Introduction to Linux Tutorial

The aim of this tutorial is to familiarise you with the Linux operating system. It is very basic and is aimed at people who have no experience using Linux at all. The bulk of this tutorial is based upon modules 1, 2 and partly 3 at http://www.linuxsurvival.com . After you have finished going through this document, you might want to visit their site.

Structure of Tutorial

Linux Tutorial

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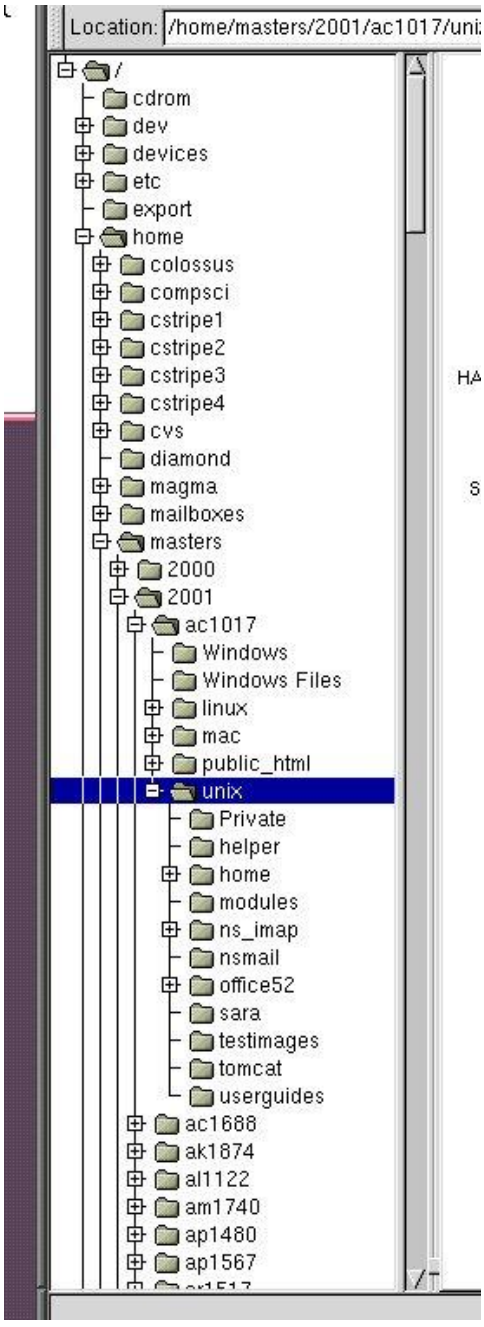
Note that hannuna and sh1670 are used interchangeably in this tutorial as my username was recently changed from hannuna to sh1670.

The Linux and Windows Directory Trees

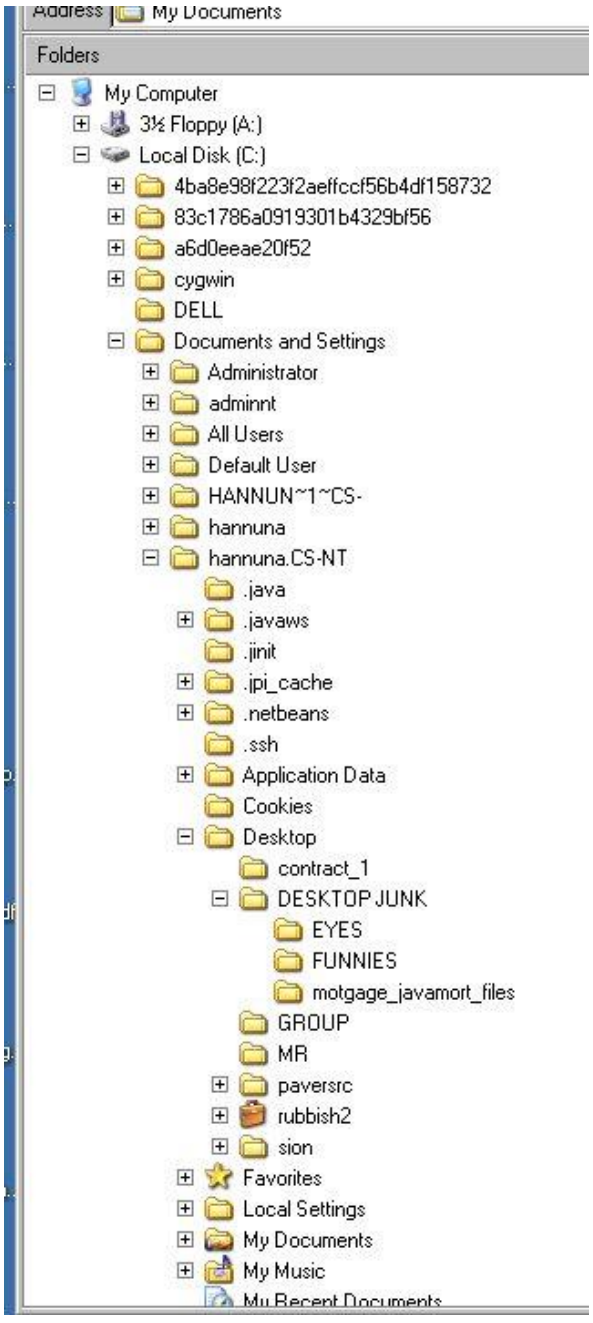
Before we explore the commands used to manipulate the Linux environment, we should take a quick look at the structure of the environment itself.

Microsoft Windows users will find the Linux file system to be a familiar structure because it is basically the same. You can think of a Linux file system as a tree. See the diagrams below.

Linux Directory Tree



Windows Directory Tree



A Simpler Directory Structure

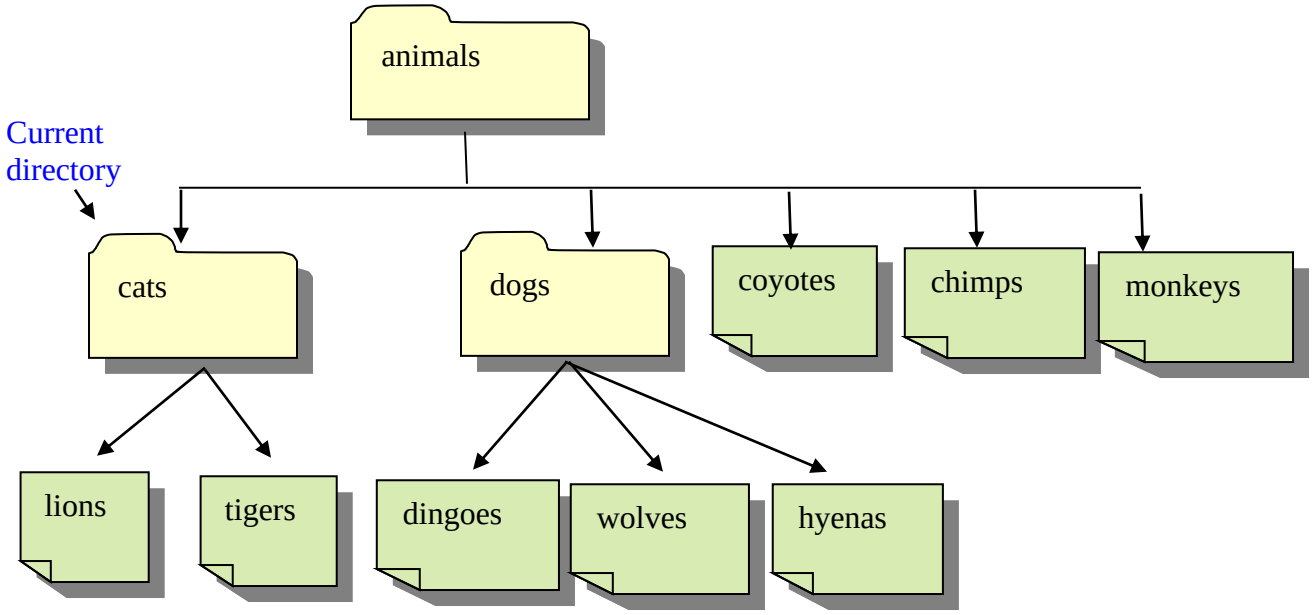
The previous structure was very complex. In order to practice on a simpler structure …

Open a terminal and then type the following:

```
cd ~
wget seis.bristol.ac.uk/~sh1670/make_tut
chmod a+x make_tut
./make_tut
cd animals/cats
```

Note that if the `wget` command fails, you will need to install it on your system (it is already installed on the lab machines)

This should add the following structure to your "top level" and place you in the "cats" folder:



Using “ls”

Probably the most often used command in Linux is the "ls" command. It is used to list the contents of a directory.

For example, your current directory is "cats". To see what it contained, you would type "ls". The output should be the following:

```
lions     tigers
```

Unlike many other operating systems, Linux is case-sensitive. In other words, if you type "LS" instead of "ls", Linux will not recognize the command. This applies to filenames, like "lions" and "tigers", as well.

Using “more” to view the contents of files

Before we start moving the files around, let's take a look in one of them to see what it contains. We'll look at the lions file to make sure it has the proper information in it.

The "more" command is used to view the contents of a file. For example, to see the contents of the "lions" file, you would type

```
more lions
```

It is called "more" because after it has displayed a page of text, it pauses and puts "--More --" at the bottom of the screen to let you know that there is more text yet to be shown. To see the next page of text, you just hit the spacebar.

Now type the command to view the contents of the "tigers" file.

Organising files and directories - using “more”, “mv”, “pwd”, and “cd”

Okay, it's time to start organizing our animal files. **First, we'll create a directory under "animals" called "primates"**. The command to create a directory is "mkdir" which is short for "make directory".

For example, to make a directory named domestic_breeds, you would type

```
mkdir domestic_breeds
```

This will create a directory called domestic_breeds, within the current directory.

First, we need to get into the animals directory (there are shortcuts). To change directories, use the "cd" command, which stands for -- you guessed it -- "change directory".

For example, to change to directory "dogs", you would type

```
cd dogs
```

To move up one level, to the “parent directory”, you would type

```
cd ..
```

To find out where you are, use the "pwd" command, which stands for "print working directory".

Type it at the command prompt to verify your current location. Then, type the command which lists the contents of the current directory.

Finally use the “mkdir” command to make a directory called primates

```
You work it out
```

Now, let's move all of the primate files into our newly created directory.

To move a file, you just use the "mv" command. For example, to move a file called "wolves" into directory "dogs", you would type

```
mv wolves dogs
```

Renaming files is simply a case of "moving" a file from one name to another. For example, to rename file "wolves" to "mean_dogs ", you would type

```
mv wolves mean_dogs
```

Let's start by moving "chimps" into the "primates" directory. Type the command to move file "chimps" into directory "primates". Do the same for the “monkeys”. Finally put the “coyotes” and “kittens” (ahh bless) in the most appropriate folder.

To Summarize:

ls - list current directory contents
more - show the contents of a file (text file)
mv - move or rename file or directory
cd - change directory
pwd - present directory
mkdir - make a new directory

Using Pathnames

Now we have to take a time-out to explain "pathnames".

So far we have only been manipulating files which are in our current directory. But sometimes you might want to manipulate files which are not in your current directory. For example, you may be doing a lot of work in the "dogs" directory, but you remember that you wanted to rename "tigers" to "siberians". You could accomplish this by using these commands:

```
cd ..
cd cats
mv tigers siberians
cd ..
cd dogs
(continue working in "dogs")
```

That's an awful lot of work just to perform a simple task. Fortunately, there's a way to accomplish this task with only one command instead of five.

You can refer to a filename by its "pathname". This means that you specify what "path" to follow down the tree to find the file. The path to "tigers" is represented like this:

```
~/animals/cats/tigers
```

We built this pathname by starting at the top of the tree (your top level – represented by '~') and adding "animals" to it. Then we added a "slash" ('/') every time we moved down the tree another level.

We can use this pathname to accomplish our task with only one command:

```
mv ~/animals/cats/tigers ~/animals/cats/siberians
```

Typing in a full pathname can be tedious, though, especially if you are a long way down the tree. That's why it is often easier to specify a "relative pathname". It is called "relative" because it specifies a filename relative to your current location, rather than from the root directory. If you don't put '~/' or '/' at the beginning of a pathname, then Linux knows that you are using a relative pathname. For example, if you were in the "animals" directory and you wanted to rename "tigers" to "siberians", you could do so with this command:

```
mv cats/tigers cats/siberians
```

In this case, you specified your pathnames relative to the "animals" directory (your current directory), so you didn't need to include "animals" in them.

So far we haven't shown you how to use relative pathnames from the "dogs" directory, which was our current directory in the original example. There is a way to do it by using something we learned a few pages ago.

```
mv ../cats/tigers ../cats/siberians
```

Recall that ".." refers to the directory above your current directory.

Now try the same using the full pathname from the root: `/home/ you do the rest`

Using “cp” to copy files

All right, enough theory -- it's time for practice. We need to move "hyenas" from the "dogs" directory to the "animals" directory, but out of paranoia, we're going to copy it and then remove the original file after we're sure that it was copied correctly. The copy command is "cp" and it has the same syntax as the "mv" command. For example:

```
cp apples apples2
```

We're not in the "dogs" directory, so you'll have to use a relative pathname in your copy command. Type the command to copy "hyenas" from the "dogs" directory to the "animals" directory. Note: Use ‘./’ to represent current directory.

Check the copy of "hyenas" which is in the "animals" directory using “more”. If everything is okay, we should now remove the original "hyenas" file in the "dogs" directory. The remove command is "rm". For example, to remove file "platypus", you would type

```
rm platypus
```

Type the command to remove the "hyenas" file in the "dogs" directory.

Using “rmdir”

The "remove directory" command is "rmdir". For example, to remove directory "fish", you would type

```
rmdir fish
```

Now use `‘mkdir’` and this command to create and remove a new directory in your home folder.

Security

Now it's time to talk about security. Many PC users have little experience with file security because Windows does not have any. It doesn't need security because it is a single-user operating system. Linux is a multi-user operating system, and your files are stored on a server, so it has security to prevent people from accessing each other's confidential files. Unfortunately, the security system in Linux is not very flexible, but we'll talk about that later.

Say, we don't want anyone to modify the dog files except for a particular group. It will take quite a bit of explanation before we can show you how to arrange this sort of security.

When you execute an "ls" command, you are not given any information about the security of the files, because by default "ls" only lists the names of files. You can get more information by using an "option" with the "ls" command. All options start with a '-'. For example, to execute "ls" with the "long listing" option, you would type (note that the '-l' is a lowercase 'L')

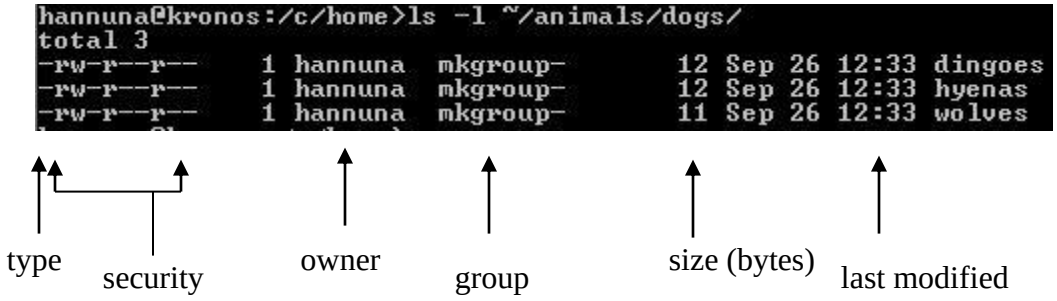
```
ls -l
```

When you do so, each file will be listed on a separate line in long format.

There are lots of other options you can use with the ls command, but we won't need them to accomplish our current goals.

Now lets try the using the '`ls`' command combined with a smart pathname to list the contents of the **'dogs'** directory':

```
ls -l ~/animals/dogs
```



There's a lot of information in those lines. The first character will almost always be either a '-', which means it's a file, or a 'd', which means it's a directory. In our example, all three of them are files.

The next nine characters (rw-r--r--) show the security; we'll talk about them on the next page.

Security Continued

Deciphering the security characters will take a bit more work.

First, you must think of those nine characters as three sets of three characters (see below). Each of the three "rwx" characters refers to a different operation you can perform on the file.

The 'r' means you can "read" the file's contents.
The 'w' means you can "write", or modify, the file's contents.
The 'x' means you can "execute" the file. This permission is given only if the file is a program.
If any of the "rwx" characters is replaced by a '-', then that permission has been revoked. For example, the owner's permissions for our three dog files are "rw-". This means that the owner of the file ("hannuna (now sh1670)", i.e. me) can "read" it (look at its contents) and "write" it (modify its contents). You cannot execute it because it is not a program; it is a text file.

Members of the group "mkgroup" can only read the files ("r--"). We want to change the second permission character from '-' to 'w' so that those people can modify the contents of these files as well.

The final three characters show the permissions allowed to anyone who has a UserID on this Linux system. We prefer to refer to this set as "world". Our three dog files are "world-readable", that is, anyone in our Linux world can read their contents, but they cannot modify the contents of the files.

Changing the Security Permissions – “chmod”

The command you use to change the security permissions on files has a horribly cryptic name. It's called "chmod", which stands for "change mode", because the nine security characters are collectively called the security "mode" of the file.

Now it will become clear why we named the three "rwx" sets "user", "group", and "other". The first argument you give to the "chmod" command is 'u', 'g', 'o', or a combination of them which specifies which of the three "rwx" sets you want to modify. For example, if you want to give "execute" permission to the world ("other") for file "coyotes", you would start by typing

```
chmod o
```

Now you would type a '+' to say that you are "adding" a permission.

```
chmod o+
```

Then you would type an 'x' to say that you are adding "execute" permission.

```
chmod o+x
```

Finally, specify which file you are changing.

```
chmod o+x coyotes
```

You can also change multiple permissions at once. For example, if you want to take all permissions away from everyone, you would type

```
chmod ugo-rwx coyotes
```

Okay, time to get back into action. Type the command to give "write" permission to the “world” (other), for the file “lions”

Then type the command to give a long listing of the files so you can check your handywork (try and use pathnames to achieve this).

Time Savers

Wildcards

A wildcard allows you to specify more than one file at the same time. The '*' matches any number of characters. For example, if you want to execute a command on all files in the current directory, you would specify '*' as the filename. If you want to be more selective and match only files which end in "ing", you would use "*ing". Note that the '*' can even match zero characters, so "*ing" would match "ing" as well as "sing".

The other wildcard, '?', is not used very often, but it can be useful. It matches exactly one character. For example, if you want to match "sport", but not "spat", you would use "sp??t". The first '?' matches the 'a' in "spat", but the second '?' can't match anything, so "spat" fails.

So to list all the html files in my public_html directory you would type (note you do not have access to this folder so it will not work for you):

```
ls /home/cosc/sh1670/public_html/*.html
```

A word of warning: It's not a good idea to use wildcards when deleting files. Linux stores previously typed commands. This can be accessed by pressing the up arrow. A common way of losing a lot of work is to type 'rm *.*' in one folder and then to input the same command in another folder by mistake.

Auto-complete

Pressing the 'TAB' button will execute Linux's auto-complete functionality.

Accessing previously typed commands

Pressing the 'up' and 'down' arrows at the command prompt will bring up previously typed commands. These are stored in the '.bash_history' file in your 'top level'. You can see this file by typing 'ls –las'.

Home Directories or Top Level or ~username

In a multi-user system, it is convenient for each user to have his own private place to store files. Linux calls this private place your "home directory". The location of home directories varies greatly between systems.

When you login to your Linux system, you are automatically placed in your home directory. So, if you want to display its pathname, simply login, then type "pwd". In our system, the output would be "/home/your_username".

Because most people need to refer to their home directories on a regular basis, Linux makes them easy to specify. You can use the tilde everywhere that you would normally use "/home/your_username".

For example, if you wanted to copy a file called "jokes" from your home directory to the "/tmp" directory, you could just type

```
cp ~/jokes /tmp
```

rather than

```
cp /home/keeper/jokes /tmp
```

You can even use the tilde to specify another user's home directory. If '~' is immediately followed by a User ID, then it no longer refers to your own home directory; it refer's to User ID's home directory. For example, if you wanted to go into hannuna (now sh1670)'s home directory, you could just type

```
cd ~sh1670
```

rather than

```
cd /home/sh1670/
```

In fact, '~' by itself is just a short form of "~your_username".

Remember that if you put anything after '~' other than '/', Linux will assume that you are referring to another user's home directory. So, in our "cp ~/jokes /tmp" example above, if we had typed

```
cp ~jokes /tmp
```

instead, we would have received an error message because there is no User ID called "jokes".

One of the nicest things about using the tilde is that you don't have to know where anyone's home directory is located. Sometimes system administrators will move home directories to new locations to alleviate disk space problems. If you always use the tilde, you might not even notice such moves.

Compiling and Executing C Programs Under Linux

Creating your file

Say you want to create a file called my_test.c. At a prompt type :

```
gedit my_test.c &
```

Or if you only have the terminal window (when using putty.exe, say)

```
nano my_test.c
```

If you already have a file called my_test.c in your current directory, gedit will open that file.

You can now type text, which will be inserted at the cursor. The mouse allows you to move the cursor around the screen, whilst the backspace and return keys all do what you would expect.

To save a file i.e. store it in your Linux file-space with a given name, click on the save icon. This saves the file in your top-level, with the name my_test.c

If you edit a file with a .c file suffix, then the editor recognises this as a C program and will switch on features related to the programming language. For example, the editor will calculate the proper indentation for each line. Just hit the tab key once when typing in a line, and the line will be indented the right distance.

(note that you may need to install gedit and / or nano to your system if you are using your own machine)

What to Type !!

```
#include <stdio.h>

int returnSum(int iNum1, int iNum2);

int main(void)
{

      int i,j,k;

      j = 2; k = 3;

      i = returnSum(j,k);

      printf("The sum of j and k is %d\n", i);

      return 0;
}

int returnSum(int iNum1, int iNum2)
{
      int i;

      i = iNum1 + iNum2;

      return i;
}
```

Compiling and Executing Your Program

To compile your program type:

```
clang my_test.c -o my_test
```

To execute your program, type the name of the executable at the command prompt:

```
./my_test
```

Be careful not to name your executable after a unix command (‘test’ is the usual culprit)!!

Other Useful Linux Programs and Tips on MVB2.11 Machines

Vital Stuff When Using Command Prompt

Ctrl+C: This command halts a running process. Use this to quickly exit from any program that you are running.

Ctrl+Z: Sends a current process into the background. Also if your terminal is messed up because you 'cat' a binary file 'ctrl + z' will clear up the screen for you and give you a clean prompt.

Tab: One of the most used keys. Pressing the 'tab' key while typing the path to any directory or a filename is very helpful. Write the first few characters of the file or directory and press the tab key to complete the name or give you a list of possibilities. When pressed during an incomplete command, the 'tab' key completes the command for you.

UP Arrow: In the terminal, it cycles through the list of commands that you have executed.

MiddleMouseButton: Just select the text you would want to copy using your mouse. Do as you would under Windows. Press and hold the right mouse button and then drag to select the text. Then switch to the terminal you want to copy to and click the middle mouse button. This will paste the text at the current cursor location.

Manual: If you want to know more about a particular program – "ls" for example type "man ls" at the command prompt.

Useful Programs

Web Browser: Either type "firefox &" at the command prompt or click on the globe with a mouse attached to it.

Word Processor: Clicking on the CentOS icon (bottom left)->Office->Open Office.org Writer **OR** Type "oowriter &" in a terminal.

Acrobat Viewer: Type "kpdf &" or "acroread &" at the command prompt.

Viewing Postrscript: Type "kghostview &" at the command prompt. Alternatively, convert the file to a PDF using ps2pdf and use "acroread" to view it.

File Explorer – Like Windows explorer: Type "nautilus &" or click on your home directory on the desktop. Also xdg-open . &

Image Viewer: Type "xv &" at the command prompt.

Launch Default Application for File type: xdg-open <your filename> &

Other Useful Stuff (John McGonigle's favourites):

```
useful commands:

[command] && [another command] //run commands one after the other

du -h   //how much space is being used
df -h   //how much on filesystems
rm -rf  //delete directories and file

ls -l -a //show files with permissions and show hidden files
chmod -R 700 [folder/file] //make file private
chmod -R 755 [folder/file] //other people can read it
chmod -R 666 [folder/file] //anyone can do anything

ssh csjmg@bluecrystal.acrc.bris.ac.uk //pass: main password
ssh ice -X //ssh with windows

scp -p -r [path to folder to copy/*] [username]@[other machine]:[path
to dir on other machine]

passwd //change password (usually on server)

rdesktop -a 16 -f atlas -g 1270x945 -u [username]//log into windows,
word 2007 etc.

convert -crop [finalxsize]x[finalysize]+[cutherex]+[cutherey]
Screenshot-*.png cropss*.png
//cuts out chunk of image
convert -delay 10 -loop 0 cropss*.png ani.gif
//make these into an animated gif loop

emacs -nw

matlab -nodisplay

anyprogram | grep [string to find in output]
anyprogram | more  //read the output of a program one screen at a time
cat /proc/meminfo | more //RAM
cat /proc/cpuinfo | more //CPU

cat > [new filename]
[write notes etc here]
[ctrl-d]

anyprogram > [output file]
anyprogram 2> [error output file]
anyprogram >> [add to output file]

pwd // what directory am i in (what's the path)
whoami // what's my user name



//compress stuff
zip stuff.zip *
```