**Q1**

parsetree -p --highlight-pid <pid of shell> highlighted nodes are ans

The pid of the shell was obtained using the top command.
pid = 5848
systemd(1) -lightdm(830) - lightdm(1157) - upstart(1215)- gnome-terminal
This was found on a computer running Ubuntu 15.10, which has the systemd process instead of init.

**Q2**

cd-shell
ls-exec
history-shell
ps-exec
Shell commands were identified using the command ‘help’.
Exec commands were identified by ‘exec’ing them on the shell. Ex - ‘exec ls’

**Q3**

PID of the new process in 2718
Using proc/pid/fd/
then readlink 0/1/2 tells is what the symbolic link of the fd's points too.
0- /dev/pts/5
1- /tmp/tmp.txt  (This is the ouput redirection)
2- /dev/pts/5

Here, the fd #1 is set to the output file. So, the first process thinks it is writing to stdout, but actually gets redirected to the file.

**Q4**

systemd(1) -lightdm(830) - lightdm(1157) - upstart(1215) -gnome-terminal(2239)-bash(2684) - a.out(2873) and grep(2874)

Using below two commands we see that both the stdout of a.out and the stdin of grep now point to a pipe with the same id. This ensures the output from cpuprint goes directly to grep.

$ readlink /proc/2873/fd/1
pipe:[44132]
$ readlink /proc/2874/fd/0
pipe:[44132]

**Q5-7**

Currently sending in multiples of 512 bytes. Code attached in the submission directory.