
# Three Graphics Routines Available on the MFE Cray Computers

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FUSION TECHNOLOGY INSTITUTE

UNIVERSITY OF WISCONSIN

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## INTRODUCTION

The purpose of this report is to describe three graphics routines available on the National Magnetic Fusion Energy Computer Center (MFE) Cray computers. The three routines are all based on the Issco DISSPLA library and include: 1) a routine to plot arbitrary x-y points which was written by the author in order to obtain high quality graphics output of x-y plots for publication; 2) a routine to graph countries of the world and/or states in the United States of America; the routine was written with the intent that for domestic or international meetings a graphic description of where work is being done can be obtained; 3) a routine to make a calendar of individual months of the year; the routine was taken out of the DISSPLA manual and adapted for interactive use on MFE. The intent of this third routine is for graphic illustration of timetables and schedules.

The use of each of these three routines will be described in the following sections. In general, each routine was developed to be user interactive – that is, the routine prompts the user for information. Each routine is therefore very simple to use, and even a casual user can make publication quality output with only a little experience. The underlying intent for all three routines is to make graphics output readily available for MFE users.

## EZGRAF

The EZGRAF routine was written to be particularly easy to use for a beginner. The routine prompts the user for all necessary information; no manual or guide is needed

to use EZGRAF. In fact, you do not even need to read this report. However, for those who wish to read on, I will describe some of the important features of EZGRAF.

The routine makes simple x-y plots of arbitrary data points. The data points can be entered either interactively from the terminal or they can be in a text file which is subsequently read by the routine. The routine will prompt the user for the desired method of data point input. Also, the routine will prompt for the user's choice of four different axis types (linear-linear, log-log, linear-log, log-linear), and the limits of the axes. To complete the basic plot, the x and y axes can be labeled and a four line heading can be entered.

Enhancements to the basic plot include the following:

a. Any number of sets of data points can be entered.
b. The data points can be marked and/or connected. If they are connected, a spline fit to the data points can be done. The user also has a choice of four different line types (*e.g.* solid, dotted lines).
c. A block of text can be entered on the plot to further describe the data points.
d. A grid can be specified for the plot so that data points can be read from the plot more easily.

Two additional features written into EZGRAF to facilitate its use are: 1) a file is created which contains all of the user's entered data points for all of the curves, 2) a file is created which contains all of the user's input commands. These two files can be SWITCHed, edited, and then EZGRAF can be re-executed using either the first file as a data file or using the second file as a command file. Using a command file is faster than interactive input; but the disadvantage is that the user must be careful in editing the command file or EZGRAF may produce errors. With a little experience, command files can be written from scratch; however, it is easier to first input commands interactively and have EZGRAF create a file which can then be used as a command file.

The easiest way to understand what EZGRAF does it to execute it yourself. All pertinent information is presented on the terminal screen unless command file use is specified. See the attached figures for an example of an x-y plot made with EZGRAF.

For the more experienced DISSPLA users, there also exists a more advanced plotting routine, ADVGRAF, which does everything listed above and more. For example, different fonts are available (including greek letters and superscripts), a legend can be made to label each curve, and multiple message blocks can be put on the plot. The user must have some knowledge of DISSPLA and must have at least the DISSPLA pocket guide in order to know how to switch into different fonts with the instruction alphabet.

## USAMAP

The map making routine was initially intended to make only a map of the United States of America (hence the name USAMAP). However, it was later expanded to map any and/or all of the countries of the world. Map making can become quite involved as described in part D of the DISSPLA users manual. While the USAMAP routine simplifies map making as much as possible, at least the DISSPLA pocket guide will be required to specify the type of map projection and the type of coastline and/or political boundaries.

The routine prompts the user for all the necessary information which includes the following items:

a. The page limits have been set at 12 x 12 inches; nevertheless, the user must specify the area of the map to be drawn on the page. Accordingly, the x and y dimensions must be chosen so that the map will fit into the area. For example, the United States of America is approximately twice as long in x as it is in y. Therefore, a good initial guess at the x and y dimensions would be 10, 5.

b. There is an option to have longitude and latitude lines marked and labeled. The spacing of these grid lines will be as specified in the step size (to be described later). The marking of longitudes and latitudes is useful for illustrating the limits of the map.

c. A characteristic variable of map making is the map pole. A good way to understand the concept of map pole is to discuss the azimuthal map projections concurrently. To approach the projection of a spherical three dimensional curve onto a two dimensional surface one can consider a plane just touching the sphere at one point (the map pole). Then project the spherical earth surface onto this plane by looking through the plane at the earth at a certain angle. As one looks through the plane at the earth, one can trace on the plane the outline of the world. Hence, not only is the projection important but so is the map pole in determining how the surface is viewed. This is in fact a simple description of azimuthal projections. For more information on azimuthal projections and other projections (elliptical, cylindrical, and conical) consult the DISSPLA users manual. A good starting point for a map is for the longitude and latitude of map pole to be 0, 0; and for the projection to be a conical 'albert'. See the pocket guide for a listing of the 18 different types of projections.

d. The user must specify the longitude and latitude origins, step size, and ending. The step size will determine the grid spacing as discussed in part (b) above. The origin specifies the left (and bottom) of the map; the ending specifies the right (and top) of the map. Western longitudes and southern latitudes must be marked with a minus sign in front. Furthermore, if the maps looks beyond the 180°W longitude (*i.e.* $-180$) the use of the minus sign must continue. For example, to cover the entire globe longitudes with 90°W in the middle, the longitudes will start at $-270$ and end at $+90$.

e. The type of coastline must next be specified. Once again, refer to the pocket guide for a list of choices (there are at least 10 choices). If 'mapdta' is specified, all the coastlines within the longitudes and latitudes specified are drawn. If only the United States of America is desired the 'usal', 'usam', or 'usah' should be specified for low, medium, or high resolution.

f. If political boundaries (*i.e.* countries) are wanted the next step is to specify which boundaries. See the pocket guide for a list of the seven choices. The choice 'political' will draw in the countries within the longitude and latitude limits.

At this point, the map is completed but there are additional options for a heading, for messages, and for curves. For a message (such as a name of a city) merely type in the message and then the routine prompts for the longitude and latitude of the beginning of the message. An unlimited number of messages can be specified. In order to put curves on the map (*e.g.* a line connecting two cities) merely specify how many points there are and then enter the longitudes and latitudes when prompted by the routine. An unlimited number of curves can be drawn. See the attached figures for two examples of the possible maps.

It may be useful to run the routine using a COSMOS job control file once the order of commands is known. In this way changes can be easily made and the routine re-executed with a minimum of effort.

## CALENDAR

The calendar routine was taken from the DISSPLA manual and adapted for interactive use on MFE. There is also an option to make the calendar with a command file instead of interactively. The routine is very simple to use. The routine first prompts for either interactive or command file use. When interactive use is specified additional prompts are:

a. the year (*e.g.* 1984);
b. the month (*e.g.* 6 for june);
c. the number of holidays in the month;
d. the dates of the holidays (if (c) is greater than zero);
e. the day of the month that the user wants to put a message;
f. the message corresponding to (e) above;
g. parts (e) and (f) are repeated as much as the user wishes;
h. another month can be done in the same graphics file if the user wants.

At termination of the routine a text file is created. The file will contain all the user input commands. This file can be SWITCHed, edited, and then the calendar routine can be re-executed with the command file option. See the attached figures for an example of a month along with its command file.

## EXECUTION

To obtain the three above described routines on either of the MFE Crays, type:

filem read 14373 .misc xezgraf xusamap xcalenda!end / *t v*

To execute simply type:

xezgraf / *t v*

or

xusamap / *t v*

or

xcalenda / *t v*

## ACKNOWLEDGMENTS

I would like to thank Lori Wong, Pam Kahn, and Neil O'Neill of MFE for their help in debugging parts of these programs. Also, I thank Prof. Wolfer for allowing me the opportunity to work on these routines.

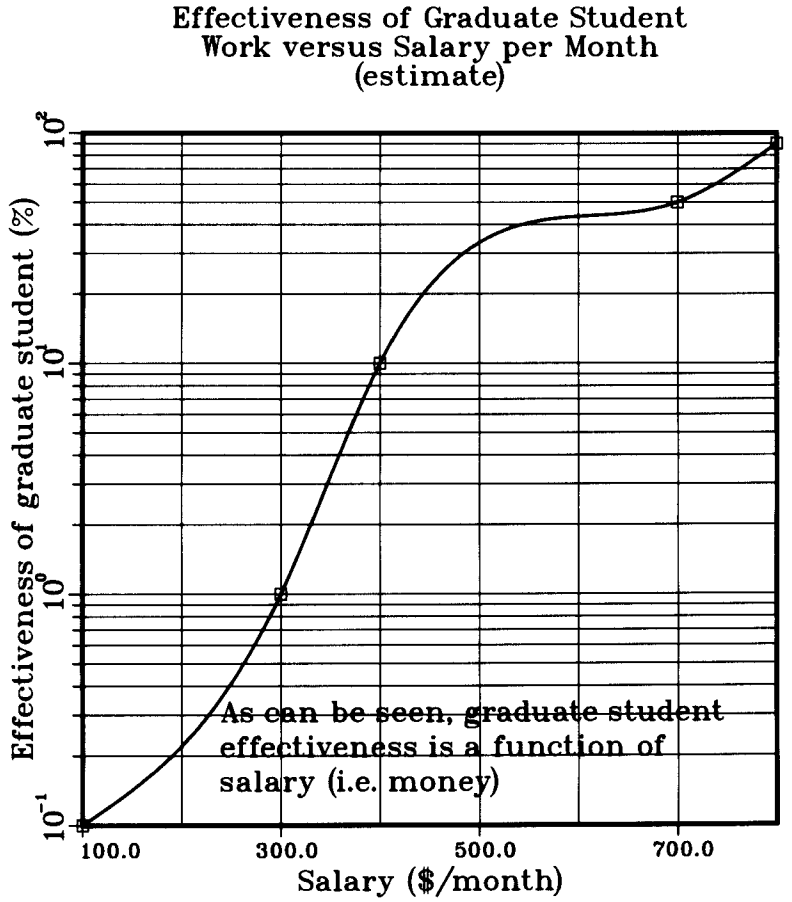


Figure 1. An example of an EZGRAF plot.

```
1 *select printlog=ezfile
2 *xezgraf

   this is ezplot. it is designed to draw a graph of arbitary data points.
   the graphics library disspla is used.
   written by b.b.glasgow, university of wisconsin - madison.

   do you want to input your commands from the terminal
   or from a previously prepared input command file?
   1-terminal,0-file.
3  1

   you will be given a choice of inputing your data points
   manually through the screen or by reading a text file.
   if you choose to input through a text file, the file
   must be set up as a text file with two entries per line,
   the x and y values. the format is free format - that is,
   input as integer, real, exponential notation, separated
   by a comma or a space.
   if you want to input two of more sets of curves through
   the text file, the sets of data must follow one another.
   you can have a maximum of 1000 points for each curve.
   if you input from the screen your data will be saved.
   you must know either the number of points for the curve
   or have the line after the last data point contain the
   words - the end. each line you input from the screen will
   be saved in a text file. the file can be slightly modified
   and used as a command file if you need to rerun the
   program in case of an error you made.

   good luck. if you have questions contact bruce glasgow.



   type in your box number and id in the form
   box ann idname.  idname must be less than 8 characters.
4 box w14 14373
   if you have a tektronics or guss monitor, do you
   want the graph displayed interactively? 1-yes,0-no.
   you must answer no if you do not have one of these devices.
5  0
```

Figure 1a. The sequence of commands to produce Fig. 1.

```
   type in the x and y dimensions of your graph.
   - maximum of 9.0 by 9.0 inches.
 6 5. , 5.
   with a maximum of 70 characters,
   what do you want to call the x axis?
 7 Salary ($/month)
   with a maximum of 70 characters,
   what do you want to call the y axis?
 8 Effectiveness of graduate student (%)
   with a maximum of 70 characters,
   what do you want to call line 1 of the heading?
 9 Effectiveness of Graduate Student
   with a maximum of 70 characters,
   what do you want to call line 2 of the heading?
10 Work versus Salary per Month
   with a maximum of 70 characters,
   what do you want to call line 3 of the heading?
11 (estimate)
   with a maximum of 70 characters,
   what do you want to call line 4 of the heading?
12
   what type of graph do you want?
   type 1 for linear-linear,
   type 2 for xlog-ylinear,
   type 3 for ylog-xlinear,
   type 4 for log-log.
13 3
   the parameters of interest depending on the type of plot are:
   orig = value at the origin
   stp = step size in units
   max = value at the end of the axis
   cycle = number of cycles

   input graph parameters in free format.
   type in the xorig,xstp,xmax,yorig,ycycle.
14 100. , 200. , 800. , 0.1 , 3.
   do you want a grid on your graph? 1-yes,0-no.
15 1
   type in the number of grid lines per step;
   two integers:  one for x, one for y.
16 2 , 1
```

Figure 1a. (continued)

```
    do you want to specify a input data file for later use?
    1-yes,0-no.
17  0
    type in the number of data points for the curve.
    if you are not sure use 1000 but the line after the last
    point must contain the two words - the end.
18  1000
    for data point     1 out of 1000,
    type x-coordinate, y-coordinate <cr>
19  100. , 0.1
    for data point     2 out of 1000,
    type x-coordinate, y-coordinate <cr>
20  300. , 1.
    for data point     3 out of 1000,
    type x-coordinate, y-coordinate <cr>
21  400. , 10.
    for data point     4 out of 1000,
    type x-coordinate, y-coordinate <cr>
22  700. , 50.
    for data point     5 out of 1000,
    type x-coordinate, y-coordinate <cr>
23  800. , 90.
    for data point     6 out of 1000,
    type x-coordinate, y-coordinate <cr>
24 the end
    do you want to review your data points? 1-yes,0-no
25  0
    your data points have been written into file holdpnts.
    but next time you execute xezplot, they will be gone.
    if you want to save them, copy holdpnts into another file
    at the end of this execution.

    do you want the points marked? 1-yes,0-no.
    if you want the points marked but not connected type -1.
26  1
    do you want a spline fit to your curve?
    be careful, a spline fit may produce funny results.
    1-yes,0-no.
27  1
    what type of line do you want connecting the points?
    0-solid,1-dot,2-dash,3-chaindot,4-chaindash
```

Figure 1a. (continued)

```
28  0
    do you want another curve on same graph? 1-yes,0-no.
29  0
    do you want messages on the graph? 1-yes,0-no.
30  1
    where do you want the message located?
    type in the position in inches of the lower left corner
    of the first line of the message.
    remember your graph is 5.0000 by 5.0000 inches.
31  1.0 , .75
    with a maximum of 35 characters,
    type in line  1 of your message.
    type a period in the first column [.<cr>] to end messages.
32 As can be seen, graduate student
    with a maximum of 35 characters,
    type in line  2 of your message.
    type a period in the first column [.<cr>] to end messages.
33 effectiveness is a function of
    with a maximum of 35 characters,
    type in line  3 of your message.
    type a period in the first column [.<cr>] to end messages.
34 salary (i.e. money)
    with a maximum of 35 characters,
    type in line  4 of your message.
    type a period in the first column [.<cr>] to end messages.
35 .
    do you want another plot in the same graphics file?
    1-yes,0-no.
36  0
    your graphics file is called fa*ezp0x.

    your points have been saved in file holdpnts.
    a command file holdcmds has been created for you in case
    you want to rerun this graph with minor changes - just
    edit the command file. but be careful, you will not get any
    error messages if you make a mistake.
    you must copy or switch the hold files to other names
    because next time you execute the files will be destroyed.

    you might check file disout* for any disspla messages.

    all done
```

Figure 1a. (continued)

A World Map

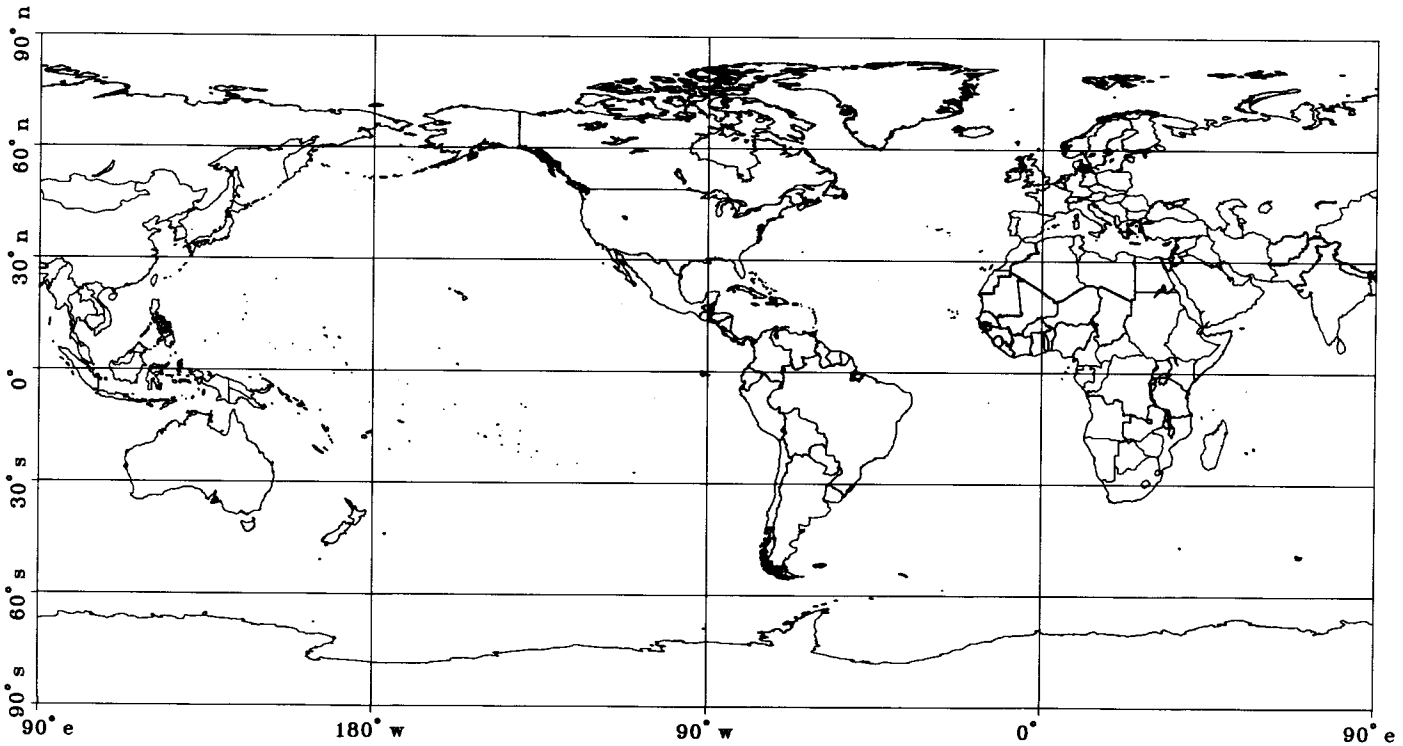


Figure 2. An example of a USAMAP plot.

```
 1 *select printlog=2file
 2 *xusamap
   type in the area2d x and y dimensions. max 11.,11.
 3 11 5
   do you want long. and lat. marked? 0-no,1-yes.
 4 1
   type in mapole long. and lat. default 0,0.
 5 -90 0
   type in the type of projection you want.
 6 cylindrical
   type the long. orig,step,max and lat. orig,step,max.
 7 -270 90 90 -90 30 90
   type in the mapfil coastline you want.
 8 coast
   type in the mapfil political you want,
   or type none.
 9 political
   type in your heading up to 80 characters.
10 A World Map
   type in your message. type [.<cr>] to quit.
11 .
   do you want any curves on this map? 0-no,1-yes.
12 0

   all done
```

Figure 2a. The sequence of commands to produce Fig. 2.

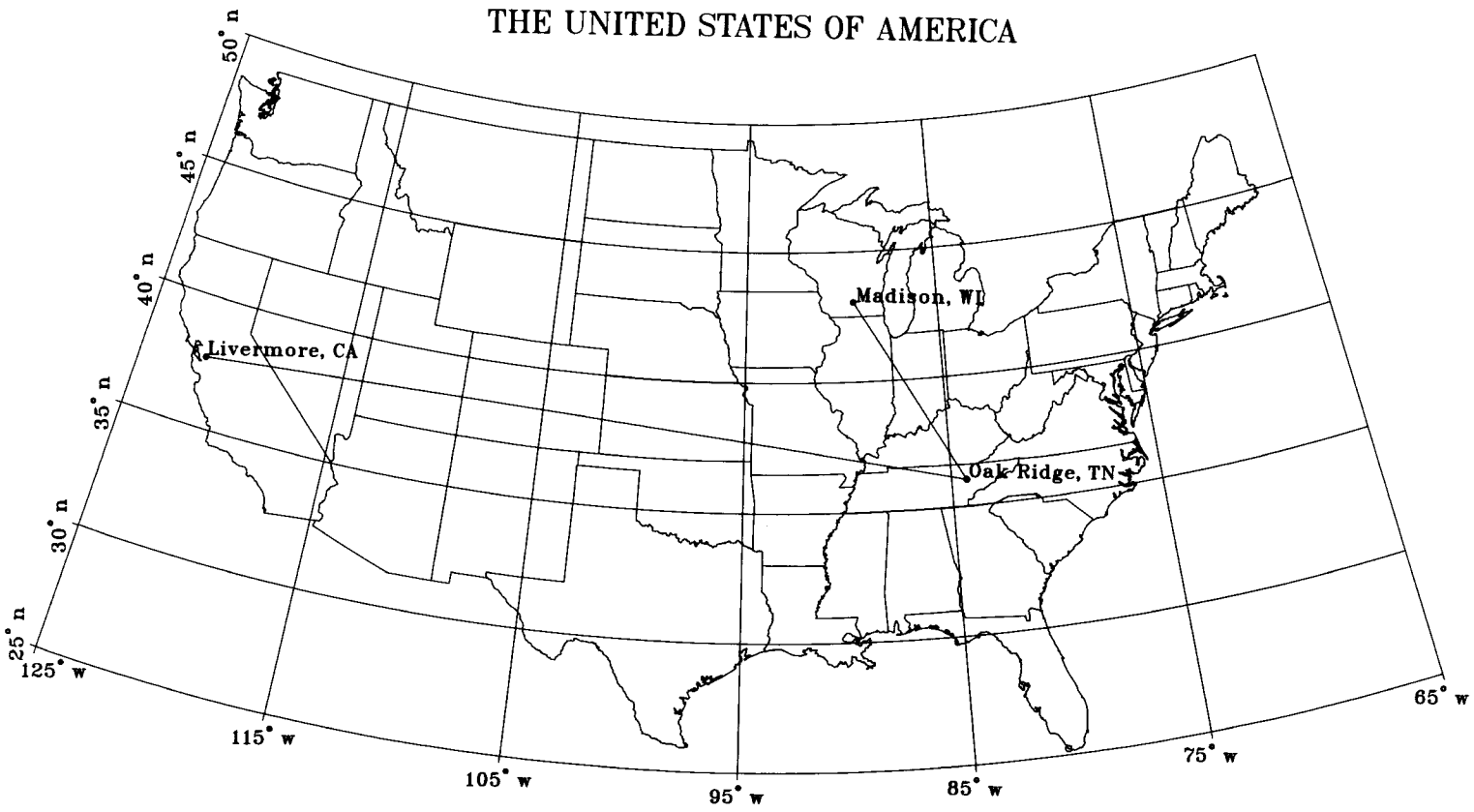


Figure 3. An example of a USAMAP plot.

```
 1 *select printlog=1file
 2 *xusamap
   type in the area2d x and y dimensions. max 11.,11.
 3 11 5
   do you want long. and lat. marked? 0-no,1-yes.
 4 1
   type in mapole long. and lat. default 0,0.
 5 0 0
   type in the type of projection you want.
 6 albert
   type the long. orig,step,max and lat. orig,step,max.
 7 -125 10 -65 25 5 50
   type in the mapfil coastline you want.
 8 usah
   type in the mapfil political you want,
   or type none.
 9 none
   type in your heading up to 80 characters.
10 THE UNITED STATES OF AMERICA
   type in your message. type [.<cr>] to quit.
11 Madison, WI
   type in the longitude and latitude of this message.
12 -89.2 43.1
   type in your message. type [.<cr>] to quit.
13 Oak Ridge, TN
   type in the longitude and latitude of this message.
14 -84.1 36.1
   type in your message. type [.<cr>] to quit.
15 Livermore, CA
   type in the longitude and latitude of this message.
16 -121.7 37.8
   type in your message. type [.<cr>] to quit.
17 .
   do you want any curves on this map? 0-no,1-yes.
18 1
   how many points are in this curve? max 100.
19 2
   do you want the points marked? 0-no,1-yes,
   -1-marked but not connected.
20 1
   type in the long. and lat. of point  1 out of  2
```

Figure 3a. The sequence of commands to produce Fig. 3.

```
21 -89.39 43.07
    type in the long. and lat. of point  2 out of  2
22 -84.27 36.01
    do you want another curve? 0-no,1-yes.
23 1
    how many points are in this curve? max 100.
24 2
    do you want the points marked? 0-no,1-yes,
    -1-marked but not connected.
25 1
    type in the long. and lat. of point  1 out of  2
26 -84.27 36.01
    type in the long. and lat. of point  2 out of  2
27 -121.78 37.68
    do you want another curve? 0-no,1-yes.
28 0

    all done
```

Figure 3a. (continued)

# SEPTEMBER

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| | | | | | | 1 |
| 2 | 3 *Labor Day* | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 *Full Moon* | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 *First Day of Autumn* |
| 23 | 24 | 25 *New Moon* | 26 | 27 *Rosh Hashanah* | 28 | 29 |
| 30 | | | | | | |

Figure 4. An example of a CALENDAR plot.

```
 1 *select printlog=calfile
 2 *xcalenda
   do you want to read the commands from a
   file or a terminal? 1-file,0-terminal
 3  0
   what year? (i.e. 1984)
 4  1984
   what month? (a number,i.e. 6 for june)
 5  9
   type in the number of holidays, from 0-20
 6  3
   type in the dates separated by a comma.
 7  3 , 22 , 27
   type in the day of the month where you want to put
   a message. type 0 if no message or your last message.
 8  3
   type in your message
   - but keep it less than 19 letters.
 9 Labor Day
   type in the day of the month where you want to put
   a message. type 0 if no message or your last message.
10  10
   type in your message
   - but keep it less than 19 letters.
11 Full Moon
   type in the day of the month where you want to put
   a message. type 0 if no message or your last message.
12  22
   type in your message
   - but keep it less than 19 letters.
13 First Day of Autumn
   type in the day of the month where you want to put
   a message. type 0 if no message or your last message.
14  25
   type in your message
   - but keep it less than 19 letters.
15 New Moon
   type in the day of the month where you want to put
   a message. type 0 if no message or your last message.
16  27
   type in your message
```

Figure 4a. The sequence of commands to produce Fig. 4.

```
    - but keep it less than 19 letters.
17 Rosh Hashanah
    type in the day of the month where you want to put
    a message. type 0 if no message or your last message.
18  0
    do you want another month? 1-yes,0-no
19  0
    your commands have been written into file holdcmd.
    you must copy or switch this file to another name if you
    wish to re-execute with this command file, or else the file
    will disappear the next time you execute.

    all done
```

Figure 4a. (continued)