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Experiment 3

AIM : Write a program which creates exactly 16 copies of itself by calling fork () only twice within a loop. The program should also print a tree of the pids.

Discussion & Output:

Fork.c

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

void printTree(int pid,int level){
    for(int i=0;i<level;i++){
        printf("\t");
    }
    printf("PID:%d\n",pid);
}

int main()
{
    int process=16;
    int level=0;
    pid_t parentpid=getpid();

    for(int i=0;i<process;i++){
        pid_t childpid=fork();

        if(childpid==0){
            level++;
            printTree(getpid(),level);
        }
        else if(childpid>0){
            wait(NULL);
            break;
        }
    }
}
```

```

        else{
            printf("Fork failed.\n");
            return 1;
        }
    }

    if(getpid()==parentpid){
        for(int i=0;i<process;i++){
            wait(NULL);
        }
        printf("All processses created.\n");
    }

    return 0;
}

```

Output:

```

manishj@ubuntu:~/Desktop/osexp3$ gedit fork.c
^C
manishj@ubuntu:~/Desktop/osexp3$ gcc fork.c
manishj@ubuntu:~/Desktop/osexp3$ ./a.out
PID:12682
  PID:12683
    PID:12684
      PID:12685
        PID:12686
          PID:12687
            PID:12688
              PID:12689
                PID:12690
                  PID:12691
                    PID:12692
                      PID:12693
                        PID:12694
                          PID:12695
                            PID:12696
                              PID:12697

All processses created.
manishj@ubuntu:~/Desktop/osexp3$ █

```

2) Demonstrate the following system calls with examples.

Fork() System call, Wait() system call, Orphan Process, Zombie process.

1. fork():

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

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

```
int main() {  
  
    pid_t pid = fork();  
  
    if (pid == 0) {  
        // Child process  
  
        printf("Child process: PID = %d\n", getpid());  
    } else if (pid > 0) {  
        // Parent process  
  
        printf("Parent process: PID = %d, Child PID = %d\n", getpid(), pid);  
    } else {  
        // Fork failed  
  
        printf("Fork failed.\n");  
  
        return 1;  
    }  
  
    return 0;  
}
```

Output:

```
manishj@ubuntu:~/Desktop/osexp3$ gedit fork2.c
^C
manishj@ubuntu:~/Desktop/osexp3$ gcc fork2.c
manishj@ubuntu:~/Desktop/osexp3$ ./a.out
Parent process: PID = 12765, Child PID = 12766
Child process: PID = 12766
manishj@ubuntu:~/Desktop/osexp3$
```

2. wait():

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

```
int main() {
    pid_t childPid;
```

```
    // Create a child process
    childPid = fork();
```

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

```
    if (childPid == 0) {
        // Child process
        printf("Child process (PID: %d) is running.\n", getpid());
        sleep(3); // Simulate some work in the child process
        printf("Child process (PID: %d) is exiting.\n", getpid());
        exit(EXIT_SUCCESS);
    } else {
        // Parent process
        printf("Parent process (PID: %d) is waiting for the child to exit.\n", getpid());
```

```

int status;
pid_t terminatedChildPid = wait(&status);

if (terminatedChildPid == -1) {
    perror("wait");
    exit(EXIT_FAILURE);
}

if (WIFEXITED(status)) {
    printf("Child process (PID: %d) exited with status %d.\n", terminatedChildPid,
WEXITSTATUS(status));
} else if (WIFSIGNALED(status)) {
    printf("Child process (PID: %d) terminated by signal %d.\n", terminatedChildPid,
WTERMSIG(status));
}

printf("Parent process (PID: %d) is done.\n", getpid());
}

return 0;
}

```

Output:

```

manishj@ubuntu:~/Desktop/osexp3$ gedit wait.c
^C
manishj@ubuntu:~/Desktop/osexp3$ gcc wait.c
manishj@ubuntu:~/Desktop/osexp3$ ./a.out
Parent process (PID: 12791) is waiting for the child to exit.
Child process (PID: 12792) is running.
Child process (PID: 12792) is exiting.
Child process (PID: 12792) exited with status 0.
Parent process (PID: 12791) is done.
manishj@ubuntu:~/Desktop/osexp3$ █

```

3. orphan():

```

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

```

```

int main() {
    pid_t pid = fork();

    if (pid == 0) {
        // Child process
        sleep(5);
        printf("Orphan Child process: PID = %d, Parent PID = %d\n", getpid(), getppid());
    } else if (pid > 0) {
        // Parent process
        printf("Parent process: PID = %d\n", getpid());
    } else {
        // Fork failed
        printf("Fork failed.\n");
        return 1;
    }

    return 0;
}

```

Output:

```

manishj@ubuntu:~/Desktop/osexp3$ gedit orphan.c
^C
manishj@ubuntu:~/Desktop/osexp3$ gcc orphan.c
manishj@ubuntu:~/Desktop/osexp3$ ./a.out
Parent process: PID = 12817
manishj@ubuntu:~/Desktop/osexp3$ Orphan Child process: PID = 12818, Parent PID = 1431
^C
manishj@ubuntu:~/Desktop/osexp3$

```

4. zombie():

```

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

int main() {
    pid_t pid = fork();

    if (pid < 0) {
        // Fork failed
        fprintf(stderr, "Fork failed.\n");
    }
}

```

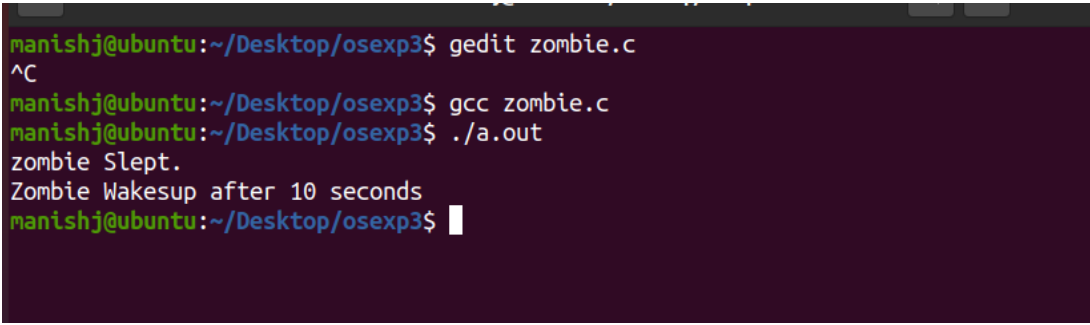
```

        return 1;
    } else if (pid == 0) {
        // Child process
        printf("zombie Slept.\n");
        exit(0); // Child process exits immediately
    } else {
        // Parent process
        sleep(10); // Parent process sleeps for 5 seconds
        printf("Zombie Wakesup after 10 seconds\n");
    }

    return 0;
}

```

Output:



```

manishj@ubuntu:~/Desktop/osexp3$ gedit zombie.c
^C
manishj@ubuntu:~/Desktop/osexp3$ gcc zombie.c
manishj@ubuntu:~/Desktop/osexp3$ ./a.out
zombie Slept.
Zombie Wakesup after 10 seconds
manishj@ubuntu:~/Desktop/osexp3$

```

CONCLUSION: Hence, by completing this experiment I came to know about how to write a program which creates exactly 16 copies of itself by calling fork () only twice within a loop. The program should also print a tree of the pids and also to demonstrate wait() system call, orphan(), and zombie() function.