# Lab-3 Report

**Group Members:**


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**Question 1:**

pid of shell is 3908
The process tree is as follows:
systemd(init) -> lightdm -> lightdm -> upstart -> gnome-terminal -> bash
We can get this using the pstree command

**Question 2:**

cd is shell builtin
ls is exec'd by the bash shell(its executable can be found at /bin/ls)
history is shell builtin
ps is exec'd by the bash shell(its executable can be found at /bin/ps)

**Question 3:**

fd 0(standard input) points to /dev/pts/1
fd 1(standard output) points to /tmp/tmp.txt
fd 2(error stream) points to /dev/pts/1
Input redirection by Bash:
First, a new process is forked which has the default file descriptors. Then, seeing the '>' sign, the file descriptor 1 is closed(in child). And the file /tmp/tmp.txt is opened. Since 1 is the smallest available file descriptor available, it points to the newly opened file.

**Question 4:**

For cpu1printf, the fd's point as follows:
fd 0(standard input) points to /dev/pts/18
fd 1(standard output) points to pipe:[72166]
fd 2(error stream) points to /dev/pts/18

For grep, the fd's point as follows:
fd 0(standard input) points to pipe:[72166]
fd 1(standard output) points to /dev/pts/18
fd 2(error stream) points to /dev/pts/18
Implementation of pipe in Bash:
First a pipe is called before forking a new process. File descriptor 1 of the child process is redirected to the write file descriptor of the pipe. The child dups the write end of the pipe onto

the file descriptor 1 of the child process and then closes both the file descriptors of the pipe and execs "./cpu1print".
Meanwhile, the parents till the execution of the child process. It dups the read end of the pipe onto the file descriptor 0 of the parent process. Then the parent execs "grep hello" with the modified file descriptors.