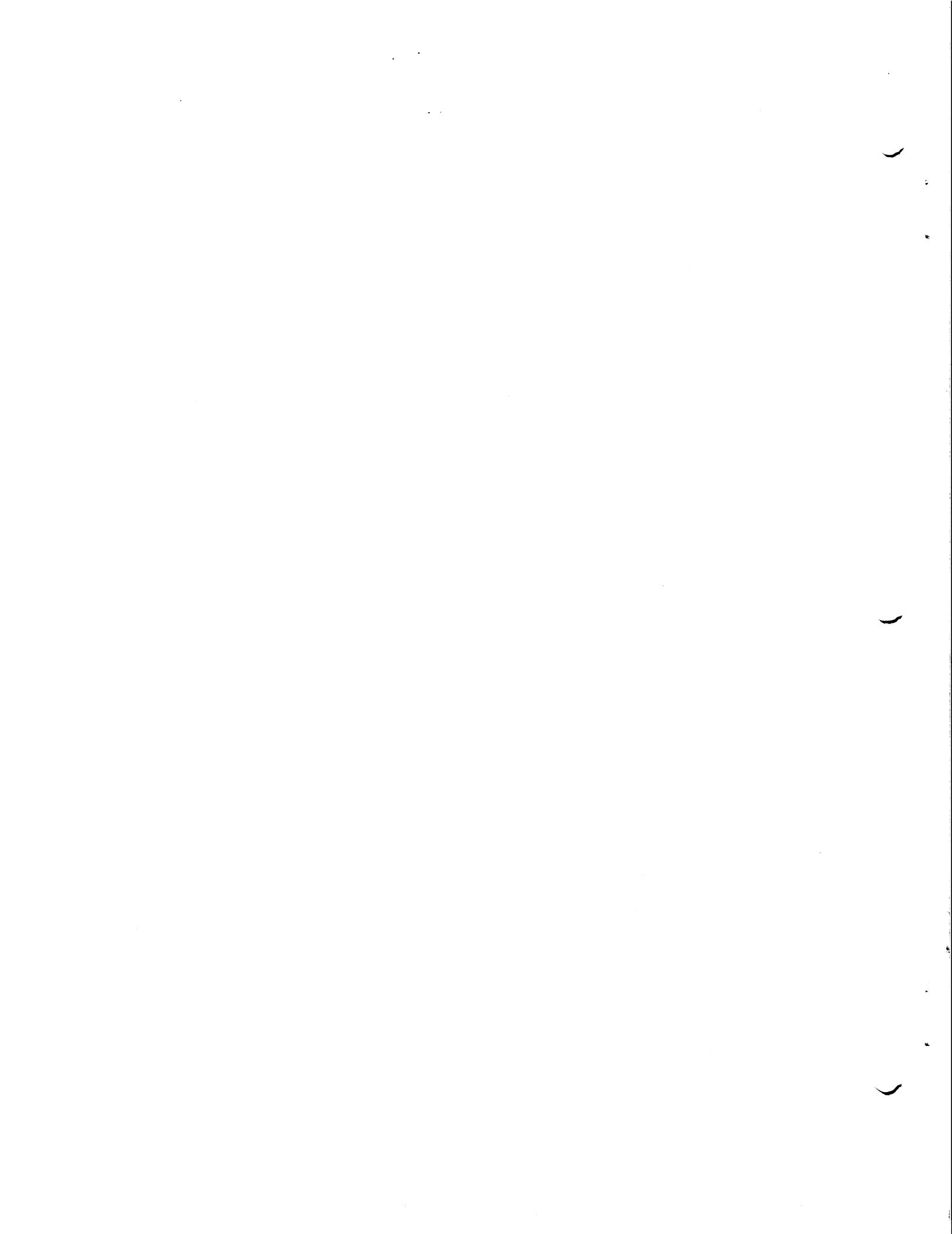


MAP 4



MAP 5





DISCLAIMER OF WARRANTY AND LIABILITY ON COMPUTER PROGRAMS

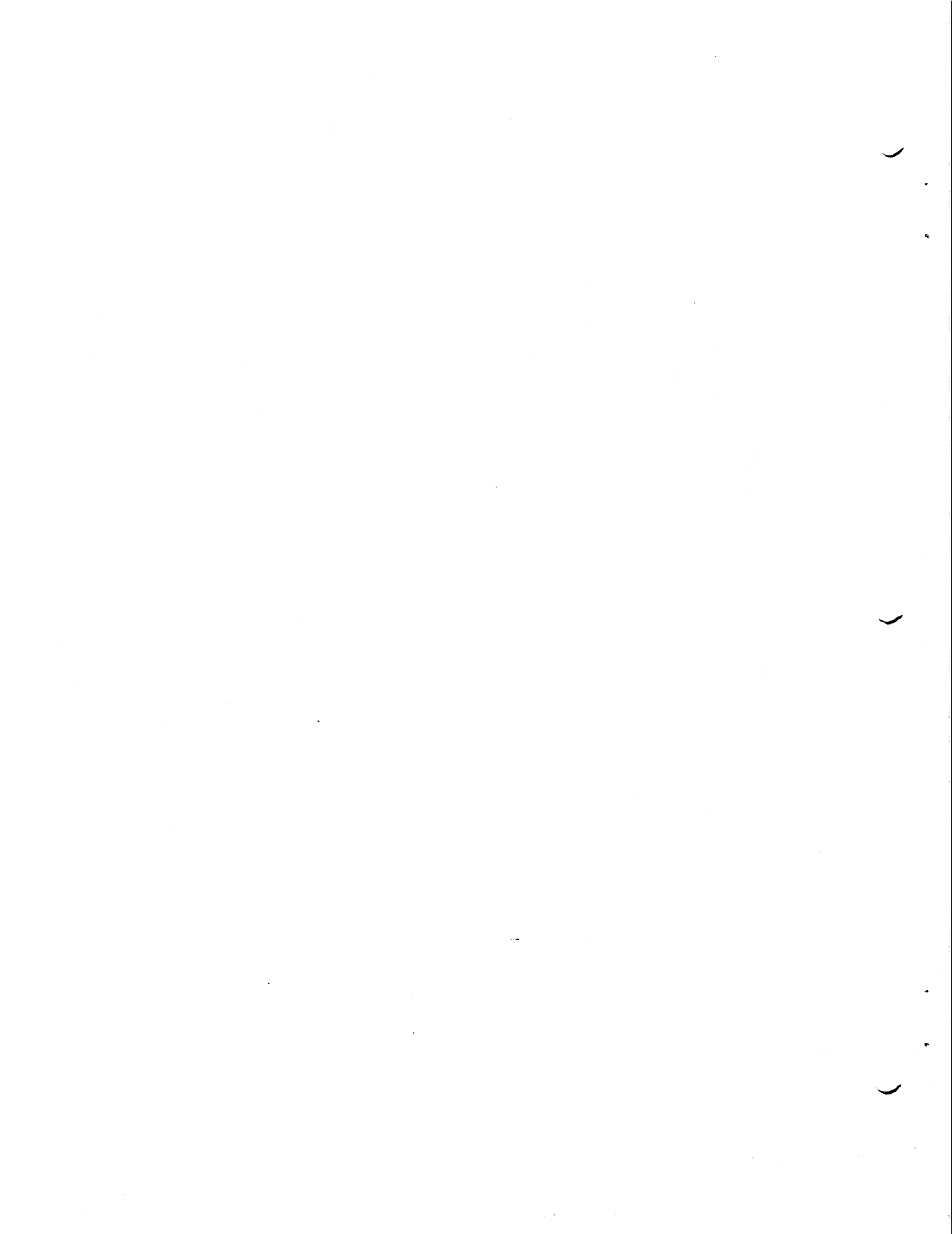
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ATARI PROGRAM EXCHANGE

REVIEW FORM

We're interested in your experiences with APX programs and documentation, both favorable and unfavorable. Many software authors are willing and eager to improve their programs if they know what users want. And, of course, we want to know about any bugs that slipped by us, so that the software author can fix them. We also want to know whether our documentation is meeting your needs. You are our best source for suggesting improvements! Please help us by taking a moment to fill in this review sheet. Fold the sheet in thirds and seal it so that the address on the bottom of the back becomes the envelope front. Thank you for helping us!

1. Name and APX number of program _____

2. If you have problems using the program, please describe them here.

3. What do you especially like about this program?

4. What do you think the program's weaknesses are?

5. How can the catalog description be more accurate and/or comprehensive?

6. On a scale of 1 to 10, 1 being "poor" and 10 being "excellent", please rate the following aspects of this program?

- _____ Easy to use
- _____ User-oriented (e.g., menus, prompts, clear language)
- _____ Enjoyable
- _____ Self-instructuve
- _____ Useful (non-game software)
- _____ Imaginative graphics and sound

7. Describe any technical errors you found in the user instructions (please give page numbers).

8. What did you especially like about the user instructions?

9. What revisions or additions would improve these instructions?

10. On a scale of 1 to 10, 1 representing "poor" and 10 representing "excellent", how would you rate the user instructions and why?

11. Other comments about the software or user instructions:

STAMP

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[seal here]