Introduction to
UNIX
and the
SUN
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounts and Passwords</td>
<td>1</td>
</tr>
<tr>
<td>Accounts</td>
<td>1</td>
</tr>
<tr>
<td>Passwords</td>
<td>1</td>
</tr>
<tr>
<td>Logging On and Logging Off</td>
<td>2</td>
</tr>
<tr>
<td>Logging on from a Sun Workstation</td>
<td>2</td>
</tr>
<tr>
<td>Logging off from a Sun Workstation</td>
<td>2</td>
</tr>
<tr>
<td>Logging on from a machine other than a Sun Workstation</td>
<td>3</td>
</tr>
<tr>
<td>Logging off from a machine other than a Sun Workstation</td>
<td>3</td>
</tr>
<tr>
<td>Common Desktop Environment (CDE)</td>
<td>3</td>
</tr>
<tr>
<td>About CDE</td>
<td>3</td>
</tr>
<tr>
<td>The Front Panel</td>
<td>4</td>
</tr>
<tr>
<td>Using the Front Panel</td>
<td>5</td>
</tr>
<tr>
<td>Pull Down Menus</td>
<td>5</td>
</tr>
<tr>
<td>On-Line Help</td>
<td>6</td>
</tr>
<tr>
<td>Files</td>
<td>6</td>
</tr>
<tr>
<td>File Structure</td>
<td>6</td>
</tr>
<tr>
<td>Listing Files</td>
<td>6</td>
</tr>
<tr>
<td>File Names and File and Directory Commands</td>
<td>8</td>
</tr>
<tr>
<td>Moving Around the File System</td>
<td>8</td>
</tr>
<tr>
<td>Using the Pico Editor</td>
<td>9</td>
</tr>
<tr>
<td>Invoking Pico</td>
<td>9</td>
</tr>
<tr>
<td>Pico Commands</td>
<td>10</td>
</tr>
<tr>
<td>Editing Your File</td>
<td>11</td>
</tr>
<tr>
<td>Printing</td>
<td>12</td>
</tr>
<tr>
<td>Printing a File</td>
<td>13</td>
</tr>
<tr>
<td>Redirecting Terminal Output to the Printer</td>
<td>13</td>
</tr>
<tr>
<td>Retrieving Output</td>
<td>13</td>
</tr>
<tr>
<td>Using a Laser Printer</td>
<td>13</td>
</tr>
<tr>
<td>Navigating the Internet from a Sun Workstation</td>
<td>14</td>
</tr>
<tr>
<td>Netscape</td>
<td>14</td>
</tr>
<tr>
<td>Telnet and FTP</td>
<td>14</td>
</tr>
<tr>
<td>Telnet</td>
<td>14</td>
</tr>
<tr>
<td>FTP</td>
<td>15</td>
</tr>
<tr>
<td>Listservs and Usenet</td>
<td>15</td>
</tr>
<tr>
<td>Listserv</td>
<td>15</td>
</tr>
<tr>
<td>Usenet</td>
<td>16</td>
</tr>
<tr>
<td>Unix Pipes and Filters</td>
<td>16</td>
</tr>
<tr>
<td>Filters</td>
<td>16</td>
</tr>
<tr>
<td>Input-Output Redirection</td>
<td>17</td>
</tr>
<tr>
<td>Pipes</td>
<td>18</td>
</tr>
<tr>
<td>Running Common Programs</td>
<td>18</td>
</tr>
<tr>
<td>Running C Programs</td>
<td>18</td>
</tr>
<tr>
<td>Running Fortran Programs</td>
<td>19</td>
</tr>
<tr>
<td>A Summary of Solaris Commands</td>
<td>21</td>
</tr>
<tr>
<td>Sun Software</td>
<td>23</td>
</tr>
</tbody>
</table>
Accounts and Passwords

Accounts

General Access Accounts
All students are assigned a General Access account on BINGSUNS at the start of each semester. Students can obtain their account information, userID, and password by accessing the Binghamton University Student Information (BUSI) database from any public terminal or microcomputer on campus. See the Computing Services document Using BUSI for more information.

Instructional Accounts
BINGSUN accounts for course instructors are authorized through their department coordinator; if possible, instructors should arrange accounts for their students at the same time.

Course Accounts
Accounts for students who need to use the Sun for their course work must be set up by the course instructor through their department coordinator.

Research Accounts
BINGSUN accounts for research purposes may be arranged through department coordinators.

Passwords

A common assumption is that if one has nothing private in their account, then changing passwords is unnecessary. However, passwords protect much more than just the privacy of one’s e-mail and files. Intruders who gain access to accounts can erase files, send e-mail and/or harassing messages in the account owner’s name, and in some cases launch entry attacks on other systems from the owner’s account. A “hacked” account becomes a liability to the owner, to the owner’s colleagues, and to the institution.

You should change your password the first time you log on to your account and once every month or so thereafter. BINGSUNS passwords should be between six and eight characters. A password MUST contain at least one numeric or special character and at least two alphabetic characters.

IMPORTANT NOTE: CDE only accepts the first eight characters of your password. If your password is greater than eight characters, enter the first eight characters only! If you enter more than eight characters you will get an “invalid login” message.

How to Change Your BINGSUNS Password
1) Log on to your BINGSUNS account as you normally would.
2) Type passwd (in lowercase) from the BINGSUNS system prompt and <RETURN>. You’ll see this message:
   /usr/bin/nispasswd: Changing password for J Doe
   Enter login(NIS+) password:
3) Enter your current BINGSUNS password and <RETURN>. (This password change does NOT affect your BingNet/E-mail password.) You’ll see the following message asking for a new password:
   New password:
4) Enter a new password. Press <RETURN>.
5) You’ll then be asked to enter your new password again:
   Re-enter new password:
6) Then you’ll see a message saying:
   NIS+ password information changed for J Doe
   NIS+ credential information changed for J Doe
   bingsun2%
You’ll then be automatically returned to the BINGSUNS system prompt.

**What To Do If You Lose Your Password**
If you’re unable to log on the system because you’ve forgotten your password, you’ll have to get your password reset. To get your password reset, bring your validated University ID to the Computer Center Help Desk, Computer Center room 102B and explain your problem. This should be done as soon as you’re aware of the problem because someone else may have illegally accessed your account.

**Logging On and Logging Off**

The Solaris operating system on the Suns is case sensitive. When logging on to a Sun Workstation or BINGSUNS, you should *always* log on using lower-case letters. If you accidentally enter your userID or password in upper-case, log out and redo the logon procedure using lower-case characters.

**Logging on from a Sun Workstation:**
Public Sun Workstations on campus use the Common Desktop Environment (CDE). Sun Workstations can be found in South POD classrooms 1 and 3, and in the West POD.

1) If you are logging on from a Sun Workstation using CDE, you’ll see a graphic screen box that asks for your user name. Type in your userID and press <RETURN>.
2) You’ll see another box asking for your password. Type in your BINGSUNS password and press <RETURN>.

**Logging off from a Sun Workstation:**
1) Close all applications and windows.
2) Using the mouse, click on the **EXIT** button in the middle of the Front Panel menu bar, or select **Log Out** from the Workspace menu.
3) You’ll see a logout verification dialog box. Read it and click on the OK button — you’re now logged out.

**Logging on from a machine other than a Sun Workstation:**
1) Get a copy of the *Logon Quick Reference Card* for instruction on how to connect to the Sun system from the machine you are working on.
2) Once you are connected to the Sun system, you’ll be prompted for your login ID (userID). For example: 
   
   bingsunl login:

3) Type in your userID and press <RETURN>.
4) You’ll be prompted for your password. Type in your BINGSUNS password and press <RETURN>.

If you’ve entered your logon information correctly, you’ll get a series of messages similar to:

```
Last login: Tue Oct 14 14:05:44 from 128.226.105.43
Sun Microsystems Inc.  SunOS 5.5.1  Generic May 1995

******************************************************************************************
Message of the day........
******************************************************************************************

Disk quotas for bzs9999 (uid 2222):
Filesystem usage quota limit timeleft files quota limit timeleft
/u0/users 734 2000 2100 102 0 0
bingsun1%```
These messages include the date and time of your last login, the message of the day (if there is one), and information about your disk quotas. Note that the system prompt is the name of your machine followed by a percent sign (%).

If you haven’t entered a valid userID and password, you’ll again be prompted for this information. If you believe that you’ve entered everything correctly and still aren’t allowed access to the system, come to the Computing Services Help Desk, located on the first floor (rm. 102) of the Computer Center, for assistance.

**Logging off from a machine other than a Sun Workstation:**

1) Type `logout` at the system prompt. (You can also log out by using control-d. Hold down the control key (labeled <Ctrl>) and press the letter d.)

If you receive the message: There are stopped jobs. — you are not logged off! This message means that a job (or jobs) you’ve initiated has been stopped by you (probably using <Ctrl> z). At this point you should identify the stopped job (or jobs) and kill it. To identify your current processes, both stopped and running, enter `jobs` at the system prompt. This command displays any processes you’ve initiated, their status (running or stopped), and the process number enclosed in square brackets. For example, if you stopped an emacs editing session on some program, say progl.c, the output from the `jobs` command would be:

```
[1] +Stopped   emacs progl.c
```

You should then either resume the editing session with the command `fg` (for foreground) and exit the process normally or kill the process by typing `kill -9 %1` which causes the process numbered [1] to exit. This should be done with any other processes that you don’t intentionally choose to leave running in the background.

**Common Desktop Environment (CDE)**

**About CDE:**

- The Solaris Common Desktop Environment (CDE) is an easy-to-use interface that provides a consistent look and feel across UNIX environments.
- SunSoft, Inc., Hewlett-Packard Company, IBM Corporation, and Novell, Inc. each contributed technologies to establish a new standard for user and application interfaces based on the X-Window System and Motif.
- CDE (Common Desktop Environment) is the default window manager for Sun Workstations in public areas, such as the PODs.
- CDE has been customized to reflect the software applications currently on the Suns.
- Users can customize the desktop in CDE.
The Front Panel

An icon menu, called a Front Panel, at the bottom of the screen gives you easy point and click access to applications, print options, help, directories, and more.

Front Panel:

- Clicking the left mouse button on a Front Panel icon will give you the default option for that selection.
- Clicking the left mouse button on an arrow above a Front Panel icon will bring up a submenu with other options.

Network Applications Submenu:

Front Panel Icon Descriptions

Entries in bold denote icon defaults.

- **CLOCK**: Displays the current time.
- **FILE MANAGER**: Provides a graphical display of your files and directories.
- **PINE MAIL**: Invokes Pine.
- **EDITORS & IMAGE TOOLS**: Provides access to **vi**, Emacs, pico, WordPerfect, Image Viewer and xv.
- **REMOTE LOGINS**: Opens a local window or a telnet session to BINGSUNS, BINGVMB, BINGTW or Elixir.
- **WORKSPACE SWITCH**: A control that enables you to select from among multiple virtual screens.
- **SUN APPLICATIONS**: Provides access to Maple, Matlab, Minitab, PV-WAVE and SAS, as well as a description of these applications.
- **NETWORK APPLICATIONS**: Provides access to Netscape Navigator, and Xarchie.
• **STYLE MANAGER**: Allows you to customize the appearance of your CDE session (i.e. color, font, backdrop, and so on.) NOTE: To save changes permanently, you must restart the Workspace Manager by selecting Restart Workspace Manager... from the Workspace menu. (See pull down menus section below.)

• **PRINT OPTIONS**: Provides drag and drop ability or dialog box interaction to dlpr, cclaser1 and cclaser2.

• **HELP**: Provides on-line help.

• **TRASH**: A container to which you drag and drop files to be deleted. Files remain in the trash can until you shred them or log off.

### Using the Front Panel

The Front Panel is a special desktop window that contains a set of icons and buttons (controls) you use often. The two main elements of the Front Panel are the Main Panel, which includes the workspace switch, and the subpanels. If a control in the Main Panel has an arrow button on top of it, then that control has a subpanel. The workspace switch contains the buttons you use to change from one workspace to another. Each workspace occupies the entire display and the Front Panel moves with you as you switch workspaces. (Workspaces multiply the amount of display area available for windows.)

**To activate a Front Panel Control**

• Click on a control.

• The clock and the busy light do not have a click action.

**To open a Subpanel**

• Click the arrow button above the control.

**To close a Subpanel**

• The subpanel closes automatically after you make a selection from it unless you have moved the subpanel from its original location.

• Click the down arrow on the subpanel.

**To move the Front Panel or a Subpanel**

• Subpanels are moved like other windows, by dragging the title bar.

• The Front Panel is moved by clicking on and dragging the far left or right horizontally lined boxes (move handles).

**To Minimize the Front Panel**

• Click the dot (.) in the upper right hand corner of the Front Panel to turn it into an icon.

### Pull Down Menus:

As an alternative to the Front Panel, you can use pull down menus.

- To access the Applications menu, move your cursor to the background section of the screen and click the left mouse button.

- To access the default CDE Workspace menu, move your cursor to the background section of the screen and click the right mouse button.
On-line Help

On-line help is available for CDE; click the ? icon on the Front Panel or from the Workspace Menu and select Programs; under Programs, select help.

Files

Everything in the Sun operating system can be considered a file, and every file is just a sequence of bytes (characters). "No structure is imposed on the file by the system, and no meaning is attached to its contents—the meaning of the bytes depends solely in the programs that interpret the file. This isn't just true of disc files but of peripheral devices as well. Magnetic tapes, mail messages, characters typed on the keyboard, line printer output, data flowing in pipes—each of these files is just a sequence of bytes as far as the system and the programs in it are concerned."

File Structure

The Sun file system is organized in a tree structure. The first level, or root directory, is designated by a slash (/). There are branches extending off the root (etc, dev, tmp, usr,...) that each contain groups of related files. Each of these directories may or may not have its own branches, or subdirectories. The system does not impose any limit to the number of branches on branches, or subdirectories within subdirectories, other than the amount of available disc storage.

When you log on to the Sun, you are placed in your home directory. Each user has a unique home directory identified by their userID. To see which directory you are in, type the command:

```
pwd
```

which stands for present working directory.

Listing Files

To list the contents of your present directory, enter the command

```
ls
```

If you haven't created any files yet, you'll probably see only a file named bin (a directory for storing your executable files). You do own some other files; to see their names, enter the command:

```
ls -al
```

This will produce a more informative listing of all the files in your present directory. It will probably look something like this:

```
total 17
    drwx-x       3 bb09999  512 May 8  14:16 .
    drwxr-xr-x69 8 root 11264 Apr 29 10:56 ..
    -rwx-------- 1 bb09999  190 Jan 15 10:28 .cshrc
    -rwx-------- 1 bb09999  243 Jan 15 10:28 .login
    -rwx-------- 1 bb09999  142 Jan 15 10:28 .profile
    drwx-------- 2 bb09999  512 Jan 15 10:28 bin
    -rw-------- 1 bb09999  177 Jan 15 10:28 .logout
```

Filenames

The filenames are listed in the rightmost column. Those beginning with a period (.) are only displayed when you specify the -a (show all) option with the ls command. These "dot" files are files that are usually used by the system. For instance, the .cshrc, .login, and .profile are executed when you log on. They give the system information about your working environment and set up system default values.
File Information
The `-l` option of the `ls` command causes `ls` to list more information about your files. The three columns to the left of the filename contain the date and time of the last edit on the file or, if never edited, when it was created. The number to the left of the date is the number of bytes (characters) in the file. The column to the left of the filesize is the userID of the owner of the file.

You’ll notice that the first file listed when you execute `ls -al` is the file named `. (period). This refers to your present working directory; in the case of user `bb09999`, it is her home directory, which let’s say for illustration purposes, is located at `/u0/users/1/bb09999`. The second file listed is called `..` (two periods). This refers to the parent directory of your present directory. For user `bb09999`, it refers to the directory `/u0/users/1`. The owner of this file, `..`, is called root. Root is the userID of the “super user” used for system administrative purposes. Every directory has both a `. (period) and `..` (two periods) directory.

The column to the left of the file owner column contains the number of links to the file; you shouldn’t have to worry about this column.

Filetype and Access Permissions
The first column on the left consists of eleven characters that show the filetype and the access permissions of the file. The first character represents the filetype of the file. A `d` means that the file is a directory. A dash (`-`) means that the file is a plain file; programs and data that you create are considered plain files. The next nine characters represent the access permissions on the file. These characters consist of three groups with three in each group.

The first group of three characters refers to the permissions allowed to the owner of the file, as specified in the file owner column. (Try to think of the owner of the file as the “user.” This will help you later if you need to change access permissions on a file.) The next group of three characters show the permissions allowed to members of your group. All students are members of the group called users. The last three characters are the permissions allowed to the world, or anyone with access to the computer. Try to think of this group as “others.” For plain files

- `r` means the file is readable
- `w` means the file is writable
- `x` means the file is executable
- `-` means the indicated permission is not granted

Unless you indicate otherwise, files you create are readable and writable by you alone; that is, the default permissions on files you create are

```
-rw-----
```

meaning that only you have read and write authority on these files. No other users, except the system administrator, can access your files unless you change the access permission on them.

Changing Access Permissions
By default, you are the only user who can initially read, write, execute, remove, and create files in your directory. In order to grant even one other user access to your files, you must supply the same authority to all other users as well. To grant other users access to your files, you must set the appropriate permission on the desired file(s), and you must also set the permissions on the directory that the file(s) is in. Note that the permission codes (`rwx`) have different meanings when used on directories instead of plain files. For example, say you want to grant others read access to your file `hmwk1.c` located in your home directory. Let’s assume that your userID is `bb09999`. First, you would change the access permission of your home directory to allow others read and search access to it.

Note: Granting others modify permission (`w`) on your home directory is asking for trouble. *Anyone* could remove or change all your files!
To grant others read access and search access to your home directory, type
```
chmod o=rx /u0/users/1/bb09999
```
To now grant read access to the file named `hmwk1.c`, type
```
chmod o=r hmwk1.c
```
This allows all other users to read your home directory by typing `ls /u0/users/1/bb09999`
All other users also have permission to view the file `hmwk1.c` by typing `more /u0/users/1/bb09999/hmwk1.c`
If you later decide to remove read access to the file `hmwk1.c`, you can specify no permissions for the file by typing
```
chmod o=- hmwk1.c
```

**Filenames and File and Directory Commands**

Filenames may consist of any number of characters; however, names longer than eighty characters will
scroll off the screen. It's best to limit your filenames to fourteen characters or fewer. Although almost any
character can be used in a filename, you should restrict your selection to upper-case and lower-case letters,
numbers, the period, and the underscore. Don't use a minus `-` as the first character of a filename; you'll
have a tough time performing some operations such as remove and move on it.

| To copy a file*:                      | `cp file1 file2` | This makes a copy of the file named
<table>
<thead>
<tr>
<th></th>
<th></th>
<th><code>file1</code> and calls it <code>file2</code>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>To display the contents of a file (you may display more than one file if you want)</td>
<td><code>cat filename</code></td>
<td>The file will scroll with no pauses.</td>
</tr>
<tr>
<td></td>
<td><code>more file1</code></td>
<td>The files are displayed one screen at a time. Press the space bar to advance to</td>
</tr>
<tr>
<td></td>
<td><code>file2</code></td>
<td>the next screen.</td>
</tr>
<tr>
<td>To move, or rename, a file*:</td>
<td><code>mv file1 file2</code></td>
<td>This renames <code>file1</code>. Its new name is <code>file2</code>.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>To move a file to another existing directory*:</td>
<td><code>mv file1 class/first</code></td>
<td><code>file1</code> has been renamed first and is now located in the subdirectory <code>class</code></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>To create a new directory off of your present directory:</td>
<td><code>mkdir newdir</code></td>
<td>Creates a new directory named <code>newdir</code>.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>To remove or delete a file:</td>
<td><code>rm filename</code></td>
<td>Once a file has been removed, it may not be possible to restore it, so be</td>
</tr>
<tr>
<td></td>
<td></td>
<td>careful!</td>
</tr>
<tr>
<td>To remove a directory (it must be empty—contain no files—first):</td>
<td><code>rmdir dirname</code></td>
<td>If the directory is not empty, the system will notify you.</td>
</tr>
</tbody>
</table>

* These commands are destructive! They will OVERWRITE any existing file with the same name as the second filename in these commands!

**Moving Around the File System**

To identify your present location (present working directory), enter the command `pwd`.
This will list the complete path name of your current directory. For example, if user bb09999 issues this
command from his or her home directory, the response will be: `/usr/users/bb09999`.

To change your current directory enter the command:
```
cd dirname
```
Note: If you enter `cd` without a directory name, you'll be placed back into your home directory.

If the first character in the directory path you specify is a `/` (slash), the system will start at the root directory and follow the specified path to the last subdirectory you've named. If the first character is not a slash, the system will start from your present directory and follow the specified path from there.

For example, let's again assume you're user bb09999. If you want to change from your home directory to a subdirectory named bin, you could enter either of the following:

```
cd /usr/users/bb09999/bin
```

or just

```
cd bin
```

What if you then wanted to change to a directory parallel to bin named work and to its subdirectory homework_sept? You'd enter:

```
cd /usr/users/bb09999/work/homework_sept
```

### Using the Pico Editor

This section covers the basics of using the Pico text editor. Pico is an easy-to-use, full-screen text editor. (When you use the Pine mail program on BINGSUNS, the default editor to compose messages is Pico.)

#### Invoking Pico

To edit a previously existing file, or to create a new file, enter:

```
Pico filename or pico /path/filename
```

at the system prompt, where `filename` is the name of your file.

When pico is invoked, you'll see a mostly blank screen with a status line at the top and a command prompt Hint line at the bottom. For example, if `my_work` is a new file that you're creating, you'll see a blank screen with the cursor in the upper left-hand corner. At the bottom of the screen, you'll see the name of the file, underneath which will be the message (`New file`).

If the file `my_work` already exists, the file's first page will be displayed on the screen. A line at the bottom of the screen will show the file's name.
The status line at the top of the display shows Pico's version, the current file being edited, and whether or not there are changes to the file that have not been saved. The third line from the bottom is used for informational messages and for additional command input. The bottom two lines list the available editing commands.

**Pico Commands**

The commands used by Pico typically involve using two keys. You issue editing commands by typing control-key sequences. A caret (^) is used to denote the Control key, sometimes marked "ctrl," so the ctrl-q key combination is written as ^Q. When a command is described as being ^a, this means press and hold the Control key down while pressing the a key. (On most keyboards, the Control key is located near the left side Shift key.)

Please remember, all of the letters given here must be typed as you see them. If something is shown here in lower case, type it in lower case. If something is shown in upper case, type it in upper case.

**Editing Commands**

^d Delete current character
^h Delete previous character
^^ Set a mark
^k Cut marked text or delete current line. Delete the entire line the cursor is currently on. The last batch of lines that were deleted one after another is saved so it can be undeleted elsewhere. If you have set the mark, then the marked block is deleted.

^u
^c Report current cursor position.

**Function Commands**

The following Cursor Motion key functions are available:

Left Arrow ^b Back character
Right Arrow | ^f | Forward character
Up Arrow | ^p | Previous line
Down Arrow | ^n | Next line
| ^a | Beginning of line
| ^e | End of line
| ^y | Previous page
| ^y | Next page
| ^v | Next word

**Screen and Composition Commands**

| ^g | Help | Display the Pico help file.
| ^w | Where is (search for string) | Search the file for a word or part of a word. The cursor is put on the first occurrence appearing after the location of the cursor. The search will wrap to the beginning of the file when it no longer finds matches in the remainder of the file. To search for the same string a second time, press ^W to begin search and then just press Return to accept the previous search string shown in square brackets rather than entering a new search string.
| ^t | Spell checker | Check the spelling in the file you are composing. You will be prompted at the bottom of the screen with each misspelled word. You can correct the word, then press Return to actually change it in the text. If the word is not misspelled or is a name or such, don’t change it and just press Return to continue the spell check. If a word is misspelled more than once, then you will be prompted to confirm the correction of each occurrence of it.
| ^j | Justify | Reformat the text in the paragraph the cursor is on so that it is left-justified and the right is ragged (a paragraph is separated by one blank line). Useful when you have been editing a paragraph and the lines become uneven.
| ^l | Redraw screen
| ^r | Read in a file | Insert text from an existing file. Pico prompts you for the file name to insert. The file name is relative to your home directory or must be a full path name on your system. If the file is on a PC or Macintosh, you must first transfer it to the Unix system where Pico is running. The file is inserted at the cursor.
| ^o | WriteOut | Output the current buffer to a file, saving it.
| ^x | Exit | Exit Pico. You’ll be prompted whether to save the buffer (your changes).

**Editing Your File**

When you enter Pico, you are automatically in insert mode. That is, if you just start typing, the text you type will be inserted into the file where you type it. Any existing text will be shifted to the right and/or to lower lines. You may use the delete key to delete existing text.

Text automatically wraps as you type past the end of a line so you do not have to hit return. Using the "Ctrl-J" command, you can also reformat text explicitly, perhaps after you have deleted some text.

You can include other text files with the "Ctrl-R". You will be prompted for the file name of the file.
Marking, Cutting, and Pasting

TIP: Mark is shown as ^^ The first ^ indicates that you should hold down the Control key on your keyboard. The second ^ means "type the character ^" (shift-6).

The mark feature (^) allows you to mark any segment of text, cut it out (^K), move the cursor, and paste it (^U) in a new location. If you use ^K (delete) and ^U (undelete) without using ^^ (mark), the last batch of lines that were deleted one after another is saved as a group so it can be pasted elsewhere. To delete a series of lines and move them to another location, be sure to delete them all at once. Undelete then pastes them as a group in the new location.

^^ Mark Sets a mark in the file text. Used to set a mark and then perform a delete/move operation on a block of text.

Printing

Most UNIX systems use the lp command to print files at the default printer. Since the Suns have no default system printer, lp is not used as much as dlpr, a command written at Binghamton University. Thus, the majority of this section will describe how to use dlpr; a brief section on lp is included at the end of this section.

The complete syntax for the dlpr command is

dlpr [options] filename

for example,

dlpr -C K -F 5806 -# 3 -P CC my.file

will print three copies of the file my.file at the CC printer, using class K and form 5806 (narrow white paper, 6 lines to the inch). (Use capitols and lowercase exactly as they appear.)

Following is a list of the Printer, Class and Form options:

<table>
<thead>
<tr>
<th>Printer</th>
<th>Form</th>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC</td>
<td>1108</td>
<td>A</td>
<td>green bar, uppercase, 8 lines/inch</td>
</tr>
<tr>
<td>CC</td>
<td>1106</td>
<td>C</td>
<td>green bar, uppercase, 6 lines/inch</td>
</tr>
<tr>
<td>CC</td>
<td>5108</td>
<td>C</td>
<td>narrow green bar, uppercase, 8 lines/inch</td>
</tr>
<tr>
<td>CC</td>
<td>5106</td>
<td>C</td>
<td>narrow green bar, uppercase, 6 lines/inch</td>
</tr>
<tr>
<td>CC</td>
<td>5808</td>
<td>C</td>
<td>8.5 by 11 inch white, uppercase, 8 lines/inch</td>
</tr>
<tr>
<td>CC</td>
<td>5806</td>
<td>C</td>
<td>8.5 by 11 inch white, uppercase, 6 lines/inch</td>
</tr>
<tr>
<td>CC</td>
<td>1108</td>
<td>K</td>
<td>green bar, upper and lowercase, 8 lines/inch</td>
</tr>
<tr>
<td>CC</td>
<td>1106</td>
<td>K</td>
<td>green bar, upper and lowercase, 6 lines/inch</td>
</tr>
<tr>
<td>CC</td>
<td>5108</td>
<td>K</td>
<td>narrow green bar, upper and lowercase, 8 lines/inch</td>
</tr>
<tr>
<td>CC</td>
<td>5106</td>
<td>K</td>
<td>narrow green bar, upper and lowercase, 6 lines/inch</td>
</tr>
<tr>
<td>CC</td>
<td>5808</td>
<td>K</td>
<td>8.5 by 11 inch white, upper and lowercase, 8 lines/inch</td>
</tr>
<tr>
<td>CC</td>
<td>5806</td>
<td>K</td>
<td>8.5 by 11 inch white, upper and lowercase, 6 lines/inch</td>
</tr>
<tr>
<td>CC1</td>
<td>1108</td>
<td>A</td>
<td>green bar, upper and lowercase, 8 lines/inch</td>
</tr>
<tr>
<td>P0D1</td>
<td>1108</td>
<td>E</td>
<td>green bar, upper and lowercase, 8 lines/inch</td>
</tr>
<tr>
<td>P0D1N</td>
<td>5706</td>
<td>F</td>
<td>8.5 by 11 inch white, upper and lowercase, 6 lines/inch</td>
</tr>
<tr>
<td>WPOD1</td>
<td>1108</td>
<td>A</td>
<td>green bar, upper and lowercase, 8 lines/inch</td>
</tr>
</tbody>
</table>

For most purposes, the only option you need is the name of the printer to use, like this:

dlpr -P wpod1 my.file

This will print the file my.file at the West POD printer.
These printers are available through the `dlpr` command:
- `cc` a high-speed printer located in the machine room (102) of the Computer Center
- `cc1` a high-speed printer located in the machine room (102) of the Computer Center
- `pod1` the printer in the South POD that uses wide green paper
- `pod1n` the printer in the South POD that uses narrow white paper
- `wpod1` the printer in the West POD.

**Printing a File**

To send an existing file to a printer, enter

```
    dlpr -P printer filename
```
at the system prompt.
or `dlpr filename`

The latter will send the file to your default printer.

**Redirecting Terminal Output to the Printer**

You may also redirect the output from your terminal to the printer. This is especially helpful if your program produces more output than your present disk quota can handle. For example, to send the output from the Pascal program `Progl.p` directly to the printer in the West POD, enter:

```
    pix Progl.p | dlpr -P wpod1
```
at the system prompt.

Note: `pix` is the command to compile and execute your program; the vertical bar character( | ) creates a pipeline from one process to the next. (For more information about 'pipes', see the section in this document on UNIX pipes and filters.)

**Retrieving Output**

Files sent from the Sun to the printers may be retrieved at the appropriate printer rooms. If your printout isn't on the printer room window ledge, it will be in one of the printer output boxes outside the printer room.

The one exception to this is the `cc1` printer. The `cc1` printer is located in the machine room of the Computer Center. Output from `cc1` is checked approximately once every hour by Computing Services staff and placed in alphabetized output boxes located outside the Help Desk in the Computer Center (rm. 102).

**Using a Laser Printer**

The `lp` command is not used for most printing, but it can be used to send your file to a laser printer in the Computer Center machine room. Be aware that there is a charge of 25 cents per page, which must be paid with laser stickers purchased at the campus bookstore.

The laser printer is an Apple LaserWriter, and will accept PostScript format as well as standard format.

There are two laser printers to which you can specify to send your files. Both yield the same output type — they simply have different names. One is called 'cclaser1' and the other 'cclaser2'. To send a file to a laser printer, type:

```
    lp -d cclaser1 filename  OR  lp -d cclaser2 filename
```

There is also a PostScript color laser printer available. This printer is located in the South POD printer room. There is NO CHARGE for laser output from this printer. Output to this printer is limited to
Postscript files containing class-related color graphics output — other output sent here will be automatically discarded. To send a file to the PostScript color printer, type:

```
lp -d bpps filename
```

## Navigating the Internet from a Sun Workstation

These days everyone wants to get access to the Internet for one reason or another. And, it's true, a wealth of information is available out there — the trick is finding what you're looking for. That's why specific navigation tools have been developed. Netscape is installed on the Sun system.

### Netscape

**What is it?**

Netscape is a hypertext viewer of a world-wide collection of linked documents, images, sounds, and video segments.

**How do I access it?**

Netscape can only be accessed from a Sun Workstation or an X-Terminal. To access Netscape, choose Netscape from the Applications menu.

**How do I use it?**

What you will see is the Binghamton University 'home page'. Netscape is very graphic oriented — to select different Netscape items, simply click on any highlighted word or area.

Netscape is capable of accessing a wealth of information. The depth of its capabilities is far too great to be covered in this document.

## Telnet and ftp

Up until this point we have been looking at the Internet through the eyes of Netscape. While Web browsers are wonderful tools for navigating the Internet, not all sites are accessible via Web browsers. Also, thus far we have only been concerned with publicly available information. Suppose you or a friend or colleague of yours has an account on a computer at a remote site and you want to log on to it or retrieve some information from it. What can you do?

### Telnet

The telnet program is a remote login facility that allows you to connect to another computer over a network. For instance, at Binghamton University, you can telnet from BINGSUNS to another remote machine if you have an account on the remote machine.

To use telnet, just type:

```
telnet internet_site
```

where: *internet_site* is the name of the Internet site you want to connect to (beech.tc.cornell.edu, for example.)
When the connection is made, you'll be given the opportunity to log on. This part should be familiar to you. Simply enter your userID and password. When you have finished using your account, remember to log off. This will put you back at the local host's (i.e. bingsun1% or podsun5%) prompt.

**ftp**

FTP (File Transfer Protocol) allows people to copy files from a remote machine to a local machine and vice versa. You can only use FTP between machines on the Internet. All Binghamton University host computers (including the Sun) are on the Internet, as are the IBM PCs on the Local Area Networks in the public areas.

FTP allows you to simulate a login session at a remote site. You are not *really* logged in. You can not run programs at this remote site, but you can:
- look at the remote directory(s) and files
- GET files from there to your local machine
- PUT files from here to the remote machine

You can only FTP if you have an account on the remote machine OR if that machine has an 'anonymous' account.

**Anonymous FTP:**

Some institutions have created public accounts from which anyone may copy files using FTP. The userID for these accounts is usually 'anonymous'. The password is sometimes the word 'guest', but many sites ask you to enter your Internet e-mail address as your password. Such sites are commonly referred to as 'anonymous FTP sites'. A wide variety of freeware or shareware is available from these locations — usually in a 'pub' or 'public' directory. **BE WARNED:** there is no guarantee that software down-loaded from these locations will function or be free of computer-viruses. Free software is often worth what you pay for it and sometimes less.

For more information on FTP, get a copy of the Computing Services *Quick Tip* handout on FTP.

---

**LISTSERVs and Usenet**

This section will give a brief overview of these resources. For more detailed information on accessing or subscribing to LISTSERV or Usenet groups, pick up a copy of Binghamton University Computing Services' document *Accessing Internet Discussion Groups; using LISTSERV and Usenet at Binghamton University Workshop notes.*

**LISTSERV**

A LISTSERV is essentially an electronic mail extension that redirects messages sent to it to a collection of people interested in the discussion of a particular topic. This topic can range from computer programming, to veterinary medicine, to *The Simpsons* television show.

A LISTSERV group contains all the e-mail addresses of all the members of the discussion. The LISTSERV itself has it's own e-mail address. When a member of the discussion wishes to send a message to everyone else, they simply e-mail a message to the LISTSERV's e-mail address. The message is automatically broadcast to all the other recipients of the LISTSERV.

Some LISTSERVs restrict who can subscribe to them. This may be because of confidential material on the LISTSERV, or to limit the type of user subscribing. Some of these LISTSERVs, while limiting subscription, will allow any non-subscriber to send messages to the LISTSERV. Some LISTSERVs only allow the subscribed members of the list to submit messages.
Different LISTSERVs are maintained by different machines all over the world. Binghamton itself, maintains quite a variety of local LISTSERVs. (Local meaning only users on our machines can subscribe to them.) These LISTSERVs cover such areas as class discussion groups and internal Computer Center discussions.

Lastly, some LISTSERVs are monitored. This means there is a person who reads all the incoming messages to the LISTSERV before they are sent out. This person may throw out inappropriate messages; then, they send out a group of related messages, in a journal format, to all the LISTSERV subscribers. Most LISTSERVs are not monitored.

To join a LISTSERV, you subscribe to it. To leave a LISTSERV, you unsubscribe from it. Anyone with a valid account on any of Binghamton's machines can subscribe to just about any LISTSERV.

Send commands to LISTSERV to get on or off of lists, to learn about lists, to change your subscription settings, and all other "administrative" tasks. **Do not send LISTSERV commands to an actual list!** Send commands directly to LISTSERV at the site hosting a particular list.

The universal way to send commands is with electronic mail. Address the mail to LISTSERV@NODE. Leave blank the user name and subject fields. The message body contains one or more commands to LISTSERV. For example:

```
sub [list name] [your name] (get on the list)
unsub [list name] (get off of the list)
```

**USENET**

USENET is a collection of different discussion groups (called 'news groups'), organized by subject. Groups are named such things as rec.comics.misc; this would be a group concerned with miscellaneous topics having to do with comic books. The rec. heading stands for recreation. Other such main headings include soc. for social and comp. for computer.

USENET is like having interactive access to a large group of LISTSERVs, all at once. (And, in fact, some news groups are linked to LISTSERVs, so that a post to that news group is automatically sent to that LISTSERV.) You can browse through a list of all the available news groups. If you find one that you want to read, you can read any note (or 'post') in it and reply or post your own note to it. Unlike LISTSERVs, you don't have to 'subscribe' to have access to any particular news group.

The network newsreader program used on the Sun is called 'tin'. To access Usenet news groups, simply type tin at the system prompt.

**UNIX Pipes and Filters**

Pipes and filters are facilities within UNIX that allow you to manipulate the input and output processes. This manipulation may be something as simple as sorting a file or formatting it for printing, or something as time consuming as searching through every readable directory on the system for a particular filename.

**Filters**

Filters are programs that take an input file, perform a simple transformation on it—a sort, for example—and write some output.
sort
sort filename  sorts the input file filename into alphabetical order line by
line—blanks first, then capitals, then lower-case. The result is
printed on your screen.

sort -r filename  sorts the file filename in reverse order and prints the result on
your screen.

grep (Don't bother trying to figure out what "grep" means!)
grep  allows you to search a file or files for a
characte_string  searches the file filename and prints each
character_string  lists lines in the file filename that don't
characte_string  contains the character string specified.
characte_string
characte_string
characte_string
characte_string
characte_string
characte_string
characte_string
characte_string

Other filters
pr  formats a file for printing, including page headers, numbers and page breaks.
noff  a text formatter that allows you to embed commands for highlighting, page
breaks, spacing, use of hyphenation, and so forth.

Input-Output Redirection

The greater than symbol (>) means put the output in the following file, instead of printing it on your
screen. For example:

    sort myfile > sortedfile

The less than symbol (<) means take the input for a program from the following file instead of from the
terminal. For example:

    elm bb09999 < a.file

tails the file a.file to user bb09999.

The command ls > filename executes the command ls, lists directory contents and, instead of
displaying them on your screen, writes the results to the file filename.

The cat command, which displays the contents of a file, can be used with the greater than sign to create a
file that contains the contents of the other files you've specified. For example:

    cat file1 file2 > both.files

tees a file named both.files, which contains the contents of file1 and file2.

A Sample Combination of the Above Commands

The following sequence of commands creates a file named temp, which contains the current users on the
system. That file is then sorted and stored in another file called sorted.temp. That file is then searched
for the userID bb09999.

    w > temp
    sort temp > sorted.temp
    grep bb09999 < sorted.temp
Pipes

A pipe (|) connects the output of one program to the input of another without creating any temporary files. For example:

```
w | sort | grep bb09999
```

produces the same result as the boxed example above without the need of temporary files; `w` | `sort` sends the list of current users on the system to the sort routine, which then sorts it. The result goes directly to `grep` to search for the userID bb09999. The result is printed on the screen.

To format the file `filename` for printing and then send it to the West POD printer, type:

```
pr filename | dlpr -p wpod1
```

---

Running Common Programs

This section discusses how to run programs written in C, FORTRAN, and Pascal.

Running C Programs

The Sun C compiler is invoked by entering the command:

```
cc [option(s)] filename(s)
```

where `[option(s)]` is a list of available optional arguments that the cc compiler recognizes, and `filename(s)` is one or more files to compile and link together.

The C compiler (cc) will accept as input C programs (files with an extension of `.c`), assembler files created by the C compiler or some other language processor (files with an extension of `.s`), and object files created by the C compiler or some other language processor (files with an extension of `.o`).

If no options are specified, the C compiler will create object modules with the same name as the C and assembler source files that you pass it, but with extensions of `.o` instead of `.c` and `.s`. (If only one C program is being compiled, however, the object file won’t be saved.) The C compiler will then link the object modules and create an executable file called `a.out`.

If there were errors detected during compilation, the compiler will identify the line number and the error discovered. As with most compilers, it can only provide the error it’s detected. The cause of the error may precede the compiler’s determination of the error.

For example, say you had a main calling routine called `main.c` that called two functions—`getline.c` and `index.c`. To compile and link the three programs, enter:

```
cc main.c getline.c index.c
```

The compiler will then display the name of each function as it compiles:

```
main.c:
g getline.c:
index.c:
```

If no errors are detected, the system prompt will return when the compiler is finished. If you then list the directory with the `ls -l` command, you’ll notice four new files: `a.out`, `main.c`, `getline.o`, and `index.o`. The `a.out` file will be executable; the others won’t be. To run your program, enter:
C Options
The C compiler cc provides numerous options:
- `c` suppresses the loading phase of the compiler; that is, it doesn't create the executable file. It creates and saves the object files, even if only one file is being compiled.
- `s` suppresses the loading phase and saves the assembler files.
- `o` filename allows you to specify a name for the executable file instead of using the default a.out.

C Utilities
There are a number of handy utilities available for tracing, debugging, and formatting your programs.

ctrace allows you to trace the execution of your program statement by statement. It only accepts a single input file, so you either have to concatenate your files or pipe them to ctrace. For example, to trace the three files previously mentioned, enter

```
cat main.c getline.c index.c | ctrace > temp.c
c c temp.c
a.out
```

Note: cc does not allow the use of a pipe; therefore, we had to create the temporary file temp.c

cb is a program beautifier. It provides spacing and indentation depending on the program structure.

```
cb < file.c > beauty.c
```

Note: You must specify a different filename for the output or you'll lose the original file!

indent is a C source formatter. It not only provides indentation, but also aligns comments, inserts spaces around operators and breaks up declaration lists.

```
indent file.c
```

Note: To save the original file, be sure to specify a new output file, for example,

```
indent file.c > indented.c
```

Running FORTRAN Programs
The FORTRAN compiler on the Sun is invoked by entering:

```
f77 [option] filename(s)
```

where [option] may be one of the optional arguments the f77 compiler recognizes and filename(s) is one or more files to compile and link together into an executable file.

Acceptable input files to f77 are FORTRAN 77 source programs (files with an extension of .f), assembler source programs created by the f77 compiler or some other language processor (files with an extension of .s), and object files created by the f77 compiler or some other language processor (files with an extension of .o). It also accepts files with extensions of .r and .e for Ratfor (Rational Fortran Dialect) and Efl (Extended Fortran Language) language source files.

Note: You may want to look into Ratfor and Efl if you're importing programs from another system.

If no option is specified upon invoking f77, it will create object files with the same names as your source files but with extensions of .o. (If only one FORTRAN program is being compiled, however, the object file won't be saved.) The FORTRAN compiler will then link the object file(s) and create an executable file called a.out.
If errors are detected, the compiler will display the line number at which the error is detected and what the error is.

For example, say you had a main calling routine, main.f, that called two functions—getline.f and index.f. To compile and link the three programs, enter:

```
f77 main.f getline.f index.f
```

The compiler will then display the name of each function as it compiles:

```
main.f:
  getline.f:
  index.f:
```

If no errors are detected during compilation, the system prompt will return when the compiler is finished. If you then list the directory with the `ls -l` command, you'll notice four new files: a.out, main.o, getline.o, and index.o. The a.out file will be executable; the others won't be. To run your program, enter:

```
a.out
```

**FORTRAN Compiler Options**
The FORTRAN f77 compiler provides numerous options for compiling your program(s).

- `-c` suppresses loading and creates object files for all source programs.
- `-s` suppresses loading and creates assembler files for all source files. No object files are created.
- `-o output.file` allows you to specify a name for the executable file instead of using the default a.out; for example, to name your output file results, enter
  
  ```
  -o results
  ```
- `-d` used for debugging. This option causes f77 to display each command that it uses to compile and link your program.

**FORTRAN Utilities**
SUN provides a utility for breaking up a multiroutine FORTRAN file. This may be useful for large programs; you can save time recompiling routines that you know work. To use, enter

```
fsplit file
```
A Summary of Solaris Commands

Please pay careful attention to capitalization and spacing!

`passwd` allows user to change his or her logon password

`more filename` displays a file a page at a time. You may scroll backward by pressing the letter b. Press the space bar to scroll forward

`cat file(s)` concatenates one or more files together. This command can also be used to display the file on the terminal — it will not pause after each page

`cp file1 file2` copies file1 to file2 (may overwrite existing file2)

`rm filename` removes (deletes) a file

`mv oldfile newfile` moves (renames) oldfile to newfile (may overwrite existing newfile)

`cd directory` changes your working directory

`mkdir new_directory` makes a new subdirectory

`rmdir directory` removes a directory (it must be empty first)

`pwd` prints the current working directory

`logout` logs user off from SUN system

`ls` lists the files in the current directory

`ls -l` lists the files in the current directory in long format, giving access authority, size in bytes

`ls -a` lists all the files in the current directory, including the dot files (e.g., .login, .profile)

`quota` shows disk quota

`man command` displays the Solaris manual description for the desired command

`apropos string` displays commands that may pertain to the given character string

`du -ak` gives the number of 1K blocks contained in files on your disk

`who` displays the users on the system

`w` displays users and what they’re working on

`ps` shows your current processes

`jobs` shows your current stopped and running processes

`kill -9 processID` kills a process (the process ID, labeled PID, is obtained by using the `ps` command)

`kill -9 %job-number` kills a process (the job-number is obtained by using the `jobs` command)

`write userID` allows you to write a message to another user (use Ctrl-d to end the message)

`talk userID` allows you to communicate interactively with another user (use Ctrl-c to end communications)

`dlpr -P printer filename` prints a file on the selected printer
dlpr filename
lp -d cclaser1 filename
lp -d cclaser2 filename
elm
pine
setup
fg
bg
pico filename
emacs filename
vi filename
cc
pc
f77
Ctbl-d
Ctbl-c
Ctbl-z
Ctbl-s
Ctbl-q

prints a file on the default printer
prints a file on the Apple laser printer in the Computer Center. Costs $0.25 per page, payable only with laser printer stickers available from the bookstore.
acceses the elm mail facility
accesses the Pine mail facility
use to view and change such things as default printers, default editors and other default parameters.
restarts a process stopped with Ctrl-z
moves a stopped process to background
accesses the pico text editor
accesses the emacs text editor
accesses the vi text editor
accesses the C compiler
accesses the Pascal compiler
accesses the FORTRAN compiler
signals the end of input (also used to logout)
sends a break
interrupts the process, which may be continued later by entering the command fg
stops scrolling
restarts scrolling
## SUN Software

<table>
<thead>
<tr>
<th>Software</th>
<th>Command</th>
<th>Description</th>
<th>Any X-Terminals &amp; Workstations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abaqus</td>
<td>abaqus</td>
<td>general finite element analysis package</td>
<td>X</td>
</tr>
<tr>
<td>Adams</td>
<td>adams</td>
<td>general modeling/analysis package</td>
<td>X</td>
</tr>
<tr>
<td>Ansys</td>
<td>ansys</td>
<td>finite element analysis package</td>
<td>X</td>
</tr>
<tr>
<td>Aspirin</td>
<td>aspirin</td>
<td>lexical analyzer</td>
<td>X</td>
</tr>
<tr>
<td>Balance</td>
<td>balance</td>
<td>checks account balance</td>
<td>X</td>
</tr>
<tr>
<td>DI3000</td>
<td>di3000</td>
<td>graphics package</td>
<td>X</td>
</tr>
<tr>
<td>dlpr</td>
<td>dlpr</td>
<td>prints to remote RCSC printers</td>
<td>X</td>
</tr>
<tr>
<td>Emacs</td>
<td>emacs</td>
<td>screen oriented editor</td>
<td>X</td>
</tr>
<tr>
<td>Fidap</td>
<td>fidap</td>
<td>fluid dynamics package</td>
<td>X</td>
</tr>
<tr>
<td>FORTRAN Compiler</td>
<td>f77</td>
<td>FORTRAN compiler for SUN</td>
<td>X</td>
</tr>
<tr>
<td>FTP</td>
<td>ftp</td>
<td>file transfer program</td>
<td>X</td>
</tr>
<tr>
<td>Ghostscript</td>
<td>gs</td>
<td>programming language similar to PostScript</td>
<td>X</td>
</tr>
<tr>
<td>Ghostscript Preview</td>
<td>gspreview</td>
<td>Ghostscript/Postscript file previewer</td>
<td>X</td>
</tr>
<tr>
<td>GNU CC and C++</td>
<td>gcc/g++</td>
<td>GNU C</td>
<td>X</td>
</tr>
<tr>
<td>GNU Flex</td>
<td>flex</td>
<td>Fast Lexical Analyzer</td>
<td>X</td>
</tr>
<tr>
<td>Gnuplot</td>
<td>gnuplot</td>
<td>data plotting software</td>
<td>X</td>
</tr>
<tr>
<td>Ideas MS</td>
<td>ideasms4</td>
<td>mechanical engineering design and analysis package</td>
<td>X</td>
</tr>
<tr>
<td>Kermit</td>
<td>kermit</td>
<td>network protocol software for remote connection</td>
<td>X</td>
</tr>
<tr>
<td>LaTex</td>
<td>latex</td>
<td>Tex; intentional text formatting and typesetting</td>
<td>X</td>
</tr>
<tr>
<td>Lisp</td>
<td>lisp</td>
<td>LISP language interpreter</td>
<td>X</td>
</tr>
<tr>
<td>Magic</td>
<td>magic65</td>
<td>CAD software for VLSI chip design</td>
<td>X</td>
</tr>
<tr>
<td>Maple</td>
<td>maple</td>
<td>mathematical package</td>
<td>X</td>
</tr>
<tr>
<td>Matlab</td>
<td>matlab</td>
<td>interactive matrix laboratory</td>
<td>X</td>
</tr>
<tr>
<td>Minitab</td>
<td>minitab</td>
<td>general purpose statistical package</td>
<td>X</td>
</tr>
<tr>
<td>Netscape</td>
<td>Netscape</td>
<td>versatile multi-platform hypermedia interface to the World Wide Web (WWW)</td>
<td>X</td>
</tr>
<tr>
<td>Pascal Compiler</td>
<td>pc</td>
<td>pascal compiler for the SUN</td>
<td>X</td>
</tr>
<tr>
<td>Pico</td>
<td>pico</td>
<td>editor</td>
<td>X</td>
</tr>
<tr>
<td>Pine</td>
<td>pine</td>
<td>mail program</td>
<td>X</td>
</tr>
<tr>
<td>Prolog</td>
<td>prolog</td>
<td>programming language</td>
<td>X</td>
</tr>
<tr>
<td>PV-Wave</td>
<td>wavepc</td>
<td>visual data analysis program</td>
<td>X</td>
</tr>
<tr>
<td>Simple Phigs</td>
<td>sphigs</td>
<td>simple phigs graphics package</td>
<td>X</td>
</tr>
<tr>
<td>Simple Raster Graphics</td>
<td>srgp</td>
<td>Simple Raster Graphics</td>
<td>X</td>
</tr>
<tr>
<td>Program</td>
<td></td>
<td>Program</td>
<td></td>
</tr>
<tr>
<td>Spice</td>
<td>sp3.spice</td>
<td>circuit design tool kit</td>
<td>X</td>
</tr>
<tr>
<td>Suprem — III</td>
<td>suprem</td>
<td>silicon circuit-making simulator</td>
<td>X</td>
</tr>
<tr>
<td>Surface Evolver</td>
<td>evolver</td>
<td>surface manipulation package</td>
<td>X</td>
</tr>
<tr>
<td>Telnet</td>
<td>telnet</td>
<td>user interface to remote system</td>
<td>X</td>
</tr>
<tr>
<td>Program</td>
<td>Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>tn3270</td>
<td>emulates a 3270 terminal for IBM connection</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>x3270</td>
<td>X-Window version of tn3270</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Usenet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tin</td>
<td>threaded read-news program</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>vi</td>
<td>editor</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>WordPerfect</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wp</td>
<td>word processor</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>xwp</td>
<td>X-Window version of Word Perfect</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>XFIG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>xfig</td>
<td>facility for interactive generation of figures under X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>XV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>xv</td>
<td>image viewer / editor</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Zeta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>zeta</td>
<td>fundamental plotting subroutines for the Zeta Plotter</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>