OS LAB WEEK – 1

1. To study and execute the basic commands in UNIX

Ans.

A) File related commands

```
osprac@osprac-virtual-machine:~$ mkdir oslab
osprac@osprac-virtual-machine:~$ ls
Desktop    Downloads  oslab     Public  Templates
Documents  Music      Pictures  snap    Videos
osprac@osprac-virtual-machine:~$ pwd
/home/osprac
osprac@osprac-virtual-machine:~$ cd oslab
osprac@osprac-virtual-machine:~/oslab$ touch file.txt
osprac@osprac-virtual-machine:~/oslab$ cat >file.txt
hello cbit
osprac@osprac-virtual-machine:~/oslab$ cat file.txt
hello cbit
osprac@osprac-virtual-machine:~/oslab$ ls
file.txt
osprac@osprac-virtual-machine:~/oslab$ ls -lrt
total 4
-rw-rw-r-- 1 osprac osprac 11 Sep  7 14:35 file.txt
```

```
osprac@osprac-virtual-machine:~$ cd oslab
osprac@osprac-virtual-machine:~/oslab$ ls
file.txt
osprac@osprac-virtual-machine:~/oslab$ touch file1.txt
osprac@osprac-virtual-machine:~/oslab$ cat >file1.txt
hello world
osprac@osprac-virtual-machine:~/oslab$ cmp file.txt file1.txt
file.txt file1.txt differ: byte 7, line 1
osprac@osprac-virtual-machine:~/oslab$ rm file1.txt
osprac@osprac-virtual-machine:~/oslab$ ls
file.txt
```

```
osprac@osprac-virtual-machine:~$ cd oslab
osprac@osprac-virtual-machine:~/oslab$ ls
subfoldr
osprac@osprac-virtual-machine:~/oslab$ cd subfoldr
bash: cd: subfoldr: Not a directory
osprac@osprac-virtual-machine:~/oslab$ mv subfoldr ./file.txt
osprac@osprac-virtual-machine:~/oslab$ ls
file.txt
osprac@osprac-virtual-machine:~/oslab$ cat file.txt
hello cbit
osprac@osprac-virtual-machine:~/oslab$ mv file.txt ./file1.txt
osprac@osprac-virtual-machine:~/oslab$ ls
file1.txt
osprac@osprac-virtual-machine:~/oslab$ cat file1.txt
hello cbit
osprac@osprac-virtual-machine:~/oslab$ cp file1.txt file2.txt
osprac@osprac-virtual-machine:~/oslab$ cat file2.txt
hello cbit
osprac@osprac-virtual-machine:~/oslab$ echo hello world
hello world
```

```
osprac@osprac-virtual-machine:~/oslab$ paste file1.txt file2.txt
hello cbit      hello cbit
osprac@osprac-virtual-machine:~/oslab$ mkdir subfolder
osprac@osprac-virtual-machine:~/oslab$ ls
file1.txt  file2.txt  subfolder
osprac@osprac-virtual-machine:~/oslab$ rmdir subfolder
osprac@osprac-virtual-machine:~/oslab$ ls
file1.txt  file2.txt
osprac@osprac-virtual-machine:~/oslab$ gedit file1.txt
osprac@osprac-virtual-machine:~/oslab$ head file1.txt
hello cbit
how is the college
is it fine??
hhhhhhhhhhhhhhh
jjjjjjjjjjjjjjjjjjjjjjj
kkkkkkkkkkkk
rrrrrrrrrrrrr
hello cbit
how is the college
is it fine??
osprac@osprac-virtual-machine:~/oslab$ tail file1.txt
kkkkkkkkkkkk
rrrrrrrrrrrrr
hhhhhhhhhhhhhhh
jjjjjjjjjjjjjjjjjjjjjjj
kkkkkkkkkkkk
rrrrrrrrrrrrr
hhhhhhhhhhhhhhh
jjjjjjjjjjjjjjjjjjjjjjj
kkkkkkkkkkkk
rrrrrrrrrrrrr
```

```
osprac@osprac-virtual-machine:~/oslab$ date
Wednesday 07 September 2022 03:00:51 PM IST
osprac@osprac-virtual-machine:~/oslab$ grep "hello cbit" file1.txt file2.txt
file1.txt:hello cbit
file1.txt:hello cbit
file1.txt:hello cbit
file2.txt:hello cbit
osprac@osprac-virtual-machine:~/oslab$ ls -lrt
total 8
-rwxrwxr-x 1 osprac osprac  11 Sep  7 14:48 file2.txt
-rwxrwxrwx 1 osprac osprac 619 Sep  7 14:55 file1.txt
osprac@osprac-virtual-machine:~/oslab$ chmod 777 file2.txt
osprac@osprac-virtual-machine:~/oslab$ ls -lrt
total 8
-rwxrwxrwx 1 osprac osprac  11 Sep  7 14:48 file2.txt
-rwxrwxrwx 1 osprac osprac 619 Sep  7 14:55 file1.txt
osprac@osprac-virtual-machine:~/oslab$ chmod 421 file1.txt
osprac@osprac-virtual-machine:~/oslab$ ls -lrt
total 8
-rwxrwxrwx 1 osprac osprac  11 Sep  7 14:48 file2.txt
-r---w---x 1 osprac osprac 619 Sep  7 14:55 file1.txt
osprac@osprac-virtual-machine:~/oslab$
```

```
osprac@osprac-virtual-machine:~/oslab$ ls -lrt
total 8
-rwxrwxrwx 1 osprac osprac  11 Sep  7 14:48 file2.txt
-r---w---x 1 osprac osprac 619 Sep  7 14:55 file1.txt
osprac@osprac-virtual-machine:~/oslab$ chown master file1.txt
chown: invalid user: ‘master’
osprac@osprac-virtual-machine:~/oslab$ sudo chown root file1.txt
[sudo] password for osprac:
osprac@osprac-virtual-machine:~/oslab$ ls -lrt
total 8
-rwxrwxrwx 1 osprac osprac  11 Sep  7 14:48 file2.txt
-r---w---x 1 root   osprac 619 Sep  7 14:55 file1.txt
```

```
MAN(1)                                   Manual pager utils                                   MAN(1)

NAME
       man - an interface to the system reference manuals

SYNOPSIS
       man [man options] [[section] page ...] ...
       man -k [apropos options] regexp ...
       man -K [man options] [section] term ...
       man -f [whatis options] page ...
       man -l [man options] file ...
       man -w|-W [man options] page ...

DESCRIPTION
       man  is  the system's manual pager.  Each page argument given to man is normally the name of a program, utility or function.  The manual page associ-
       ated with each of these arguments is then found and displayed.  A section, if provided, will direct man to look only in that section of  the  manual.
       The default action is to search in all of the available sections following a pre-defined order (see DEFAULTS), and to show only the first page found,
       even if page exists in several sections.

       The table below shows the section numbers of the manual followed by the types of pages they contain.

       1   Executable programs or shell commands
       2   System calls (functions provided by the kernel)
       3   Library calls (functions within program libraries)
       4   Special files (usually found in /dev)
       5   File formats and conventions, e.g. /etc/passwd
       6   Games
       7   Miscellaneous (including macro packages and conventions), e.g. man(7), groff(7), man-pages(7)
       8   System administration commands (usually only for root)
       9   Kernel routines [Non standard]

       A manual page consists of several sections.

       Conventional section names include NAME, SYNOPSIS, CONFIGURATION, DESCRIPTION, OPTIONS, EXIT STATUS, RETURN VALUE, ERRORS, ENVIRONMENT,  FILES,  VER-
       SIONS, CONFORMING TO, NOTES, BUGS, EXAMPLE, AUTHORS, and SEE ALSO.

       The following conventions apply to the SYNOPSIS section and can be used as a guide in other sections.

       bold text          type exactly as shown.
       italic text        replace with appropriate argument.
       [-abc]             any or all arguments within [ ] are optional.
       -a|-b              options delimited by | cannot be used together.
       argument ...       argument is repeatable.
       [expression] ...   entire expression within [ ] is repeatable.

       Exact  rendering  may  vary depending on the output device.  For instance, man will usually not be able to render italics when running in a terminal,
       and will typically use underlined or coloured text instead.

 Manual page man(1) line 1 (press h for help or q to quit)
```

B) Process related commands

Top command:

```
top - 15:15:05 up 45 min,  1 user,  load average: 0.14, 0.18, 0.20
Tasks: 308 total,   1 running, 307 sleeping,   0 stopped,   0 zombie
%Cpu(s):  3.4 us,  0.7 sy,  0.0 ni, 95.9 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
MiB Mem :   7917.6 total,   4518.0 free,   1897.2 used,   1502.3 buff/cache
MiB Swap:   2048.0 total,   2048.0 free,      0.0 used.   5651.4 avail Mem

    PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
   7727 osprac    20   0 3259680 418872 202744 S   5.6   5.2   1:20.24 firefox
   4757 osprac    20   0  595648  75812  61556 S   5.3   0.9   0:17.20 gnome-terminal-
   1108 osprac    20   0 5123232 331072 148400 S   2.7   4.1   2:09.79 gnome-shell
   9388 osprac    20   0 2685780 151312  97600 S   1.7   1.9   0:16.93 Isolated Web Co
    777 message+  20   0   10840   5988   3892 S   0.7   0.1   0:00.72 dbus-daemon
     39 root      20   0       0      0      0 S   0.3   0.0   0:00.30 kcompactd0
    330 root      20   0       0      0      0 S   0.3   0.0   0:00.87 jbd2/sda3-8
    540 systemd+  20   0   14824   6204   5404 S   0.3   0.1   0:04.46 systemd-oomd
   1202 root      20   0  250856   8700   7560 S   0.3   0.1   0:00.05 upowerd
   4790 root      20   0       0      0      0 I   0.3   0.0   0:02.23 kworker/u256:1-writeback
   9571 osprac    20   0 2401844  61696  50028 S   0.3   0.8   0:00.14 Web Content
   9862 root      20   0       0      0      0 I   0.3   0.0   0:00.20 kworker/2:0-mm_percpu_wq
      1 root      20   0  166564  11744   8256 S   0.0   0.1   0:04.03 systemd
      2 root      20   0       0      0      0 S   0.0   0.0   0:00.02 kthreadd
      3 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 rcu_gp
      4 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 rcu_par_gp
      5 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 netns
      7 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/0:0H-events_highpri
     10 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 mm_percpu_wq
     11 root      20   0       0      0      0 S   0.0   0.0   0:00.00 rcu_tasks_rude_
     12 root      20   0       0      0      0 S   0.0   0.0   0:00.00 rcu_tasks_trace
     13 root      20   0       0      0      0 S   0.0   0.0   0:00.19 ksoftirqd/0
     14 root      20   0       0      0      0 I   0.0   0.0   0:06.26 rcu_sched
     15 root      rt   0       0      0      0 S   0.0   0.0   0:00.05 migration/0
     16 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/0
     17 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/0
     18 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/1
     19 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/1
     20 root      rt   0       0      0      0 S   0.0   0.0   0:00.70 migration/1
     21 root      20   0       0      0      0 S   0.0   0.0   0:00.83 ksoftirqd/1
     23 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/1:0H-events_highpri
     24 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/2
     25 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/2
     26 root      rt   0       0      0      0 S   0.0   0.0   0:00.70 migration/2
     27 root      20   0       0      0      0 S   0.0   0.0   0:00.15 ksoftirqd/2
     29 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/2:0H-events_highpri
     30 root      20   0       0      0      0 S   0.0   0.0   0:00.01 kdevtmpfs
     31 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 inet_frag_wq
     32 root      20   0       0      0      0 S   0.0   0.0   0:00.00 kauditd
     36 root      20   0       0      0      0 S   0.0   0.0   0:00.00 khungtaskd
     37 root      20   0       0      0      0 S   0.0   0.0   0:00.00 oom_reaper
     38 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 writeback
```

ps command

```
osprac@osprac-virtual-machine:~/oslab$ ps
    PID TTY          TIME CMD
   4775 pts/0    00:00:00 bash
   9979 pts/0    00:00:00 ps
```

kill command

```
osprac@osprac-virtual-machine:~/oslab$ kill firefox
bash: kill: firefox: arguments must be process or job IDs
osprac@osprac-virtual-machine:~/oslab$ kill 7727
```

```
top - 15:19:35 up 49 min,  1 user,  load average: 0.03, 0.10, 0.16
Tasks: 299 total,   1 running, 298 sleeping,   0 stopped,   0 zombie
%Cpu(s):  1.0 us,  0.6 sy,  0.2 ni, 98.2 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
MiB Mem :   7917.6 total,   5062.3 free,   1359.7 used,   1495.6 buff/cache
MiB Swap:   2048.0 total,   2048.0 free,      0.0 used.   6195.5 avail Mem

    PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
   1108 osprac    20   0 5160968 340340 157572 S   3.3   4.2   2:21.39 gnome-shell
    952 osprac     9 -11 1431088  27320  21656 S   1.7   0.3   0:18.60 pulseaudio
   4757 osprac    20   0  596816  76956  61556 S   1.0   0.9   0:19.86 gnome-terminal-
   1597 osprac    20   0 2903096  81864  64028 S   0.7   1.0   0:05.28 gjs
     14 root      20   0       0      0      0 I   0.3   0.0   0:06.81 rcu_sched
    330 root      20   0       0      0      0 S   0.3   0.0   0:00.91 jbd2/sda3-8
    540 systemd+  20   0   14824   6204   5404 S   0.3   0.1   0:04.91 systemd-oomd
   1531 osprac    39  19  672796  32384  18844 S   0.3   0.4   0:01.64 tracker-miner-f
   9599 root      20   0       0      0      0 I   0.3   0.0   0:00.77 kworker/u256:3-writeback
  10026 osprac    20   0  908876  99504  59920 S   0.3   1.2   0:02.55 nautilus
  10090 osprac    20   0   21984   4192   3228 R   0.3   0.1   0:00.01 top
      1 root      20   0  166564  11744   8256 S   0.0   0.1   0:04.05 systemd
      2 root      20   0       0      0      0 S   0.0   0.0   0:00.02 kthreadd
      3 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 rcu_gp
      4 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 rcu_par_gp
      5 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 netns
      7 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/0:0H-events_highpri
     10 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 mm_percpu_wq
     11 root      20   0       0      0      0 S   0.0   0.0   0:00.00 rcu_tasks_rude_
     12 root      20   0       0      0      0 S   0.0   0.0   0:00.00 rcu_tasks_trace
     13 root      20   0       0      0      0 S   0.0   0.0   0:00.19 ksoftirqd/0
     15 root      rt   0       0      0      0 S   0.0   0.0   0:00.06 migration/0
     16 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/0
     17 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/0
     18 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/1
     19 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/1
     20 root      rt   0       0      0      0 S   0.0   0.0   0:00.70 migration/1
     21 root      20   0       0      0      0 S   0.0   0.0   0:00.83 ksoftirqd/1
     23 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/1:0H-events_highpri
     24 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/2
     25 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/2
     26 root      rt   0       0      0      0 S   0.0   0.0   0:00.70 migration/2
     27 root      20   0       0      0      0 S   0.0   0.0   0:00.16 ksoftirqd/2
     29 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/2:0H-events_highpri
     30 root      20   0       0      0      0 S   0.0   0.0   0:00.01 kdevtmpfs
     31 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 inet_frag_wq
     32 root      20   0       0      0      0 S   0.0   0.0   0:00.00 kauditd
     36 root      20   0       0      0      0 S   0.0   0.0   0:00.00 khungtaskd
     37 root      20   0       0      0      0 S   0.0   0.0   0:00.00 oom_reaper
     38 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 writeback
     39 root      20   0       0      0      0 S   0.0   0.0   0:00.33 kcompactd0
```

C) Network related commands (ping, netstat, ifconfig etc.)

```
osprac@osprac-virtual-machine:~/oslab$ ping learning.cbit.org.in
PING learning-cbit-org-in-1413882276.ap-south-1.elb.amazonaws.com (43.204.151.98) 56(84) bytes of data.
^C
--- learning-cbit-org-in-1413882276.ap-south-1.elb.amazonaws.com ping statistics ---
35 packets transmitted, 0 received, 100% packet loss, time 34774ms

osprac@osprac-virtual-machine:~/oslab$ ping cbit.ac.in
PING cbit.ac.in (3.111.165.12) 56(84) bytes of data.
^C
--- cbit.ac.in ping statistics ---
49 packets transmitted, 0 received, 100% packet loss, time 49120ms
```

```
osprac@osprac-virtual-machine:~/oslab$ ifconfig
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.5.128  netmask 255.255.255.0  broadcast 192.168.5.255
        inet6 fe80::a460:5890:b:680f  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:65:22:db  txqueuelen 1000  (Ethernet)
        RX packets 87778  bytes 91429970 (91.4 MB)
        RX errors 33  dropped 33  overruns 0  frame 0
        TX packets 57601  bytes 8694021 (8.6 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 19  base 0x2000

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 7941  bytes 1016428 (1.0 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 7941  bytes 1016428 (1.0 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

```
osprac@osprac-virtual-machine:~/oslab$ netstat
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 osprac-virtual-ma:54508 ec2-52-43-253-52.:https ESTABLISHED
tcp        0      0 osprac-virtual-ma:52416 239.237.117.34.bc:https ESTABLISHED
tcp        0      0 osprac-virtual-ma:33074 20.120.65.166:https     ESTABLISHED
udp        0      0 osprac-virtual-m:bootpc 192.168.5.254:bootps    ESTABLISHED
Active UNIX domain sockets (w/o servers)
Proto RefCnt Flags       Type       State         I-Node   Path
unix  2      [ ]         DGRAM      CONNECTED     34080    /run/user/1000/systemd/notify
unix  4      [ ]         DGRAM      CONNECTED     25364    /run/systemd/notify
unix  2      [ ]         DGRAM                    25381    /run/systemd/journal/syslog
unix  18     [ ]         DGRAM      CONNECTED     25390    /run/systemd/journal/dev-log
unix  9      [ ]         DGRAM      CONNECTED     25392    /run/systemd/journal/socket
unix  3      [ ]         STREAM     CONNECTED     35167    /run/systemd/journal/stdout
unix  2      [ ]         DGRAM      CONNECTED     31837
unix  3      [ ]         STREAM     CONNECTED     31969
unix  3      [ ]         STREAM     CONNECTED     36190
unix  3      [ ]         STREAM     CONNECTED     36999    /run/systemd/journal/stdout
unix  2      [ ]         DGRAM                    121197
unix  3      [ ]         STREAM     CONNECTED     37344    /run/user/1000/bus
unix  3      [ ]         STREAM     CONNECTED     37134
unix  3      [ ]         STREAM     CONNECTED     35652    /run/user/1000/bus
unix  3      [ ]         STREAM     CONNECTED     34142    /run/dbus/system_bus_socket
unix  3      [ ]         STREAM     CONNECTED     34129    /run/systemd/journal/stdout
unix  3      [ ]         STREAM     CONNECTED     29350
unix  3      [ ]         STREAM     CONNECTED     115557   /run/systemd/journal/stdout
unix  3      [ ]         STREAM     CONNECTED     38321    /run/user/1000/bus
unix  3      [ ]         STREAM     CONNECTED     36154
unix  3      [ ]         STREAM     CONNECTED     35985    /run/user/1000/bus
unix  3      [ ]         SEQPACKET  CONNECTED     135350
unix  3      [ ]         STREAM     CONNECTED     35864
unix  3      [ ]         STREAM     CONNECTED     28021    /run/systemd/journal/stdout
unix  3      [ ]         STREAM     CONNECTED     34245    /run/user/1000/bus
unix  3      [ ]         STREAM     CONNECTED     35640    /run/dbus/system_bus_socket
unix  3      [ ]         STREAM     CONNECTED     34708
unix  3      [ ]         STREAM     CONNECTED     35011    /run/dbus/system_bus_socket
unix  3      [ ]         STREAM     CONNECTED     117670   /run/user/1000/bus
unix  3      [ ]         STREAM     CONNECTED     47540    /run/dbus/system_bus_socket
unix  3      [ ]         STREAM     CONNECTED     36905    /run/user/1000/bus
unix  3      [ ]         STREAM     CONNECTED     35991    /run/user/1000/bus
unix  3      [ ]         STREAM     CONNECTED     46884
```

2. **Write a shell script to**
   a. **Check given number is prime or not**
   b. **Check given number is palindrome number**
   c. **Check given number is Armstrong number**
   d. **Convert decimal to binary**
   e. **Convert decimal to base 5**
   f. **Convert base 5 to decimal**

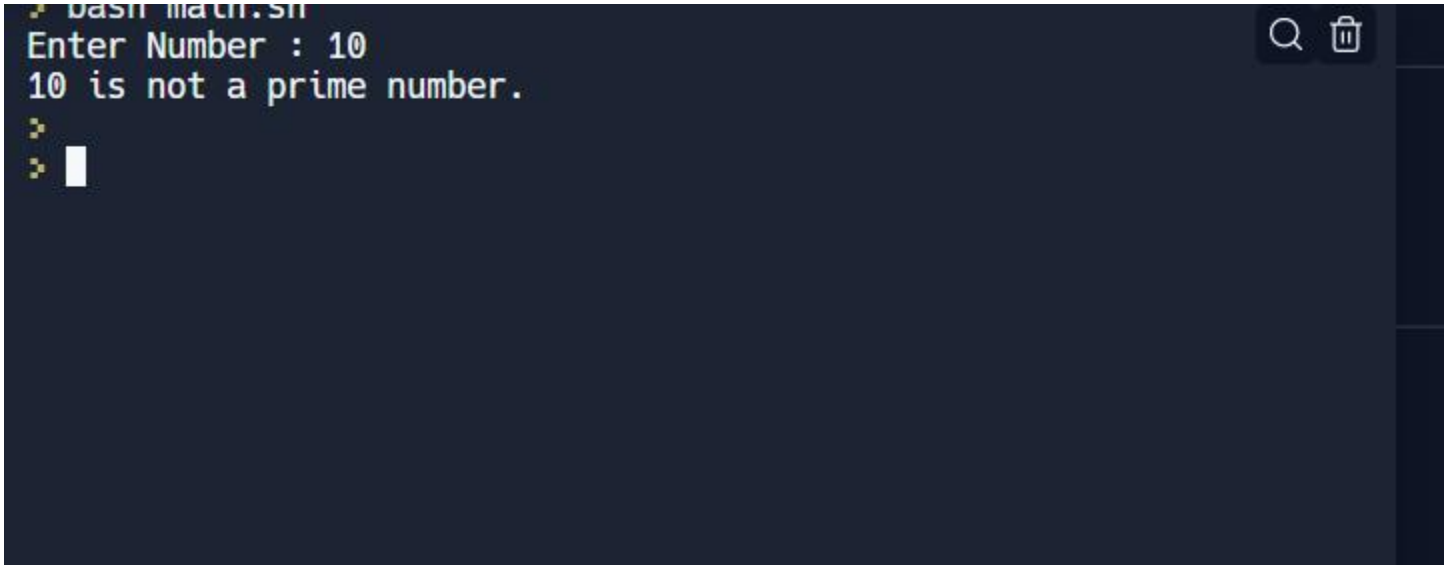
Ans.

a) A program to check given number is prime or not

PROGRAM:

```
echo -n "Enter Number : "
read n
for((i=2; i<=$n/2; i++))
do
  ans=$(( n%i ))
  if [ $ans -eq 0 ]
  then
    echo "$n is not a prime number."
    exit 0
  fi
done
echo "$n is a prime number."
```

OUTPUT:

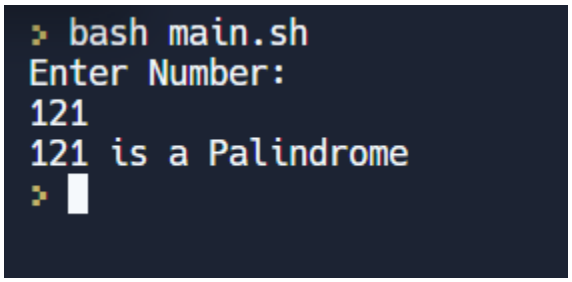


b) A program to check given number is palindrome number

PROGRAM:

```
echo "Enter Number: "
read n
num=$n
rev=0
while [ $num -gt 0 ]
do
   rev=$((rev*10 + num%10))
   num=$((num/10))
done
if [ $rev -eq $n ]
then
   echo "$n is a Palindrome"
   exit 0
fi
echo "$n is not a Palindrome"
```

OUTPUT:



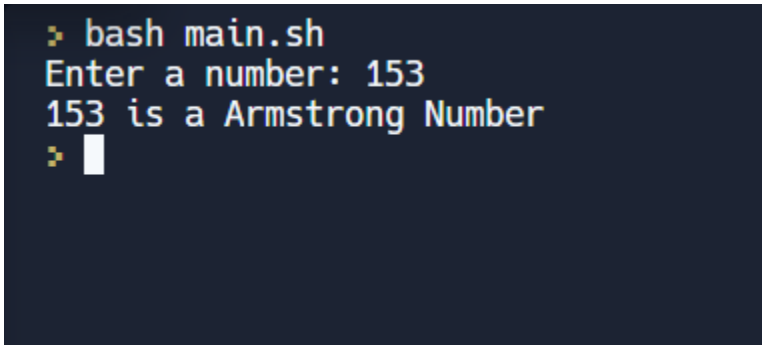
c) A program to check given number is Armstrong number

PROGRAM:

```
echo -n "Enter a number: "
read n
t=$n
sum=0
while [ $n -gt 0 ]
do
   rem=$((n%10))
   cube=$((rem*rem*rem))
```

```
    sum=$((sum+cube))
    n=$((n/10))
done
if [ $sum == $t ]
then
    echo "$t is a Armstrong Number"
else
    echo "$t is not a Armstrong Number"
fi
```

OUTPUT:



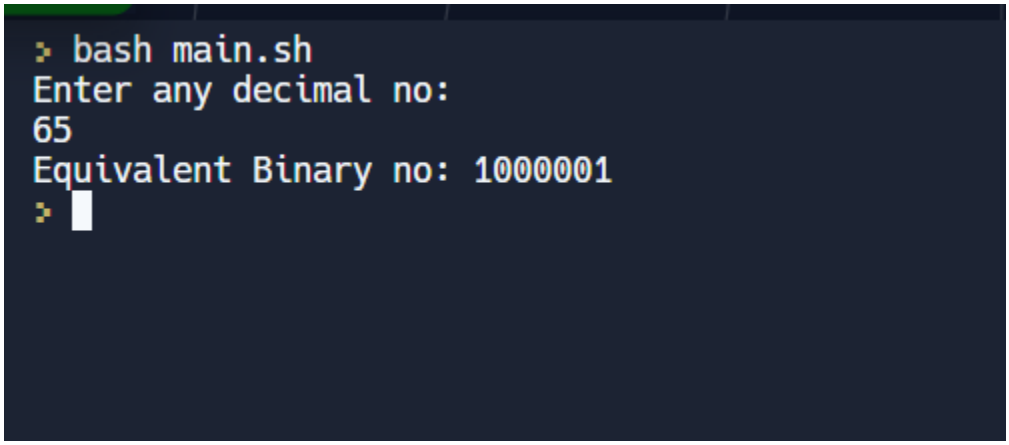
d) A program to convert decimal to binary

PROGRAM:

```
echo "Enter any decimal no:"
read num
rem=1
bno=" "
while [ $num -gt 0 ]
do
rem=`expr $num % 2 `
bno=$bno$rem
num=`expr $num / 2 `
done
i=${#bno}
final=" "
while [ $i -gt 0 ]
do
```

```
rev=`echo $bno | awk '{ printf substr( $0,'$i',1 ) }'`
final=$final$rev
i=$(( $i - 1 ))
done
echo "Equivalent Binary no:" $final
```

OUTPUT:

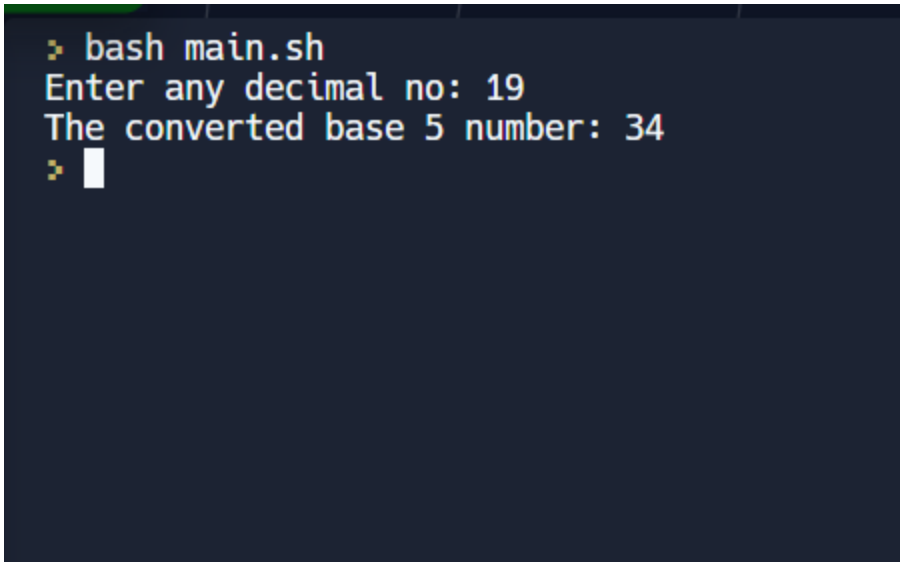


e) A program to convert decimal to base 5

PROGRAM:

```
echo -n "Enter any decimal no: "
read num
rem=1
bno=""
while [ $num -gt 0 ]
do
rem=$((num%5))
bno=$rem$bno
num=$((num/5))
done
echo "The converted base 5 number: $bno"
```

OUTPUT:

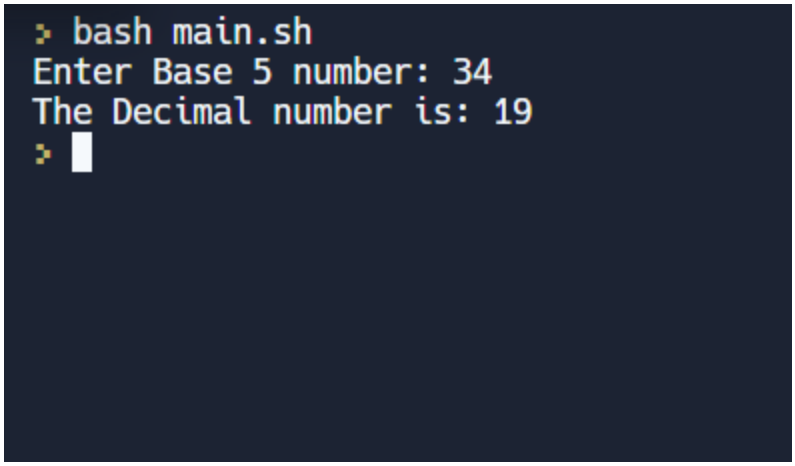


f) A program to convert base 5 to decimal

PROGRAM:

```
echo -n "Enter Base 5 number: "
read bno
dec=0
pow=1
while [ $bno -gt 0 ]
do
val=$((bno%10))
dec=$((dec+val*pow))
bno=$((bno/10))
pow=$((pow*5))
done
echo "The Decimal number is: $dec"
```

OUTPUT:


bash main.sh
Enter Base 5 number: 34
The Decimal number is: 19

NAME: B.Ashok **SECTION: CSE – 3** **Roll No: 1601-20-733-314**

OS LAB WEEK – 2

1. **Demonstrate System calls with simple example programs**

Ans.

PROGRAM:

```
#include <unistd.h>
#include <sys/types.h>
#include <stdio.h>
int main( ){
  pid_t child_pid;
  child_pid = fork (); // Create a new child process;
  if (child_pid < 0) {
    printf("fork failed");
    return 1;
  } else if (child_pid == 0) {
    printf ("child process successfully created!\n");
    printf ("child_PID = %d,parent_PID = %d\n",
    getpid(), getppid( ) );
  } else {
   //  wait(NULL);
    printf ("parent process successfully created!\n");
    printf ("child_PID = %d, parent_PID = %d", getpid( ), getppid( ) );
  }
  return 0;
}
```

OUTPUT:

```
ubuntu@ubuntu:~/Desktop/oslab$ gcc programs.c
ubuntu@ubuntu:~/Desktop/oslab$ ./a.out
parent process successfully created!
child_PID = 10970, parent_PID = 6958child process successfully created!
ubuntu@ubuntu:~/Desktop/oslab$ child_PID = 10971,parent_PID = 2436

ubuntu@ubuntu:~/Desktop/oslab$
```

2. **Demonstrate following I/O system calls with examples**
   - **i. Open**
   - **ii. Read**
   - **iii. Write**
   - **iv. Lseek**
   - **v. Ioctl**
   - **vi. Stat**
   - **vii. Syn**

Ans.

PROGRAM:

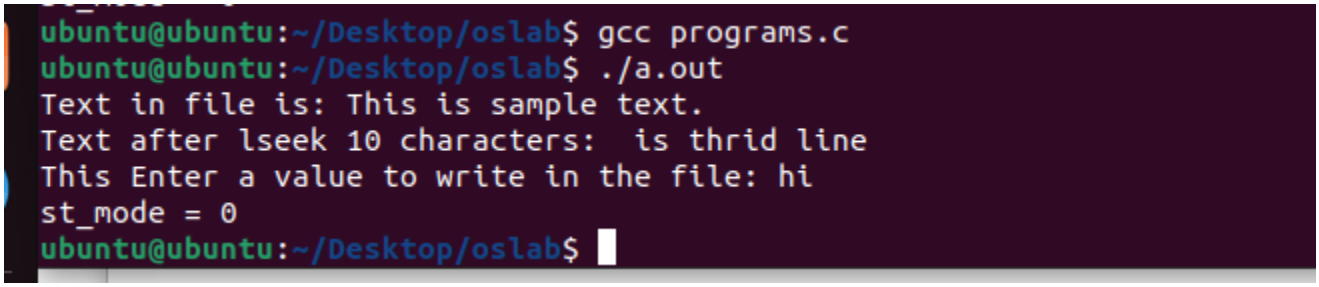
```
#include<stdio.h>
#include<unistd.h>
#include<fcntl.h>
#include<stdlib.h>
#include<sys/ioctl.h>
#include<sys/stat.h>
#define WR_VALUE _IOW('a','a',int*)
#define RD_VALUE _IOR('a','b',int*)
int main()
{
   // if file does not have in directory
   // then file foo.txt is created.
   int fd = open("sample.txt", O_RDONLY | O_CREAT);
   int fd2 = open("file2.txt", O_WRONLY | O_CREAT | O_TRUNC, 0644);
   int fd3 = open("file3.txt", O_RDWR);
   char c[20];
   // reading from sample.txt
   read(fd, &c, 20);
   printf("Text in file is: %s\n",c);
```

```
    //writing into file2.txt which was stored in c
    write(fd2, c, read(fd, &c, 20));
    lseek(fd, 5, SEEK_CUR);
    char c1[20];
    read(fd, &c1, 20);
    printf("Text after lseek 10 characters: %s",c1);
    printf("Enter a value to write in the file: ");
    int number;
    scanf("%d",&number);
    ioctl(fd3, WR_VALUE,(int*) &number);
    struct stat sfile;
    stat("stat.c", &sfile);
    printf("st_mode = %o\n",sfile.st_mode);
    close(fd);
    close(fd2);
    close(fd3);
    return 0;
}
```

OUTPUT:

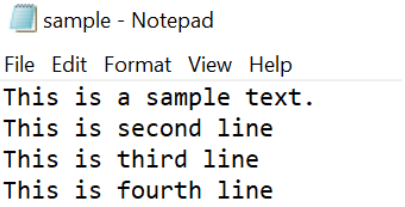
Terminal output:

File

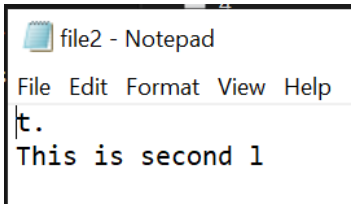


output:

i. **Sample.txt**

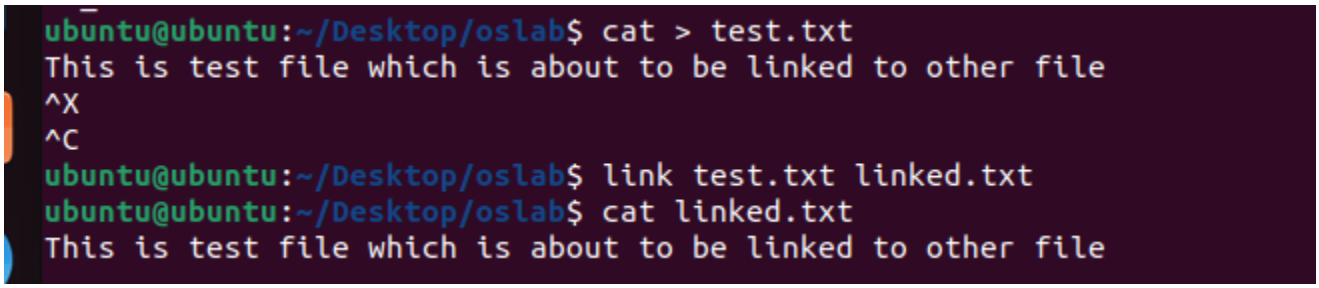


ii. **File2.txt**

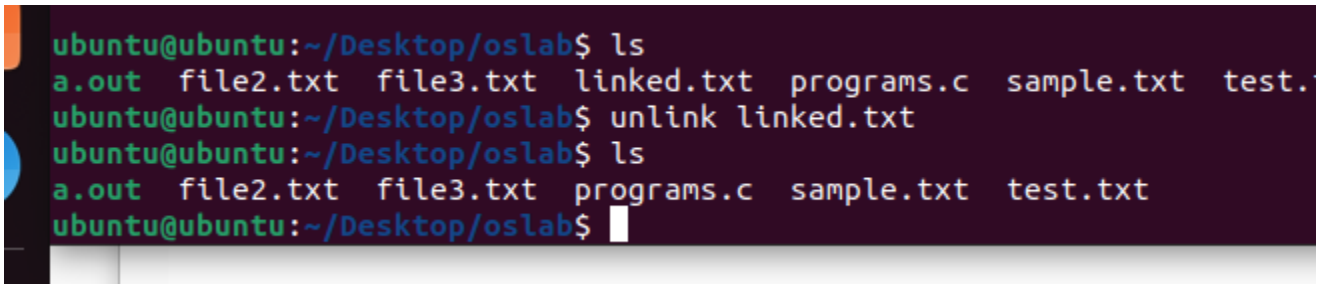


3. **Demonstrate following file system call with examples**

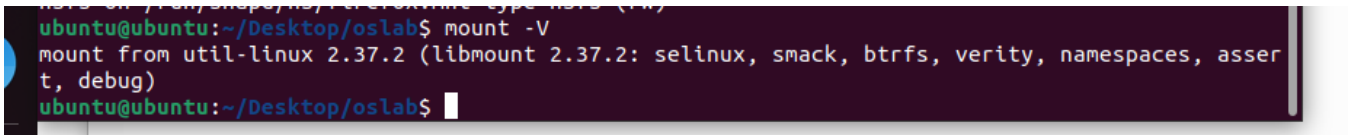
   i. **Link**



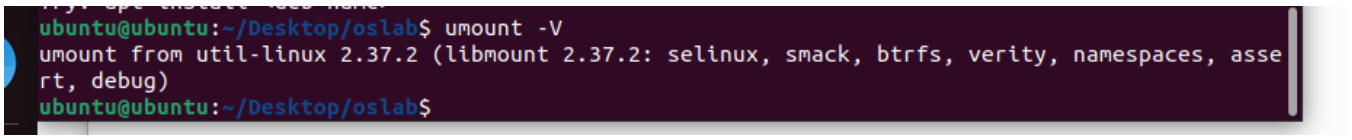
   ii. **Unlink**



   iii. **Mount**



   iv. **Unmount**



   v. **Chmod**

```
ubuntu@ubuntu:~/Desktop/oslab$ ls
a.out  file2.txt  file3.txt  programs.c  sample.txt  test.txt
ubuntu@ubuntu:~/Desktop/oslab$ ls -lrt
total 32
-rw-rw-r-- 1 ubuntu ubuntu  1054 Sep 27 23:36 programs.c
-rw-rw-r-- 1 ubuntu ubuntu    80 Sep 27 23:40 sample.txt
-rw-rw-r-- 1 ubuntu ubuntu     0 Sep 27 23:40 file3.txt
-rwxrwxr-x 1 ubuntu ubuntu 16344 Sep 27 23:40 a.out
-rw-rw-r-- 1 ubuntu ubuntu    20 Sep 27 23:40 file2.txt
-rw-rw-r-- 1 ubuntu ubuntu    62 Sep 27 23:43 test.txt
ubuntu@ubuntu:~/Desktop/oslab$ chmod 777 test.txt
ubuntu@ubuntu:~/Desktop/oslab$ ls -lrt
total 32
-rw-rw-r-- 1 ubuntu ubuntu  1054 Sep 27 23:36 programs.c
-rw-rw-r-- 1 ubuntu ubuntu    80 Sep 27 23:40 sample.txt
-rw-rw-r-- 1 ubuntu ubuntu     0 Sep 27 23:40 file3.txt
-rwxrwxr-x 1 ubuntu ubuntu 16344 Sep 27 23:40 a.out
-rw-rw-r-- 1 ubuntu ubuntu    20 Sep 27 23:40 file2.txt
-rwxrwxrwx 1 ubuntu ubuntu    62 Sep 27 23:43 test.txt
ubuntu@ubuntu:~/Desktop/oslab$
```

vi. Chown

```
ubuntu@ubuntu:~/Desktop/oslab$ sudo chown -c root test.txt
[sudo] password for ubuntu:
ubuntu is not in the sudoers file.  This incident will be reported.
ubuntu@ubuntu:~/Desktop/oslab$
```

4. Demonstrate how process is created and allocate memory in /proc folder with example program

Ans.

PROGRAM:

```
#include<stdio.h>
#include<fcntl.h>
#include<unistd.h>
int main(int argc, char *argv[])
{
int a;
int fd1=open("kk.txt",O_RDONLY,742);  //open system call
int fd2=open("kk1.txt",O_RDONLY,S_IRWXU|S_IRGRP|S_IXOTH);
printf(" fd1=%d,fd2=%d\n", fd1,fd2);
printf("Process Id=%d\n",getpid());
scanf("%d",&a);
}
```

OUTPUT:

Process program execution output:

NAME: B.Ashok **SECTION: CSE – 3** **Roll No: 1601-20-733-314**

```
ubuntu@ubuntu:~/Desktop/oslab$ gcc programs.c
ubuntu@ubuntu:~/Desktop/oslab$ ./a.out
 fd1=-1,fd2=-1
Process Id=11563
```

in proc folder

```
ubuntu@ubuntu:/proc$ ls
1      1040   111    12108  1282   1374   1462   1550   1716   24     2500   2748   2897   2950   3012   3113   37     659    742    94         devices          keys             net              timer_list
10     105    112    12109  1283   1386   1463   1580   1762   2422   2514   2753   2909   2955   3019   312    374    667    745    97         diskstats        key-users        pagetypeinfo     tty
100    10592  11259  12177  129    14     1465   1581   1765   2436   252    2758   2911   2972   302    3135   38     670    769    98         dma              kmsg             partitions       uptime
1000   106    113    12221  1295   1414   1468   1584   178    2437   2564   276    2921   2973   3020   3162   39     672    86     986        driver           kpagecgroup      pressure         version
1009   1060   114    12251  13     1416   1469   1589   179    2443   2587   2763   2923   298    303    3167   4      675    87     995        dynamic_debug    kpagecount       schedstat        version_signature
1011   1063   11423  12316  1300   1432   1470   1590   18     2444   26     28     2924   299    3035   32     482    677    873    acpi       execdomains      kpageflags       scsi             vmallocinfo
1018   10683  1145   12355  1308   1434   1477   16     1832   2445   2605   2838   2925   2996   3036   3209   484    682    88     asound     fb               loadavg          self             vmstat
1019   10698  11481  12406  1321   1437   1494   1640   1833   2454   2625   2842   2927   2999   304    3262   5      684    884    bootconfig filesystems      locks            slabinfo         zoneinfo
102    107    11512  12412  1331   1439   1495   1643   19     2457   2628   2852   2930   3      305    33     604    6859   886    buddyinfo  fs               mdstat           softirqs
1020   10897  1157   1242   1333   1441   15     1646   2      2465   2637   2858   2932   30     3056   34     6210   686    89     bus        interrupts       meminfo          stat
1021   109    1176   1245   134    1445   1518   1653   20     2472   2649   286    2935   300    3057   345    652    6860   9      cgroups    iomem            misc             swaps
1026   10912  1188   125    1343   1454   1524   1658   21     2481   2677   2866   2936   3002   306    35     653    688    90     cmdline    ioports          modules          sys
1030   11     1188   1251   1352   1455   1526   1672   211    2488   2685   2874   2942   3008   307    3523   655    693    91     consoles   irq              mounts           sysrq-trigger
1032   11010  12     1276   1353   1459   1529   1684   212    2491   27     2880   2944   3009   31     36     656    696    92     cpuinfo    kallsyms         mtd              sysvipc
104    1104   12002  1282   1374   1462   1550   1716   24     2500   2748   2897   2950   3012   3113   37     659    742    94     devices    keys             net              timer_list
ubuntu@ubuntu:/proc$ ls
1      1040   111    12108  1283   1386   1463   1580   1762   2422   2514   2753   2909   2955   3019   312    374    667    745    97         diskstats        key-users        pagetypeinfo     tty
10     105    112    12109  129    14     1465   1581   1765   2436   252    2758   2911   2972   302    3135   38     670    769    98         dma              kmsg             partitions       uptime
100    10592  11259  12177  1295   1414   1468   1584   178    2437   2564   276    2921   2973   3020   3162   39     672    86     986        driver           kpagecgroup      pressure         version
1000   106    113    12221  13     1416   1469   1589   179    2443   2587   2763   2923   298    303    3167   4      675    87     995        dynamic_debug    kpagecount       schedstat        version_signature
1009   1060   114    12251  1300   1432   1470   1590   18     2444   26     28     2924   299    3035   32     482    677    873    acpi       execdomains      kpageflags       scsi             vmallocinfo
1011   1063   11423  12316  1308   1434   1477   16     1832   2445   2605   2838   2925   2996   3036   3209   484    682    88     asound     fb               loadavg          self             vmstat
1018   10683  1145   12355  1321   1437   1494   1640   1833   2454   2625   2842   2927   2999   304    3262   5      684    884    bootconfig filesystems      locks            slabinfo         zoneinfo
1019   10698  11481  12414  1331   1439   1495   1643   19     2457   2628   2852   2930   3      305    33     604    6859   886    buddyinfo  fs               mdstat           softirqs
102    107    11512  1242   1333   1441   15     1646   2      2465   2637   2858   2932   30     3056   34     6210   686    89     bus        interrupts       meminfo          stat
1020   10897  1157   1245   134    1445   1518   1653   20     2472   2649   286    2935   300    3057   345    652    6860   9      cgroups    iomem            misc             swaps
1021   109    1176   125    1343   1454   1524   1658   21     2481   2677   2866   2936   3002   306    35     653    688    90     cmdline    ioports          modules          sys
1026   10912  1180   1251   1352   1455   1526   1672   211    2488   2685   2874   2942   3008   307    3523   655    693    91     consoles   irq              mounts           sysrq-trigger
1030   11     1188   1276   1353   1459   1529   1684   212    2491   27     2880   2944   3009   31     36     656    696    92     cpuinfo    kallsyms         mtd              sysvipc
1032   11010  12     128    1354   1460   1549   1712   22     25     2726   2894   2946   301    3101   369    657    7      93     crypto     kcore            ntrr             thread-self
104    1104   12002  1282   1374   1462   1550   1716   24     2500   2748   2897   2950   3012   3113   37     659    742    94     devices    keys             net              timer_list
ubuntu@ubuntu:/proc$
```

NAME:B.Ashok **SECTION: CSE – 3** **Roll No: 1601-20-733-314**

OS LAB WEEK – 3

1. **Write a program to demonstrate the use of fork() system call**

Ans.

PROGRAM :

```
#include<stdio.h>
#include<fcntl.h>
#include<unistd.h>
#include <stdlib.h>
int main()
{
    printf(" Before fork");
    int fd1=open("kk.txt",O_RDONLY,742);  //kk.txt is a shared resource to parent and child process
    int a;   // a is shared  variable to parent and child process
    printf(" Process Id of parent %d \n",getpid());
        int rf=fork();
        if(rf==0)   // Upon successful execution fork() -->  Child process will execute below code in if block
        {
            printf("Inside child process \n");
             printf(" Process Id of child pid= %d  rf=%d \n ",getpid(),rf);
             scanf("%d",&a);
             printf(" Inside child a value is a=%d",a);

        }
        else if (rf> 0) // Upon successful execution fork() system call --> Parent process will exceute below code in elseif block
        {
          printf("Inside parent process");
          printf(" Process Id of parent pid=%d rf=%d \n",getpid(),rf);
            scanf("%d",&a);
            printf(" Inside parent a value is a=%d",a);
        }
```

```
        else{   // Upon uncusccessful execution  fork() system call Parent process will exceute below code in else block

            printf(" Fork unsucessful \n Indide parent and Process Id of parent pid= %d  rf=%d \n  ",getpid(),rf);

      }

      printf("End of process %d", getpid());

         return 0;

}
```

OUTPUT:

```
ubuntu@ubuntu:~/Desktop/week 3$ gcc forkex1.c
ubuntu@ubuntu:~/Desktop/week 3$ ./a.out
 Before fork Process Id of parent 36102
Inside parent process Process Id of parent pid=36102 rf=36103
Inside child process
 Process Id of child pid= 36103  rf=0


hello
 Inside child a value is a=0End of process 36103hi
ubuntu@ubuntu:~/Desktop/week 3$
```

In proc folder:

```
ubuntu@ubuntu:~/Desktop/week 3$ ps -a1
    PID TTY      STAT   TIME COMMAND
      1 ?        Ss     0:06 /sbin/init splash
  35124 tty2     Ssl+   0:00 /usr/libexec/gdm-wayland-session env GNOME_SHELL_SESSI
  35135 tty2     Sl+    0:00 /usr/libexec/gnome-session-binary --session=ubuntu
  36015 pts/0    Ss     0:00 bash
  38546 pts/0    R+     0:00 ps -a1
ubuntu@ubuntu:~/Desktop/week 3$
```

2. **Write a program to demonstrate the use of exe system calls**

   Parent process → Execute factorial of given number

   Child process → Execute prime number

Ans.

PROGRAM :

```
#include<stdio.h>
#include<fcntl.h>
#include<unistd.h>
#include <stdlib.h>

int main()
{
    printf(" Before fork");
    int fd1=open("kk.txt",O_RDONLY,742);  //kk.txt is a shared resource to parent and child process
    int a;   // a is shared  variable to parent and child process
    printf(" Process Id of parent %d \n",getpid());
        int rf=fork();

        if(rf==0)   // Upon successful execution fork() -->  Child process will execute below code in if block
        {
            printf("Inside child process \n");
             printf(" Process Id of child pid= %d  rf=%d \n ",getpid(),rf);
       printf("Child process: to execute the prime number program\nEnter a number: ");
             scanf("%d",&a);
       int flag = 0;
             for(int i=2;i<=a/2;i++){
         if (a%i==0){
           flag=1;
           break;
         }
       }
       if(flag==0){
        printf("Given number %d is a prime number\n",a);
       }
       else{
        printf("Given number %d is not a prime number\n",a);
       }
```

```
        }
        else if (rf> 0) // Upon successful execution fork() system call --> Parent process will exceute below code in elseif block
        {
          printf("Inside parent process");
          printf(" Process Id of parent pid=%d rf=%d \n",getpid(),rf);
    printf("Parent process: to execute the factorial of a number\nEnter a number: ");
            scanf("%d",&a);
            int total = 1, i = 1;
     while(i<=a){
       total=total*i;
       i=i+1;
     }
     printf("Factorial value is: %d\n",total);
        }
        else{   // Upon uncusccessful execution  fork() system call Parent process will exceute below code in else block
           printf(" Fork unsucessful \n Indide parent and Process Id of parent pid= %d  rf=%d \n  ",getpid(),rf);
      }
      printf("End of process %d\n", getpid());
        return 0;
}
```

OUTPUT:

```
ubuntu@ubuntu:~/Desktop/week 4$ ./prime_fact
 Before fork Process Id of parent 38931
Inside parent process Process Id of parent pid=38931 rf=38932
Parent process: to execute the factorial of a number
Enter a number: Inside child process
 Process Id of child pid= 38932  rf=0
 Child process: to execute the prime number program
Enter a number: 4
Factorial value is: 24
End of process 38931
ubuntu@ubuntu:~/Desktop/week 4$ Given number 8 is not a prime number
End of process 38932
ubuntu@ubuntu:~/Desktop/week 4$
ubuntu@ubuntu:~/Desktop/week 4$
```

3. **Write a program to demonstrate use following exe functions**

   i. **int execl(const char* path, const char* arg, …)**

   ii. **int execlp(const char* file, const char* arg, …)**

   iii. **int execle(const char* path, const char* arg, …, char* const envp[])**

   iv. **int execv(const char* path, const char* argv[])**

   v. **int execvp(const char* file, const char* argv[])**

   vi. **int execvpe(const char* file, const char* argv[], char *const envp[])**

   Program:

   Exec.c

```
#include<stdio.h>
#include<unistd.h>
int main()
{
   int i;
   printf("I am Demo file called by execvp() ");
   printf("\n");
   return 0;
}
```

Execv.c

```
#include<stdio.h>
#include<stdlib.h>
#include<unistd.h>
int main()
{
      char *args[]={"./exec",NULL};
      execv(args[0],args);
      printf("Ending-----");
   return 0;
}
```

Output:

```
ubuntu@ubuntu:~/Desktop/week 4$ gcc exec.c -o ex
ubuntu@ubuntu:~/Desktop/week 4$ ./e
bash: ./e: No such file or directory
ubuntu@ubuntu:~/Desktop/week 4$ ./ex
I am Demo file called by family of exec() functions
ubuntu@ubuntu:~/Desktop/week 4$
```

Execvp.c

```
#include<stdio.h>
#include<stdlib.h>
#include<unistd.h>
int main()
{
      char *args[]={"./3_6_demo",NULL};
      execvp(args[0],args);
      printf("Ending-----");
   return 0;
}
```

Output:

```
ubuntu@ubuntu:~/Desktop/week 4$ gcc execvp.c -o execvp
ubuntu@ubuntu:~/Desktop/week 4$ ./exevp
bash: ./exevp: No such file or directory
ubuntu@ubuntu:~/Desktop/week 4$ ./execvp
Ending-----ubuntu@ubuntu:~/Desktop/week 4$
```

4. **Write a program to demonstrate the use of vfork()**

Ans.

PROGRAM :

```
#include<stdio.h>
#include<fcntl.h>
#include<unistd.h>
#include <stdlib.h>

int main()
{
    printf(" Before fork");
    int fd1=open("kk.txt",O_RDONLY,742);  //kk.txt is a shared resource to parent and child process
    int a,b;   // a is shared  variable to parent and child process
    printf(" Process Id of parent %d \n",getpid());
        int rf=vfork();
        if(rf==0)   // Upon successful execution fork() -->  Child process will execute below code in if block
        {
            printf("Inside child process \n");
             printf(" Process Id of child pid= %d  rf=%d \n ",getpid(),rf);
             scanf("%d",&b);
             printf(" Inside child b value is b=%d",b);

        }

        else if (rf> 0) // Upon successful execution fork() system call --> Parent process will exceute below code in elseif block
```

```
        {


          printf("Inside parent process");
          printf(" Process Id of parent pid=%d rf=%d \n",getpid(),rf);
            scanf("%d",&a);
            printf(" Inside parent a value is a=%d",a);
        }
        else{   // Upon uncusccessful execution  fork() system call Parent process will exceute below code in else block
            printf(" Fork unsucessful \n Indide parent and Process Id of parent pid= %d  rf=%d \n  ",getpid(),rf);
    }
    printf("End of process %d\n", getpid());
        return 0;
}
```

OUTPUT:

```
ubuntu@ubuntu:~/Desktop/week 4$ gcc vfork.c -o vfork
ubuntu@ubuntu:~/Desktop/week 4$ ./vfork
 Before fork Process Id of parent 39046
Inside child process
 Process Id of child pid= 39047  rf=0
 hello
 Inside child b value is b=0End of process 39047
Inside parent process Process Id of parent pid=39046 rf=39047

hi
 Inside parent a value is a=889339280End of process 39046
*** stack smashing detected ***: terminated
Aborted (core dumped)
ubuntu@ubuntu:~/Desktop/week 4$ i
i: command not found
ubuntu@ubuntu:~/Desktop/week 4$
```

5. **Write a program to demonstrate Orphan process**

Ans.

PROGRAM :

```
#include<stdio.h>
#include <sys/types.h>
```

```
#include <unistd.h>

// A C program to demonstrate Orphan Process.

// Parent process finishes execution while the

// child process is running. The child process

// becomes orphan.

int main()

{

   // Create a child process

   int pid = fork();


   if (pid > 0)

      printf("in parent process\n");


   // Note that pid is 0 in child process

   // and negative if fork() fails

   else if (pid == 0)

   {

      sleep(9);

      printf("in child process\n");

   }
```

OUTPUT:

```
t: command not found
ubuntu@ubuntu:~/Desktop/week 4$ gcc orphan.c -o orphan
ubuntu@ubuntu:~/Desktop/week 4$ ./orphan
in parent process
ubuntu@ubuntu:~/Desktop/week 4$
ubuntu@ubuntu:~/Desktop/week 4$ in child process
```

6. **Write a program to demonstrate Zombie process**

Ans.

PROGRAM :

```
#include <stdlib.h>

#include <sys/types.h>
```

```
#include  <sys/wait.h>
#include  <unistd.h>
#include  <stdio.h>
int main()
{
pid_t pid;
char *message;
int n;
int exit_code;
printf("fork program starting\n");
pid = fork();
switch(pid)
{
case -1:
   perror("fork failed");
   exit(1);
case 0:
    message = "This is the child";
    n = 3;
    exit_code = 37;
break;
default:
    message = "This is the parent";
    n = 5;
    exit_code = 0;
break;
}
for(; n > 0; n--) {
puts(message);
sleep(1);
}
}
```

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OUTPUT:

```
ubuntu@ubuntu:~/Desktop/week 4$ gcc forkex2.c -o zombie
ubuntu@ubuntu:~/Desktop/week 4$ ./zombie
fork program starting
This is the parent
This is the child
This is the child
This is the parent
This is the child
This is the parent
This is the parent
This is the parent
ubuntu@ubuntu:~/Desktop/week 4$
```

Name: B. Ashok Section: CSE3 Roll no:160120733314

WEEK-5

1)

Aim: Write a program to demonstrate First Come First Serve CPU scheduling

Program:

```
#include<stdio.h>
int main()
{
   int  p[10],at[10],bt[10],ct[10],tat[10],wt[10],i,j,temp=0,n;
   float awt=0,atat=0;
   printf("enter no of proccess you want:");
   scanf("%d",&n);
   printf("enter %d process:",n);
   for(i=0;i<n;i++)
   {
   scanf("%d",&p[i]);
   }
   printf("enter %d arrival time:",n);
   for(i=0;i<n;i++)
   {
   scanf("%d",&at[i]);
   }
   printf("enter %d burst time:",n);
   for(i=0;i<n;i++)
   {
   scanf("%d",&bt[i]);
   }
   for(i=0;i<n;i++)
   {
    for(j=0;j<(n-i);j++)
   {
     if(at[j]>at[j+1])
    {
       temp=p[j+1];
       p[j+1]=p[j];
       p[j]=temp;
       temp=at[j+1];
       at[j+1]=at[j];

       at[j]=temp;
       temp=bt[j+1];
       bt[j+1]=bt[j];
       bt[j]=temp;
     }
    }
   }
   ct[0]=at[0]+bt[0];
   for(i=1;i<n;i++)
   {
     temp=0;
    if(ct[i-1]<at[i])
```

```
    {
      temp=at[i]-ct[i-1];
    }
    ct[i]=ct[i-1]+bt[i]+temp;
   }
   printf("\np\t A.T\t B.T\t C.T\t TAT\t WT");
   for(i=0;i<n;i++)
   {
   tat[i]=ct[i]-at[i];
   wt[i]=tat[i]-bt[i];
   atat+=tat[i];
   awt+=wt[i];
   }
   atat=atat/n;
   awt=awt/n;
   for(i=0;i<n;i++)
   {
    printf("\nP%d\t %d\t %d\t %d \t %d \t %d",p[i],at[i],bt[i],ct[i],tat[i],wt[i]);
   }
   printf("\naverage turnaround time is %f",atat);

   printf("\naverage wating timme is %f\n",awt);
   return 0;
}
```

Output:

```
enter no of proccess you want:4
enter 4 process:1 2 3 4
enter 4 arrival time:3 4 1 2
enter 4 burst time:1 2 2 1

p         A.T      B.T      C.T      TAT      WT
P8        0        0        0        0        0
P3        1        2        3        2        0
P4        2        1        4        2        1
P1        3        1        5        2        1
average turnaround time is 1.500000
average wating timme is 0.500000
```

2)

Aim: Write a program to demonstrate Shortest Job First or Shortest Job next CPU scheduling

Program:(preemptive)

```
#include <stdio.h>
int main()
{
    int arrival_time[10], burst_time[10], temp[10];
    int i, smallest, count = 0, time, limit;
    double wait_time = 0, turnaround_time = 0, end;
    float average_waiting_time, average_turnaround_time;
    printf("\nEnter the Total Number of Processes:\t");
```

```
    scanf("%d", &limit);
    printf("\nEnter Details of %d Processes\n", limit);
    for(i = 0; i < limit; i++)
    {
        printf("\nEnter Arrival Time:\t");
        scanf("%d", &arrival_time[i]);
        printf("Enter Burst Time:\t");
        scanf("%d", &burst_time[i]);
        temp[i] = burst_time[i];
    }
    burst_time[9] = 9999;
    for(time = 0; count != limit; time++)
    {
        smallest = 9;
        for(i = 0; i < limit; i++)
        {
            if(arrival_time[i] <= time && burst_time[i] < burst_time[smallest] && burst_time[i]
 > 0)
            {
                smallest = i;
            }
        }
        burst_time[smallest]--;
        if(burst_time[smallest] == 0)
        {
            count++;
            end = time + 1;
            wait_time = wait_time + end - arrival_time[smallest] - temp[smallest];
            turnaround_time = turnaround_time + end - arrival_time[smallest];
        }
    }
    average_waiting_time = wait_time / limit;
    average_turnaround_time = turnaround_time / limit;
    printf("\n\nAverage Waiting Time:\t%lf\n", average_waiting_time);
    printf("Average Turnaround Time:%lf\n", average_turnaround_time);
    return 0;
}
```

Output:

```
Enter the Total Number of Processes:     3

Enter Details of 3 Processes

Enter Arrival Time:       1
Enter Burst Time:         4

Enter Arrival Time:       2
Enter Burst Time:         6

Enter Arrival Time:       3
Enter Burst Time:         3


Average Waiting Time:    2.666667
Average Turnaround Time:7.000000
```

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Program(non preemptive):

```
#include<stdio.h>
 int main()
{
   int bt[20],p[20],wt[20],tat[20],i,j,n,total=0,pos,temp;
   float avg_wt,avg_tat;
   printf("Enter number of process:");
   scanf("%d",&n);

   printf("\nEnter Burst Time:n");
   for(i=0;i<n;i++)
   {
      printf("p%d:",i+1);
      scanf("%d",&bt[i]);
      p[i]=i+1;
   }

  //sorting of burst times
   for(i=0;i<n;i++)
   {
      pos=i;
      for(j=i+1;j<n;j++)
      {
         if(bt[j]<bt[pos])
            pos=j;
      }

      temp=bt[i];
      bt[i]=bt[pos];
      bt[pos]=temp;

      temp=p[i];
      p[i]=p[pos];
      p[pos]=temp;
   }

   wt[0]=0;


   for(i=1;i<n;i++)
   {
      wt[i]=0;
      for(j=0;j<i;j++)
         wt[i]+=bt[j];

      total+=wt[i];
   }

   avg_wt=(float)total/n;
   total=0;
```

```
    printf("\nProcess\t    Burst Time    \tWaiting Time\tTurnaround Time");
    for(i=0;i<n;i++)
    {
        tat[i]=bt[i]+wt[i];
        total+=tat[i];
        printf("\np%d\t\t  %d\t\t    %d\t\t\t%d",p[i],bt[i],wt[i],tat[i]);
    }

    avg_tat=(float)total/n;
    printf("\n\nAverage Waiting Time=%f",avg_wt);
    printf("\nAverage Turnaround Time=%f\n",avg_tat);
}
```

Output:

```
Enter number of process:4

Enter Burst Time:np1:3
p2:3
p3:5
p4:8

Process      Burst Time          Waiting Time     Turnaround Time
p1                 3                   0                   3
p2                 3                   3                   6
p3                 5                   6                   11
p4                 8                   11                  19

Average Waiting Time=5.000000
Average Turnaround Time=9.750000
```

3)

Aim: Write a program to demonstrate Round Robin CPU scheduling

Program:

```
#include<stdio.h>
int main()
{
    int i, limit, total = 0, x, counter = 0, time_quantum;
    int wait_time = 0, turnaround_time = 0, arrival_time[10], burst_time[10], temp[10];
    float average_wait_time, average_turnaround_time;
    printf("\nEnter Total Number of Processes:\t");
    scanf("%d", &limit);
    x = limit;
    for(i = 0; i < limit; i++)
    {
        printf("\nEnter Details of Process[%d]\n", i + 1);

        printf("Arrival Time:\t");

        scanf("%d", &arrival_time[i]);

        printf("Burst Time:\t");

        scanf("%d", &burst_time[i]);

        temp[i] = burst_time[i];
    }
```

```
    printf("\nEnter Time Quantum:\t");
    scanf("%d", &time_quantum);
    printf("\nProcess ID\t\tBurst Time\t Turnaround Time\t Waiting Time\n");
    for(total = 0, i = 0; x != 0;)
    {
        if(temp[i] <= time_quantum && temp[i] > 0)
        {
            total = total + temp[i];
            temp[i] = 0;
            counter = 1;
        }
        else if(temp[i] > 0)
        {
            temp[i] = temp[i] - time_quantum;
            total = total + time_quantum;
        }
        if(temp[i] == 0 && counter == 1)
        {
            x--;
            printf("\nProcess[%d]\t\t%d\t\t %d\t\t\t %d", i + 1, burst_time[i], total -
arrival_time[i], total - arrival_time[i] - burst_time[i]);
            wait_time = wait_time + total - arrival_time[i] - burst_time[i];
            turnaround_time = turnaround_time + total - arrival_time[i];
            counter = 0;
        }
        if(i == limit - 1)
        {
            i = 0;
        }
        else if(arrival_time[i + 1] <= total)
        {
            i++;
        }
        else
        {
            i = 0;
        }
    }

    average_wait_time = wait_time * 1.0 / limit;
    average_turnaround_time = turnaround_time * 1.0 / limit;
    printf("\n\nAverage Waiting Time:\t%f", average_wait_time);
    printf("\nAvg Turnaround Time:\t%f\n", average_turnaround_time);
    return 0;
}
```

Output:

```
Enter Details of Process[2]
Arrival Time:    1
Burst Time:      4

Enter Details of Process[3]
Arrival Time:    3
Burst Time:      6

Enter Details of Process[4]
Arrival Time:    1
Burst Time:      5

Enter Time Quantum:      2

Process ID              Burst Time       Turnaround Time          Waiting Time

Process[2]              4                11                       7
Process[3]              6                17                       11
Process[4]              5                20                       15
Process[1]              7                20                       13

Average Waiting Time:    11.500000
Avg Turnaround Time:     17.000000
```

4)

Aim: Write a program to demonstrate Priority CPU Scheduling

Program(preemptive):

```
#include<stdio.h>
struct process
{
   int WT,AT,BT,TAT,PT;
};

struct process a[10];

int main()
{
   int n,temp[10],t,count=0,short_p;
   float total_WT=0,total_TAT=0,Avg_WT,Avg_TAT;
   printf("Enter the number of the process\n");
   scanf("%d",&n);
   printf("Enter the arrival time , burst time and priority of the process\n");
   printf("AT BT PT\n");
   for(int i=0;i<n;i++)
   {
      scanf("%d%d%d",&a[i].AT,&a[i].BT,&a[i].PT);

      // copying the burst time in
      // a temp array fot futher use
      temp[i]=a[i].BT;
   }

   // we initialize the burst time
   // of a process with maximum
   a[9].PT=10000;

   for(t=0;count!=n;t++)
   {
```

```
        short_p=9;
        for(int i=0;i<n;i++)
        {
            if(a[short_p].PT>a[i].PT && a[i].AT<=t && a[i].BT>0)
            {
                short_p=i;
            }
        }

        a[short_p].BT=a[short_p].BT-1;

        // if any process is completed
        if(a[short_p].BT==0)
        {
            // one process is completed
            // so count increases by 1
            count++;
            a[short_p].WT=t+1-a[short_p].AT-temp[short_p];
            a[short_p].TAT=t+1-a[short_p].AT;

            // total calculation
            total_WT=total_WT+a[short_p].WT;
            total_TAT=total_TAT+a[short_p].TAT;

        }
    }

    Avg_WT=total_WT/n;
    Avg_TAT=total_TAT/n;

    // printing of the answer
    printf("ID WT TAT\n");
    for(int i=0;i<n;i++)
    {
        printf("%d %d\t%d\n",i+1,a[i].WT,a[i].TAT);
    }

    printf("Avg waiting time of the process  is %f\n",Avg_WT);
    printf("Avg turn around time of the process is %f\n",Avg_TAT);

    return 0;
}
```

Output:

```
Enter the number of the process
5
Enter the arrival time , burst time and priority of the process
AT BT PT
1 4 1
2 6 2
1 4 3
2 5 1
3 7 2
ID WT TAT
1 0      4
2 8      14
3 22     26
4 3      8
5 13     20
Avg waiting time of the process  is 9.200000
Avg turn around time of the process is 14.400000
```

Program(Non preemptive):

```
#include<stdio.h>
struct process
{
   int id,WT,AT,BT,TAT,PR;
};
struct process a[10];

// function for swapping
void swap(int *b,int *c)
{
   int tem;
   tem=*c;
   *c=*b;
   *b=tem;
}

//Driver function
int main()
{
   int n,check_ar=0;
   int Cmp_time=0;
   float Total_WT=0,Total_TAT=0,Avg_WT,Avg_TAT;
   printf("Enter the number of process \n");
   scanf("%d",&n);
   printf("Enter the Arrival time , Burst time and priority of the process\n");
   printf("AT BT PR\n");
   for(int i=0;i<n;i++)
   {
      scanf("%d%d%d",&a[i].AT,&a[i].BT,&a[i].PR);
      a[i].id=i+1;
      // here we are checking that arrival time
      // of the process are same or different
      if(i==0)
       check_ar=a[i].AT;
```

```
    if(check_ar!=a[i].AT )
     check_ar=1;

  }
  // if process are arrived at the different time
  // then sort the process on the basis of AT
  if(check_ar!=0)
  {
     for(int i=0;i<n;i++)
     {
        for(int j=0;j<n-i-1;j++)
        {
           if(a[j].AT>a[j+1].AT)
           {
                swap(&a[j].id,&a[j+1].id);
                swap(&a[j].AT,&a[j+1].AT);
                swap(&a[j].BT,&a[j+1].BT);
                swap(&a[j].PR,&a[j+1].PR);
           }
        }
     }
  }

  // logic of Priority scheduling ( non preemptive) algo
  // if all the process are arrived at different time
  if(check_ar!=0)
  {
     a[0].WT=a[0].AT;
     a[0].TAT=a[0].BT-a[0].AT;
     // cmp_time for completion time
     Cmp_time=a[0].TAT;
     Total_WT=Total_WT+a[0].WT;
     Total_TAT=Total_TAT+a[0].TAT;
     for(int i=1;i<n;i++)
     {
        int min=a[i].PR;
        for(int j=i+1;j<n;j++)
        {
           if(min>a[j].PR && a[j].AT<=Cmp_time)
           {
                min=a[j].PR;
                swap(&a[i].id,&a[j].id);
                swap(&a[i].AT,&a[j].AT);
                swap(&a[i].BT,&a[j].BT);
                swap(&a[i].PR,&a[j].PR);

           }

        }
        a[i].WT=Cmp_time-a[i].AT;
        Total_WT=Total_WT+a[i].WT;
```

```
        // completion time of the process
        Cmp_time=Cmp_time+a[i].BT;

        // Turn Around Time of the process
        // compl-Arival
        a[i].TAT=Cmp_time-a[i].AT;
        Total_TAT=Total_TAT+a[i].TAT;

      }
    }

    // if all the process are arrived at same time
    else
    {
      for(int i=0;i<n;i++)
      {
        int min=a[i].PR;
        for(int j=i+1;j<n;j++)
        {
          if(min>a[j].PR && a[j].AT<=Cmp_time)
          {
            min=a[j].PR;
             swap(&a[i].id,&a[j].id);
             swap(&a[i].AT,&a[j].AT);
             swap(&a[i].BT,&a[j].BT);
              swap(&a[i].PR,&a[j].PR);
          }

        }
        a[i].WT=Cmp_time-a[i].AT;

         // completion time of the process
        Cmp_time=Cmp_time+a[i].BT;

        // Turn Around Time of the process
        // compl-Arrival
        a[i].TAT=Cmp_time-a[i].AT;
        Total_WT=Total_WT+a[i].WT;
        Total_TAT=Total_TAT+a[i].TAT;

      }

    }

    Avg_WT=Total_WT/n;
    Avg_TAT=Total_TAT/n;

    // Printing of the results
    printf("The process are\n");
    printf("ID WT TAT\n");
    for(int i=0;i<n;i++)
    {
```

```
        printf("%d\t%d\t%d\n",a[i].id,a[i].WT,a[i].TAT);
    }

    printf("Avg waiting time is: %f\n",Avg_WT);
    printf("Avg turn around time is: %f",Avg_TAT);
    return 0;
}
```

Output:

```
Enter the number of process
4
Enter the Arrival time , Burst time and priority of the process
AT BT PR
1 3 5
2 6 2
3 8 1
1 2 1
The process are
ID WT TAT
1        1        2
4        1        3
3        1        9
2        10       16
Avg waiting time is: 3.250000
Avg turn around time is: 7.500000
```

NAME: B.Ashok **SECTION: CSE – 3** **Roll No: 1601-20-733-314**

OS Lab Week – 6

1. Write a program to demonstrate the use of atexit() exit handler

Ans.

PROGRAM:

```
#include <stdio.h>
#include <stdlib.h>
#include<fcntl.h>
#include<unistd.h>
//File Discriptors
int fd1;
int fd2;
void functionA () { // Exit Handler
close(fd1);
printf("We are in functionA and closed the file fd1 \n");
}
void functionB () { // Exit Handler
close(fd2);
printf("We are in functionB and closed the file fd2\n");
}
int main () {
/* register the termination function */
char buf[10];
fd1=open("file1.txt",O_RDONLY,742);
fd2=open("file2.txt",O_RDONLY,S_IRWXU|S_IRGRP|S_IXOTH);
read(fd1,buf,10);
write(1,buf,10);
printf("\nCompleted the operation A \n");
atexit(functionA );
read(fd2,buf,10);
write(1,buf,10);
printf("\nCompleted the operation B \n");
```

```
atexit(functionB );

printf("Starting main program...\n");

printf("Exiting main program...\n");

return(0);

}
```

OUTPUT

```
ubuntu@ubuntu:~/Desktop/oslab$ gcc program.c
ubuntu@ubuntu:~/Desktop/oslab$ ./a.out
chaitanya
Completed the operation A
oslabanya
Completed the operation B
Starting main program...
Exiting main program...
We are in functionB and closed the file fd2
We are in functionA and closed the file fd1
ubuntu@ubuntu:~/Desktop/oslab$ S
```

NAME: B.Ashok SECTION: CSE – 3 Roll No: 1601-20-733-314

2. Write a program to demonstrate the use of exit() and _exit() system call

Ans.

PROGRAM:

exit() function:

```
#include<stdio.h>
#include<stdlib.h>
void func (){
   printf("Exiting from function\n");
}
int main()
{
   atexit(func);
   printf("Exiting from main()\n");
   exit(0);
}
```

```
ubuntu@ubuntu:~/Desktop/oslab$ gcc program.c
ubuntu@ubuntu:~/Desktop/oslab$ ./a.out
Exiting from main()
Exiting from function
ubuntu@ubuntu:~/Desktop/oslab$
```

_Exit() function:

```
#include<stdio.h>
#include<stdlib.h>
void func (){
   printf("Exiting from function\n");
}
int main()
{
   atexit(func);
   printf("Exiting from main()\n");
   _Exit(0);
}
```

OUTPUT

```
ubuntu@ubuntu:~/Desktop/oslab$ gcc program.c
ubuntu@ubuntu:~/Desktop/oslab$ ./a.out
Exiting from main()
ubuntu@ubuntu:~/Desktop/oslab$
```

OS Lab Week – 7

1. **Write a program to demonstrate the use of wait(), waitpid() and waitid()**

Ans.

PROGRAM:

Wait() function:

```
#define _POSIX_SOURCE
#include <sys/types.h>
#include <sys/wait.h>
#include <unistd.h>
#include <stdio.h>
#include<stdlib.h>
#include <time.h>
int main() {
  pid_t pid;
  time_t t;
  int status;
  if ((pid = fork()) < 0)
    perror("fork() error");
  else if (pid == 0) {
    time(&t);
    printf("child (pid %d) started at %s", (int) getpid(), ctime(&t));
```

```
    sleep(5);
    time(&t);
    printf("child exiting at %s", ctime(&t));
    exit(42);
  }
  else {
    printf("parent has forked child with pid of %d\n", (int) pid);
    time(&t);
    printf("parent is starting wait at %s", ctime(&t));
    if ((pid = wait(&status)) == -1)
      perror("wait() error");
    else {
      time(&t);
      printf("parent is done waiting at %s", ctime(&t));
      printf("the pid of the process that ended was %d\n", (int) pid);
      if (WIFEXITED(status))
        printf("child exited with status of %d\n", WEXITSTATUS(status));
      else if (WIFSIGNALED(status))
        printf("child was terminated by signal %d\n",
              WTERMSIG(status));
      else if (WIFSTOPPED(status))
        printf("child was stopped by signal %d\n", WSTOPSIG(status));
      else puts("reason unknown for child termination");
    }
  }
}
```

OUTPUT:

```
ubuntu@ubuntu:~/Desktop/oslab$ gcc wait.c
ubuntu@ubuntu:~/Desktop/oslab$ ./a.out
parent has forked child with pid of 14758
parent is starting wait at Tue Nov  1 22:57:42 2022
child (pid 14758) started at Tue Nov  1 22:57:42 2022


child exiting at Tue Nov  1 22:57:47 2022
parent is done waiting at Tue Nov  1 22:57:47 2022
the pid of the process that ended was 14758
child exited with status of 42
ubuntu@ubuntu:~/Desktop/oslab$
```

Waitpid() function:

```
#include <sys/wait.h>
#include <stdlib.h>
#include <unistd.h>
#include <stdio.h>



int
main(int argc, char *argv[])
{
   pid_t cpid, w;
   int status;



   cpid = fork();
   if (cpid == -1) { perror("fork"); exit(EXIT_FAILURE); }



   if (cpid == 0) {            /* Code executed by child */
      printf("Child PID is %ld\n", (long) getpid());
      if (argc == 1)
         pause();                  /* Wait for signals */
```

```
        _exit(atoi(argv[1]));



    } else {                /* Code executed by parent */
        do {
            w = waitpid(cpid, &status, WUNTRACED | WCONTINUED);
            if (w == -1) { perror("waitpid"); exit(EXIT_FAILURE); }



            if (WIFEXITED(status)) {
                printf("exited, status=%d\n", WEXITSTATUS(status));
            } else if (WIFSIGNALED(status)) {
                printf("killed by signal %d\n", WTERMSIG(status));
            } else if (WIFSTOPPED(status)) {
                printf("stopped by signal %d\n", WSTOPSIG(status));
            } else if (WIFCONTINUED(status)) {
                printf("continued\n");
            }
        } while (!WIFEXITED(status) && !WIFSIGNALED(status));
        exit(EXIT_SUCCESS);
    }
}
```

OUTPUT:

Terminal 1

```
ubuntu@ubuntu:~/Desktop/oslab$ gcc waitpid.c
ubuntu@ubuntu:~/Desktop/oslab$ ./a.out
Child PID is 16033
killed by signal 15
ubuntu@ubuntu:~/Desktop/oslab$
```

Terminal 2

```
ubuntu@ubuntu:~$ ps -a1
    PID TTY      STAT   TIME COMMAND
      1 ?        Ss     0:03 /sbin/init splash
    981 tty2     Ssl+   0:00 /usr/libexec/gdm-wayland-session env GNOME_SHELL_SESSION_MODE=ubuntu /usr/bin/gnome-session --session=ubuntu
   1000 tty2     Sl+    0:00 /usr/libexec/gnome-session-binary --session=ubuntu
   2111 pts/0    Ss+    0:00 bash
   2648 tty3     Ssl+   0:00 /usr/libexec/gdm-wayland-session env GNOME_SHELL_SESSION_MODE=ubuntu /usr/bin/gnome-session --session=ubuntu
   2653 tty3     Sl+    0:00 /usr/libexec/gnome-session-binary --session=ubuntu
  13439 pts/1    Ss     0:00 bash
  15088 pts/2    Ss     0:00 bash
  16032 pts/1    S+     0:00 ./a.out
  16033 pts/1    S+     0:00 ./a.out
  16038 pts/2    R+     0:00 ps -a1
ubuntu@ubuntu:~$ kill 16033
ubuntu@ubuntu:~$ ps -a1
    PID TTY      STAT   TIME COMMAND
      1 ?        Ss     0:03 /sbin/init splash
    981 tty2     Ssl+   0:00 /usr/libexec/gdm-wayland-session env GNOME_SHELL_SESSION_MODE=ubuntu /usr/bin/gnome-session --session=ubuntu
   1000 tty2     Sl+    0:00 /usr/libexec/gnome-session-binary --session=ubuntu
   2111 pts/0    Ss+    0:00 bash
   2648 tty3     Ssl+   0:00 /usr/libexec/gdm-wayland-session env GNOME_SHELL_SESSION_MODE=ubuntu /usr/bin/gnome-session --session=ubuntu
   2653 tty3     Sl+    0:00 /usr/libexec/gnome-session-binary --session=ubuntu
  13439 pts/1    Ss+    0:00 bash
  15088 pts/2    Ss     0:00 bash
  16042 pts/2    R+     0:00 ps -a1
ubuntu@ubuntu:~$
```

Waitid() function:

```
#define pr_exit(n) printf("%d\n", n)
#define err_sys perror
#include <stdlib.h>
#include <unistd.h>
#include <stdio.h>
#include <sys/wait.h>
int main(void)
{
   pid_t   pid;
   int     status;
   siginfo_t info;
   if ((pid = fork()) < 0)
      err_sys("fork error");
   else if (pid == 0)            /* child */
      exit(7);
   if (waitid(P_PID,pid,&info,WEXITED) != pid)       /* wait for child */
      err_sys("wait error");
   pr_exit(status);              /* and print its status */
   if ((pid = fork()) < 0)
      err_sys("fork error");
   else if (pid == 0)            /* child */
```

```
    abort();                /* generates SIGABRT */
  if (waitid(P_PID,pid,&info,WEXITED) != pid)      /* wait for child */
    err_sys("wait error");
  pr_exit(status);              /* and print its status */
  if ((pid = fork()) < 0)
    err_sys("fork error");
  else if (pid == 0)            /* child */
    status = 0;             /* divide by 0 generates SIGFPE */
  if (waitid(P_PID,pid,&info,WEXITED) != pid)      /* wait for child */
    err_sys("wait error");
  pr_exit(status);
  exit(0);
}
```

OUTPUT:

```
ubuntu@ubuntu:~/Desktop/oslab$ gcc waitid.c
ubuntu@ubuntu:~/Desktop/oslab$ ./a.out
wait error: Success
0
wait error: Success
0
wait error: Invalid argument
0
wait error: Success
0
ubuntu@ubuntu:~/Desktop/oslab$
```

2. **Write a program to demonstrate the use of wait3() and wait4()**

Ans.

PROGRAM:

Wait3() function:

```
#include <sys/wait.h>
#include <stdlib.h>
#include <unistd.h>
#include <stdio.h>
#include <sys/time.h>
#include <sys/resource.h>
```

```
int
main(int argc, char *argv[])
{
   pid_t cpid, w;
   int status;
   struct rusage Use;
  cpid = fork();
   if (cpid == -1) {
      perror("fork");
      exit(EXIT_FAILURE);
   }
  if (cpid == 0) {           /* Code executed by child */
      printf("Child PID is %ld\n", (long) getpid());
      if (argc == 1)
         pause();                  /* Wait for signals */
      _exit(atoi(argv[1]));
  } else {                  /* Code executed by parent */
      do {
         w = wait3(&status, WUNTRACED | WCONTINUED, &Use);
         if (w == -1) {
            perror("waitpid");
            exit(EXIT_FAILURE);
         }
        if (WIFEXITED(status)) {
            printf("exited, status=%d\n", WEXITSTATUS(status));
         } else if (WIFSIGNALED(status)) {
            printf("killed by signal %d\n", WTERMSIG(status));
         } else if (WIFSTOPPED(status)) {
            printf("stopped by signal %d\n", WSTOPSIG(status));
         } else if (WIFCONTINUED(status)) {
            printf("continued\n");
         }
```

```
    } while (!WIFEXITED(status) && !WIFSIGNALED(status));

    exit(EXIT_SUCCESS);

  }

}
```

OUTPUT:

Terminal 1:

```
     |                ^~~~~
ubuntu@ubuntu:~/Desktop/oslab$ gcc wait3.c
ubuntu@ubuntu:~/Desktop/oslab$ ./a.out
Child PID is 15074
killed by signal 15
ubuntu@ubuntu:~/Desktop/oslab$
```

Terminal 2:

```
ubuntu@ubuntu:~$ ps -a1
    PID TTY      STAT   TIME COMMAND
      1 ?        Ss     0:03 /sbin/init splash
    981 tty2     Ssl+   0:00 /usr/libexec/gdm-wayland-session env GNOME_SHELL_SE
   1000 tty2     Sl+    0:00 /usr/libexec/gnome-session-binary --session=ubuntu
   2111 pts/0    Ss+    0:00 bash
   2648 tty3     Ssl+   0:00 /usr/libexec/gdm-wayland-session env GNOME_SHELL_SE
   2653 tty3     Sl+    0:00 /usr/libexec/gnome-session-binary --session=ubuntu
  13439 pts/1    Ss     0:00 bash
  15073 pts/1    S+     0:00 ./a.out
  15074 pts/1    S+     0:00 ./a.out
  15088 pts/2    Ss     0:00 bash
  15102 pts/2    R+     0:00 ps -a1
ubuntu@ubuntu:~$ kill 15074
ubuntu@ubuntu:~$ ps -a1
    PID TTY      STAT   TIME COMMAND
      1 ?        Ss     0:03 /sbin/init splash
    981 tty2     Ssl+   0:00 /usr/libexec/gdm-wayland-session env GNOME_SHELL_SE
   1000 tty2     Sl+    0:00 /usr/libexec/gnome-session-binary --session=ubuntu
   2111 pts/0    Ss+    0:00 bash
   2648 tty3     Ssl+   0:00 /usr/libexec/gdm-wayland-session env GNOME_SHELL_SE
   2653 tty3     Sl+    0:00 /usr/libexec/gnome-session-binary --session=ubuntu
  13439 pts/1    Ss+    0:00 bash
  15088 pts/2    Ss     0:00 bash
  15103 pts/2    R+     0:00 ps -a1
ubuntu@ubuntu:~$
```

Wait4() function:

PROGRAM:

```
#include <sys/wait.h>

#include <stdlib.h>

#include <unistd.h>

#include <stdio.h>

#include <sys/time.h>
```

```
#include <sys/resource.h>


int
main(int argc, char *argv[])
{
   pid_t cpid, w;
   int status;
   struct rusage Use;

  cpid = fork();
   if (cpid == -1) {
      perror("fork");
      exit(EXIT_FAILURE);
   }

  if (cpid == 0) {            /* Code executed by child */
      printf("Child PID is %ld\n", (long) getpid());
      if (argc == 1)
         pause();                    /* Wait for signals */
      _exit(atoi(argv[1]));

  } else {                    /* Code executed by parent */
      do {
         w = wait4(cpid, &status, WUNTRACED | WCONTINUED, &Use);
         if (w == -1) {
            perror("waitpid");
            exit(EXIT_FAILURE);
         }

        if (WIFEXITED(status)) {
            printf("exited, status=%d\n", WEXITSTATUS(status));
         } else if (WIFSIGNALED(status)) {
```

```
            printf("killed by signal %d\n", WTERMSIG(status));
        } else if (WIFSTOPPED(status)) {
            printf("stopped by signal %d\n", WSTOPSIG(status));
        } else if (WIFCONTINUED(status)) {
            printf("continued\n");
        }
    } while (!WIFEXITED(status) && !WIFSIGNALED(status));
    exit(EXIT_SUCCESS);
  }
}
```

OUTPUT:

Terminal 1

```
ubuntu@ubuntu:~/Desktop/oslab$ gcc wait4.c
ubuntu@ubuntu:~/Desktop/oslab$ ./a.out
Child PID is 15181
killed by signal 15
ubuntu@ubuntu:~/Desktop/oslab$
```

Terminal 2

```
ubuntu@ubuntu:~$ ps -a1
    PID TTY      STAT   TIME COMMAND
      1 ?        Ss     0:03 /sbin/init splash
    981 tty2     Ssl+   0:00 /usr/libexec/gdm-wayland-session env GNOME_SHELL_SESSION_MODE=ubuntu /usr/bin/gnome-session --session=ubuntu
   1000 tty2     Sl+    0:00 /usr/libexec/gnome-session-binary --session=ubuntu
   2111 pts/0    Ss+    0:00 bash
   2648 tty3     Ssl+   0:00 /usr/libexec/gdm-wayland-session env GNOME_SHELL_SESSION_MODE=ubuntu /usr/bin/gnome-session --session=ubuntu
   2653 tty3     Sl+    0:00 /usr/libexec/gnome-session-binary --session=ubuntu
  13439 pts/1    Ss     0:00 bash
  15088 pts/2    Ss     0:00 bash
  15180 pts/1    S+     0:00 ./a.out
  15181 pts/1    S+     0:00 ./a.out
  15189 pts/2    R+     0:00 ps -a1
ubuntu@ubuntu:~$ kill 15181
ubuntu@ubuntu:~$ ps -a1
    PID TTY      STAT   TIME COMMAND
      1 ?        Ss     0:03 /sbin/init splash
    981 tty2     Ssl+   0:00 /usr/libexec/gdm-wayland-session env GNOME_SHELL_SESSION_MODE=ubuntu /usr/bin/gnome-session --session=ubuntu
   1000 tty2     Sl+    0:00 /usr/libexec/gnome-session-binary --session=ubuntu
   2111 pts/0    Ss+    0:00 bash
   2648 tty3     Ssl+   0:00 /usr/libexec/gdm-wayland-session env GNOME_SHELL_SESSION_MODE=ubuntu /usr/bin/gnome-session --session=ubuntu
   2653 tty3     Sl+    0:00 /usr/libexec/gnome-session-binary --session=ubuntu
  13439 pts/1    Ss+    0:00 bash
  15088 pts/2    Ss     0:00 bash
  15191 pts/2    R+     0:00 ps -a1
ubuntu@ubuntu:~$
```