



UNIVERSITY OF
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Worksheet 1 Report

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Issue: 1

Date: October 9, 2016

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1 Question 1

For the first exercise a number of commands were input to the linux bash prompt, in order to understand what the different commands do and how to use them. The commands are listed here in order, with the output following and finally a description of what the command has done.

a) `mkdir compphys`

No output, but a new directory has been created called “compphys”

b) `cd compphys`

No output again, but now the current working directory is “/compphys”

c) `cat > file1.txt [rtn] this is my first file [rtn][ctrl-c]`

No output is printed to the screen, however a new file called “file1.txt” has been created, containing the text “this is my first file”

d) `ls`

Output is:

```
file1.txt
```

The `ls` command lists the contents of the current working directory.

e) `more file1.txt`

Output is:

```
this is my first file
```

The `more` command pages files to the standard output, seen as the file “file1.txt” only has one line, that line is simply printed to the terminal.

f) `xclock&`

Output is shown in figure 1.

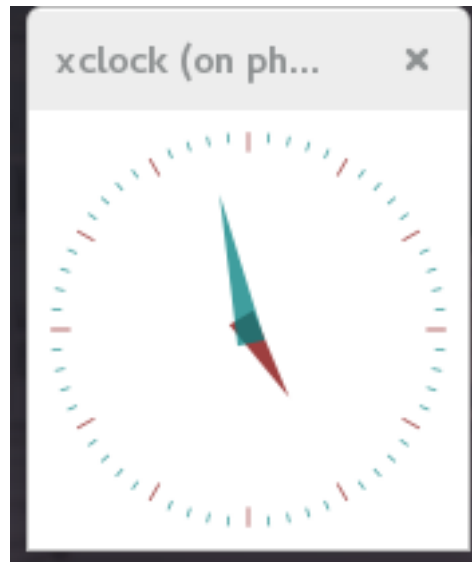


Figure 1: xclock open through the ssh session

The `xclock&` command starts an `xclock` process. This will be opened on the client side through `ssh` if X11 forwarding is enabled, and the client is able to display `xwindow` objects. The ampersand is to tell the process to start the process in the background, ie. to allow the shell session to continue while `xclock` is still running.

g) `whoami`

Output is:

mfk364

This command prints the username of the current user.

h) `man ls`

Output is a man page, a text document describing the usage of the “`ls`” command. Calling `man <command>` will display a man page on any command with proper documentation. Figure 2 shows the top of the `ls` man page.

```
Terminal
LS(1) User Commands LS(1)

NAME
ls - list directory contents

SYNOPSIS
ls [OPTION]... [FILE]...

DESCRIPTION
List information about the FILES (the current directory by default).
Sort entries alphabetically if none of -cftuvSUX nor --sort is speci-
fied.

Mandatory arguments to long options are mandatory for short options
too.

-a, --all
do not ignore entries starting with .

-A, --almost-all
do not list implied . and ..

--author
Manual page ls(1) line 1 (press h for help or q to quit)
```

Figure 2: Top of the man page for the “ls” command

i) top

Output is a display of running processes, ordered by CPU usage. The column processes are sorted by, and other options can be changed using commands while top is running. Figure 3 shows top while running, with the columns sorted by CPU usage.

```
mfk364@phymat6:~$ top
```

top - 22:33:11 up 55 days, 2:14, 1 user, load average: 0.00, 0.01, 0.05										
Tasks: 580 total, 1 running, 579 sleeping, 0 stopped, 0 zombie										
%Cpu(s): 0.0 us, 0.0 sy, 0.0 ni, 100.0 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st										
KiB Mem : 32504200 total, 19359320 free, 803004 used, 12341876 buff/cache										
KiB Swap: 2097148 total, 2097148 free, 0 used, 30665328 avail Mem										
PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
76758	mfk364	20	0	168380	2784	1620	R	0.3	0.0	0:00.06 top
1	root	20	0	194128	9220	3824	S	0.0	0.0	3:59.07 systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:02.79 kthreadd
3	root	20	0	0	0	0	S	0.0	0.0	0:04.95 ksoftirqd+
7	root	rt	0	0	0	0	S	0.0	0.0	0:01.61 migration+
8	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcu_bh
9	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcuob/0
10	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcuob/1
11	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcuob/2
12	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcuob/3
13	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcuob/4
14	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcuob/5
15	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcuob/6
16	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcuob/7
17	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcuob/8
18	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcuob/9
19	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcuob/10

Figure 3: The “top” command in action

j) kill

The “kill” command is used to stop running processes. In order to use kill one needs the PID of the process to be stopped. For this the “ps” command is used, which lists all the processes running under the current user’s UID. Once a PID is known “kill [PID]” will send a terminate signal to the process.

The output of the kill command is:

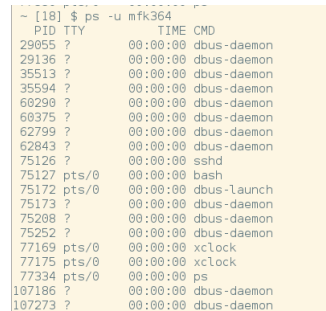
```
[running processes] Terminated\tab [process name]
```

k) ps -u [username]

As described above the “ps” command displays currently running processes. The -u option denotes that all the processes belonging to a user specified by [username] should

be displayed. The default behaviour of “ps” is to display the processes belonging to the current user running in the current TTY.

An example output of the “ps -u [username]” is shown in figure 4.



```

~ [18] $ ps -u mfk364
  PID TTY          TIME CMD
 29055 ?        00:00:00 dbus-daemon
 29136 ?        00:00:00 dbus-daemon
 35513 ?        00:00:00 dbus-daemon
 35594 ?        00:00:00 dbus-daemon
 60290 ?        00:00:00 dbus-daemon
 60375 ?        00:00:00 dbus-daemon
 62799 ?        00:00:00 dbus-daemon
 62843 ?        00:00:00 dbus-daemon
 75126 ?        00:00:00 sshd
 75127 pts/0    00:00:00 bash
 75172 pts/0    00:00:00 dbus-launch
 75173 ?        00:00:00 dbus-daemon
 75208 ?        00:00:00 dbus-daemon
 75252 ?        00:00:00 dbus-daemon
 77169 pts/0    00:00:00 xclock
 77175 pts/0    00:00:00 xclock
 77334 pts/0    00:00:00 ps
107186 ?        00:00:00 dbus-daemon
107273 ?        00:00:00 dbus-daemon

```

Figure 4: An example of “ps -u [username]” output

2 Question 4

For this question a C++ program was required to calculate different powers of ϕ (the silver ratio), given by $\phi = \frac{-1+\sqrt{5}}{2}$, and output the data to a file. The source code for this program is called “w1q4.cpp”, and when run will output data to a file called “output”. The code calculates and writes the power of phi by basic multiplication in lines 53-56.

SHOW HERE...

The function `recursion_relation` (starting at line 20 in the code) is the recursive function that uses the recursion relation defined as $\phi^{n+1} = \phi^{n-1} - \phi^n$. When the programme is run with values of N greater than around 40 the programme runs extremely slowly. This is because this recursive function runs in $O(n^2)$ time, and is therefore very slow.