

Using Windows Computers

Operating System

Computers are used extensively in crystallography to operate instruments and to perform the numerous calculations needed to solve and refine a crystal structure. There are two main types of operating systems in use on personal computers today, Windows and Linux. The Apple operating system is a proprietary version of Linux. An operating system is a group of programs and files that perform all low-level communications between the user and the computer. All computers have the same types of programs, because users of all computers need to perform the same types of tasks. The main difference between the different operating systems, at this time, is which icon is used to launch a particular program. The computers in the Crystallography Laboratory currently use the Windows 10 operating system.

Directory Structure

The directory structure describes the hierarchical arrangement of files as they are arranged in directories and subdirectories. A directory is simply a file with the names, locations, and properties of all files contained in that directory.

Windows separates a logical device label from the rest of the directory tree. Device labels are a single letter followed by a colon, e.g., "C:". A directory is separated from the device label and other directories by a backslash, e.g., "C:\Windows\System32". The backslash is also used to separate a directory from a file name.

It is always recommended that *file names* describe the information stored in the file. In Windows, file names can contain a maximum of 256 characters, but cannot include the back slash "\", the dot ".", the forward slash "/", or the asterisk "*" characters. Note that spaces or underscores are allowed. The dot character can be used one or more times in a file name however the term after the last dot is used to specify the file type, ie. which program(s) can open the file.

Each file in a directory must have a unique file name. If you need a duplicate copy of a file you must either give the copied file another name or place the copied file in another directory.

File manipulations and opening programs can be performed either in a GUI-based file manager or in a Command Prompt Window. Most users are well acquainted with file managers so those programs will not be discussed further.

Command Prompt Window

The Command Prompt program allows you to work in a command-line environment. In the Command Prompt Window, you will only use your keyboard for input. You won't use your mouse unless you open a GUI-based program.

To launch the Command Prompt Window select *Start -> Run* and type **cmd** in the box. You can also go to *Start -> All Programs -> Accessories -> Command Prompt* to open the Command Prompt Window.

The Command Prompt Window appears as a blank command prompt window. The actual *command prompt* should look something like:

```
C:\Users\username>
```

Where *username* is your login name. Commands are typed after the “>” prompt. The boldface type below (that follows the command prompt) is what you should type as you work through this tutorial. Note that the current device, in the prompt shown above is “C:”, and the current directory shown above “\Users\username”.

The Windows operating system does not care if you use upper- or lower-case characters for commands or for file names. Thus, the command **dir** is the same as **DIR**. Similarly, a file name typed as **structure1.res** is the same file as **STRUCTure1.RES** to a Windows-based computer. This is one of the significant differences between the Windows operating system and Linux or Apple systems. In Linux, the case of a command or file name is very important. Also, in Linux, directories and file names are separated by a forward slash rather than the backwards slash of Windows.

Useful Command-Line Commands

exit The exit command closes the command prompt window.

help command The help command by itself lists accepted system commands. If the help command is followed by the name of another command, help lists a brief description of that command and the more important qualifiers for the command.

L: Sets the current device to the device specified by the letter L. A: and B: are historically low capacity devices such as floppy drives. C: is the main hard disk. Other letters, D: - Z: can be any other physical device or logical partition on a disk. Linux command prompt windows use a forward slash to separate directories.

dir The dir command will list all files in the current directory.

```
Command Prompt
C:\Users\dpowell>dir
Volume in drive C has no label.
Volume Serial Number is ECF8-7CCE

Directory of C:\Users\dpowell

11/12/2015  03:40 PM    <DIR>          .
11/12/2015  03:40 PM    <DIR>          ..
01/14/2015  02:20 PM             34  .enciferargs
11/07/2015  12:13 PM    <DIR>          .oracle_jre_usage
06/06/2014  07:37 AM             369  14077.prp
11/04/2015  02:50 PM    <DIR>          a_work
10/14/2015  11:58 AM    <DIR>          Contacts
10/14/2015  11:58 AM    <DIR>          Desktop
11/03/2015  01:46 PM    <DIR>          Documents
11/11/2015  02:37 PM    <DIR>          Downloads
10/14/2015  11:58 AM    <DIR>          Favorites
09/28/2015  12:06 PM             11,203  gsvie64.ini
10/14/2015  11:58 AM    <DIR>          Links
10/14/2015  11:58 AM    <DIR>          Music
10/14/2015  11:58 AM    <DIR>          Pictures
11/03/2015  02:22 PM    <DIR>          publusr
10/14/2015  11:58 AM    <DIR>          Saved Games
10/14/2015  11:58 AM    <DIR>          Searches
10/14/2015  11:58 AM    <DIR>          Videos
08/20/2014  12:57 PM             175  xpro.pro
08/20/2014  12:57 PM             1,797  xpro.ps
          5 File(s)              13,578 bytes
          16 Dir(s)  151,486,922,752 bytes free

C:\Users\dpowell>
```

The directory above mostly contains other directories. Note that there are two special directories labeled “.” and “..”. The “.” directory refers to the current directory. The “..” directory is one directory lower in the tree, in this case the “c:\users” directory. Finally note that there are two directories that have a first character “.”, “.enciferargs” and “.oracle_jre_usage”. Usually directories whose names begin with “.” are hidden.

cd directory This command tells the computer to change the current working directory to a new designated directory. Simply typing the name of a directory that is in the current directory will transfer the command prompt to that subdirectory. This type of a transfer is called a *relative* transfer. Note that the device letter must be set before changing directories.

Thus, if the following command is typed:

```
C:\Users\class> cd documents
```

Then the command prompt would become:

```
C:\Users\class\Documents>
```

To return to the previous directory type:

```
C:\Users\class\Documents> cd ..
```

This produces the following command prompt:

```
C:\Users\class>
```

The working directory may be changed to any directory on the current device using an *absolute* transfer by simply typing the full path after the command as in: **cd** *\directory\path*

copy *file1 file2* The copy command duplicates *file1* in the file or location specified by *file2*.

move *file1 file2* Allows you to move a file from one directory to another.

del *file1 file2 ...* The delete command marks the file(s) so that the file(s) can no longer be directly accessed.

mkdir *dir* The mkdir command is used to create (make) a new directory.

rmdir *dir* The rmdir command is used to delete a directory. The directory must be empty before it is deleted.

Editing Files:

Two text-file editing programs are available through the operating system, Wordpad and Notepad. To edit a file from the command prompt with wordpad simply type: **write** *filename*
To edit a file from the command prompt with notepad simply type: **notepad** *filename*
A new file may be created and edited if it is started using the notepad program.

Running Programs:

In Windows, all executable programs have a suffix of “*.exe”. To run a program from the Command Prompt, simply type the name of the command and any qualifiers at the prompt. If the program is located in the current directory or in the executable path as specified in the path environment variable, then the program will begin. If the program is not in the path, then the absolute path to the program must be specified. Programs may also be opened using the **start** system command followed by the program name and any parameters.