Assignment 4: Familiarization with Process Management in Linux environment.

Objective of this Assignment:

- To trace the different states of a process during its execution.
- To learn the use of different system calls such as (fork(),vfork(),wait(),execl()) for process handling in Unix/Linux environment.

Q1:

Open ~/DOS_2241016309/DOSAss4 q1.c Save

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

int main()
{
    pid_t c1 = fork();
    if(c1 == 0){
        fprintf(stderr, "Child Process ID: %d\n", getpid());
        while(1);
    }
    else{
        fprintf(stderr, "Parent Process ID: %d\n", getpid());
        while(1);
    }

    return 0;
}
```

Saving file "~/DOS_2241016309/DOSAss4/q1.c"... C Tab Width: 4 Ln 7, Col 6 INS

(a):

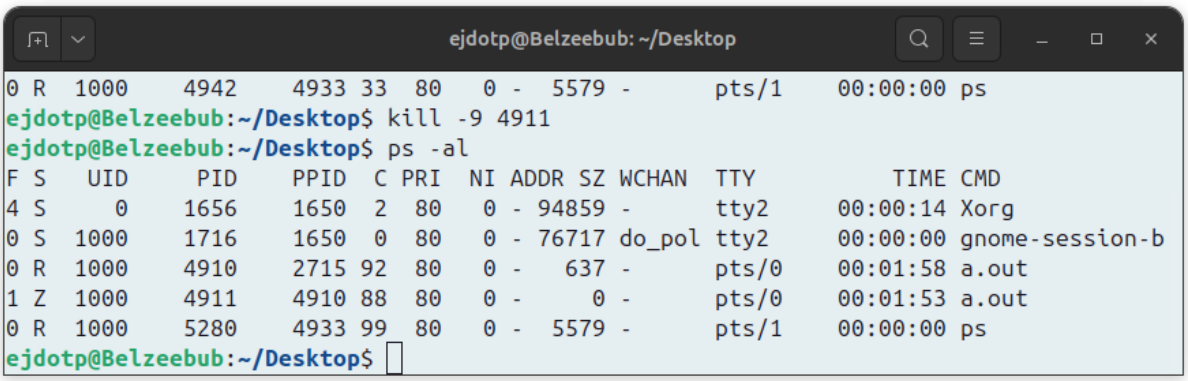
ejdotp@Belzeebub: ~/DOS_2241016309/DOSAss4

```
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ gedit q1.c
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ gcc q1.c
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ ./a.out
Parent Process ID: 4910
Child Process ID: 4911
```

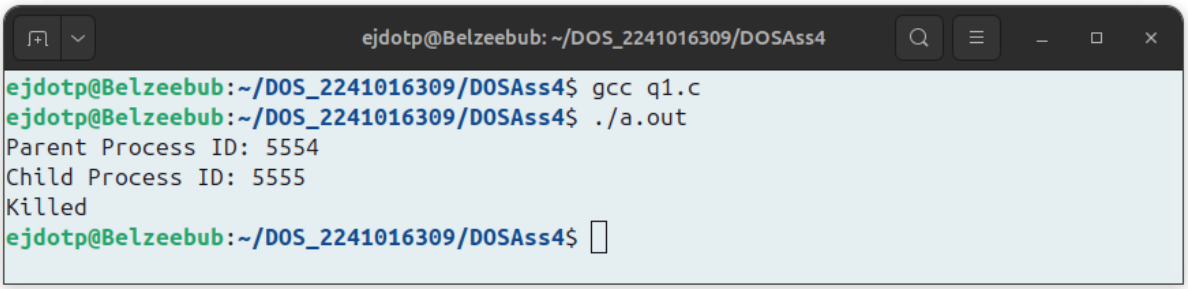
ejdotp@Belzeebub: ~/Desktop

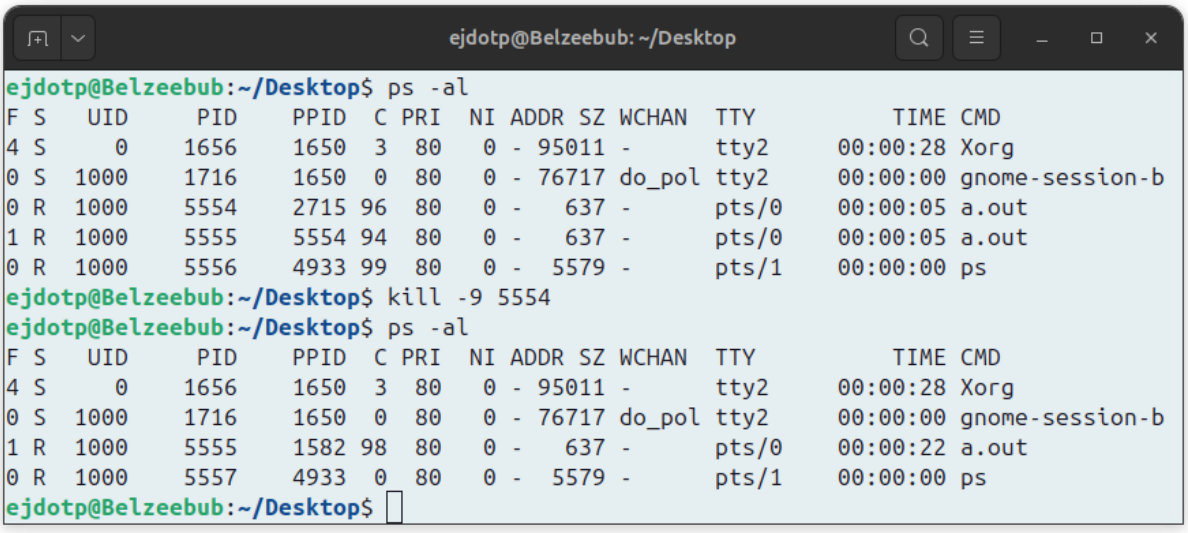
```
ejdotp@Belzeebub:~/Desktop$ ps -al
F S   UID     PID    PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
4 S     0    1656    1650  2  80   0 - 94739 -      tty2     00:00:13 Xorg
0 S  1000    1716    1650  0  80   0 - 76717 do_pol tty2     00:00:00 gnome-session-b
0 R  1000    4910    2715 84  80   0 -   637 -      pts/0    00:00:26 a.out
1 R  1000    4911    4910 85  80   0 -   637 -      pts/0    00:00:26 a.out
0 R  1000    4942    4933 33  80   0 -  5579 -      pts/1    00:00:00 ps
ejdotp@Belzeebub:~/Desktop$
```

(b):


ejdotp@Belzeebub: ~/Desktop
0 R 1000 4942 4933 33 80 0 - 5579 - pts/1 00:00:00 ps
ejdotp@Belzeebub:~/Desktop$ kill -9 4911
ejdotp@Belzeebub:~/Desktop$ ps -al
F S UID PID PPID C PRI NI ADDR SZ WCHAN TTY TIME CMD
4 S 0 1656 1650 2 80 0 - 94859 - tty2 00:00:14 Xorg
0 S 1000 1716 1650 0 80 0 - 76717 do_pol tty2 00:00:00 gnome-session-b
0 R 1000 4910 2715 92 80 0 - 637 - pts/0 00:01:58 a.out
1 Z 1000 4911 4910 88 80 0 - 0 - pts/0 00:01:53 a.out
0 R 1000 5280 4933 99 80 0 - 5579 - pts/1 00:00:00 ps
ejdotp@Belzeebub:~/Desktop$

(c):


ejdotp@Belzeebub: ~/DOS_2241016309/DOSAss4
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ gcc q1.c
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ ./a.out
Parent Process ID: 5554
Child Process ID: 5555
Killed
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$


ejdotp@Belzeebub: ~/Desktop
ejdotp@Belzeebub:~/Desktop$ ps -al
F S UID PID PPID C PRI NI ADDR SZ WCHAN TTY TIME CMD
4 S 0 1656 1650 3 80 0 - 95011 - tty2 00:00:28 Xorg
0 S 1000 1716 1650 0 80 0 - 76717 do_pol tty2 00:00:00 gnome-session-b
0 R 1000 5554 2715 96 80 0 - 637 - pts/0 00:00:05 a.out
1 R 1000 5555 5554 94 80 0 - 637 - pts/0 00:00:05 a.out
0 R 1000 5556 4933 99 80 0 - 5579 - pts/1 00:00:00 ps
ejdotp@Belzeebub:~/Desktop$ kill -9 5554
ejdotp@Belzeebub:~/Desktop$ ps -al
F S UID PID PPID C PRI NI ADDR SZ WCHAN TTY TIME CMD
4 S 0 1656 1650 3 80 0 - 95011 - tty2 00:00:28 Xorg
0 S 1000 1716 1650 0 80 0 - 76717 do_pol tty2 00:00:00 gnome-session-b
1 R 1000 5555 1582 98 80 0 - 637 - pts/0 00:00:22 a.out
0 R 1000 5557 4933 0 80 0 - 5579 - pts/1 00:00:00 ps
ejdotp@Belzeebub:~/Desktop$

(d):

Open ~/DOS_2241016309/DOSAss4 q1.c Save

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

int main()
{
    pid_t c1 = fork();
    if(c1 == 0){
        fprintf(stderr, "Child Process ID: %d\n", getpid());
        while(1);
    }
    else{
        fprintf(stderr, "Parent Process ID: %d\n", getpid());
        wait(NULL);
        while(1);
    }

    return 0;
}
```

Saving file "~/DOS_2241016309/DOSAss4/q1.c"... C Tab Width: 4 Ln 14, Col 20 INS

ejdotp@Belzeebub: ~/DOS_2241016309/DOSAss4

```
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ gedit q1.c
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ gcc q1.c
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ ./a.out
Parent Process ID: 5666
Child Process ID: 5667
```

ejdotp@Belzeebub: ~/Desktop

```
ejdotp@Belzeebub:~/Desktop$ ps -all
F S   UID     PID    PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
4 S     0    1656    1650  3  80   0 - 95071 -      tty2     00:00:37 Xorg
0 S  1000    1716    1650  0  80   0 - 76717 do_pol tty2     00:00:00 gnome-session-b
0 S  1000    5666    2715  0  80   0 -   637 do_wai pts/0    00:00:00 a.out
1 R  1000    5667    5666 99  80   0 -   637 -      pts/0    00:00:09 a.out
0 R  1000    5668    4933  0  80   0 -  5579 -      pts/1    00:00:00 ps
ejdotp@Belzeebub:~/Desktop$
```

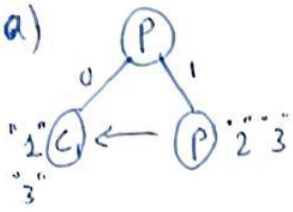
(e):

ejdotp@Belzeebub: ~/Desktop

```
0 R  1000    5668    4933  0  80   0 -  5579 -      pts/1    00:00:00 ps
ejdotp@Belzeebub:~/Desktop$ kill -9 5667
ejdotp@Belzeebub:~/Desktop$ ps -all
F S   UID     PID    PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
4 S     0    1656    1650  2  80   0 - 94951 -      tty2     00:00:37 Xorg
0 S  1000    1716    1650  0  80   0 - 76717 do_pol tty2     00:00:00 gnome-session-b
0 R  1000    5666    2715  2  80   0 -   637 -      pts/0    00:00:03 a.out
0 R  1000    5696    4933  0  80   0 -  5579 -      pts/1    00:00:00 ps
ejdotp@Belzeebub:~/Desktop$
```

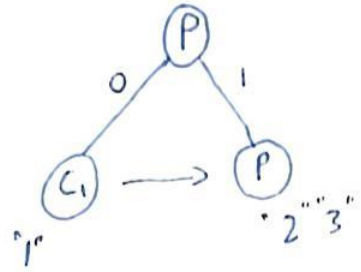
Q2:

a)



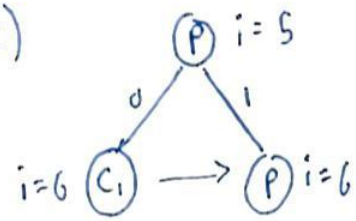
O/P = 2 3 1 3

(b)



O/P = 1 2 3 (∵ as vfork() is used, child will execute first)

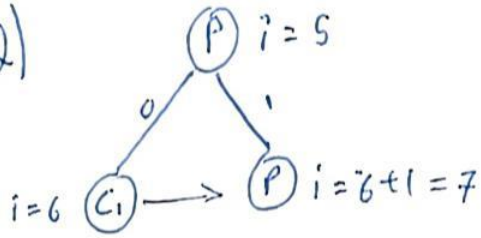
c)



O/P = Child: 6 Parent: 6

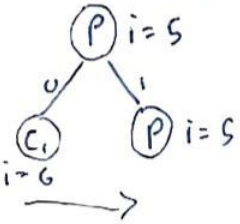
(∵ child executed first as parent uses wait(NULL))

(d)

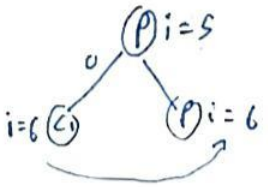


O/P = child: 6 Parent: 7

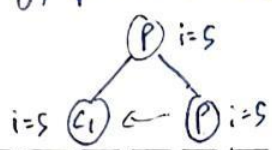
e) child: 6 Parent: 5



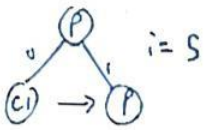
(f) child: 6 Parent: 6



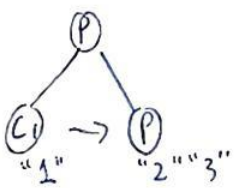
g) parent: 5 child 5



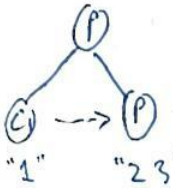
(h) child: 5 Parent: 5



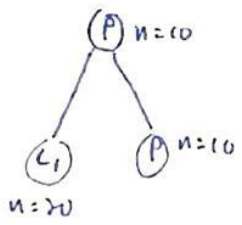
i) 1 2 3



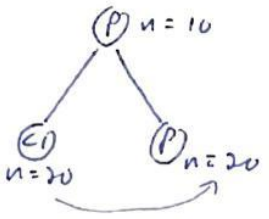
(j) 1 2 3



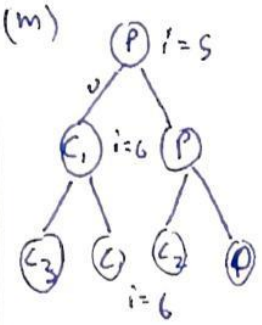
(k) child
n = 20
Parent
n = 10



(l) child
n = 20
parent
n = 20

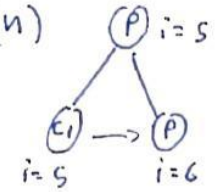


(m)



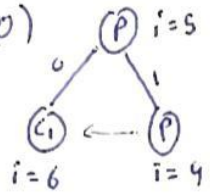
o/p = 6666

(n)



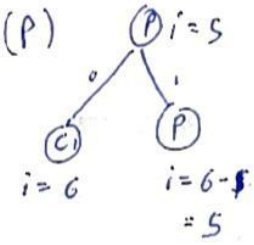
o/p: child : 5 Parent : 6

(o)



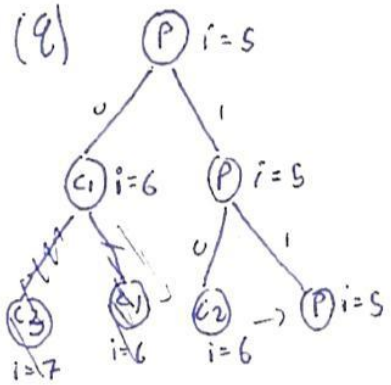
o/p = 46

(p)



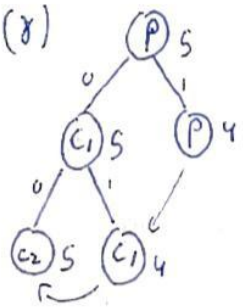
∴ o/p = 5

(q)



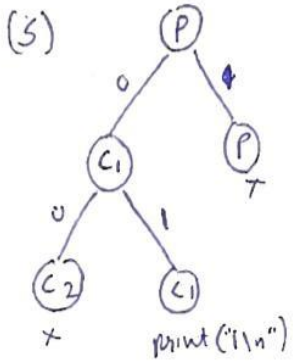
o/p = 665

(r)



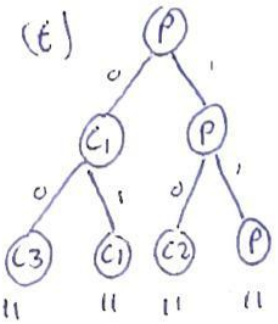
o/p = 445

(s)



o/p = 1

(t)



o/p :

1
1
1
1
1
1
1
1

∴ 8 no. of 1s
(each for force & man)

Q3:

Open ▾ | q3.c — ~/DOS_2241016309/DOSAss4 | Save

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

int main()
{
    if (vfork() == 0) {
        fprintf(stderr, "\nChild Process ID: %d\nParent Process ID: %d\n", getpid(), getppid());
        execl("/bin/cp", "cp", "file1", "file2", NULL);
    }
    sleep(1);

    if (vfork() == 0) {
        fprintf(stderr, "\nChild Process ID: %d\nParent Process ID: %d\n", getpid(), getppid());
        execl("/bin/cat", "cat", "file2", NULL);
    }
    sleep(1);

    if (vfork() == 0) {
        fprintf(stderr, "\nChild Process ID: %d\nParent Process ID: %d\n", getpid(), getppid());
        execl("/usr/bin/sort", "sort", "-r", "file2", NULL);
    }
    sleep(1);

    while (wait(NULL) > 0);
    fprintf(stderr, "\nParent Process ID: %d\n", getpid());

    return 0;
}
```

C ▾ | Tab Width: 4 ▾ | Ln 24, Col 1 | INS

ejdotp@Belzeebub: ~/DOS_2241016309/DOSAss4

```
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ cat > file1

2
4
3
1
5
^C
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ cat > file2

^C
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ gedit q3.c

ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ gcc q3.c

ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ ./a.out


Child Process ID: 3595
Parent Process ID: 3594

Child Process ID: 3596
Parent Process ID: 3594
2
4
3
1
5

Child Process ID: 3597
Parent Process ID: 3594
5
4
3
2
1

Parent Process ID: 3594
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$
```

Q4:

q4.c
~/DOS_2241016309/DOSAss4

```c
#include <stdio.h>
#include <unistd.h>

int main()
{
    int len;
    printf("Enter the Length: ");
    scanf("%d", &len);
    int fib[len];
    if(vfork() == 0){
        fib[0] = 0;
        fib[1] = 1;
        for(int i = 2; i < len; i++)
            fib[i] = fib[i-1] + fib[i-2];
        _exit(0);
    }
    printf("\nFibonacci Series: ");
    for(int i = 0; i < len; i++)
        printf("%d ", fib[i]);
    printf("\nPrimes in the series:-\n");
    for(int i = 3; i < len; i++){
        int isPrime = 1;
        for(int j = 2; j*j <= fib[i]; j++){
            if(fib[i]%j == 0)
                isPrime = 0;
        }
        if(isPrime)
            printf("%d at index %d\n", fib[i], i);
    }

    return 0;
}
```

C Tab Width: 4 Ln 23, Col 40 INS

ejdotp@Belzeebub: ~/DOS_2241016309/DOSAss4

```
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ gedit q4.c
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ gcc q4.c
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$ ./a.out
Enter the Length: 10

Fibonacci Series: 0 1 1 2 3 5 8 13 21 34
Primes in the series:-
2 at index 3
3 at index 4
5 at index 5
13 at index 7
ejdotp@Belzeebub:~/DOS_2241016309/DOSAss4$
```