Kathmandu University
Department of Computer Science and Engineering
Dhulikhel, Kavre

A Lab Report #1

[Course title: COMP 307]

Submitted by:
Bisheshwor Neupane(35)

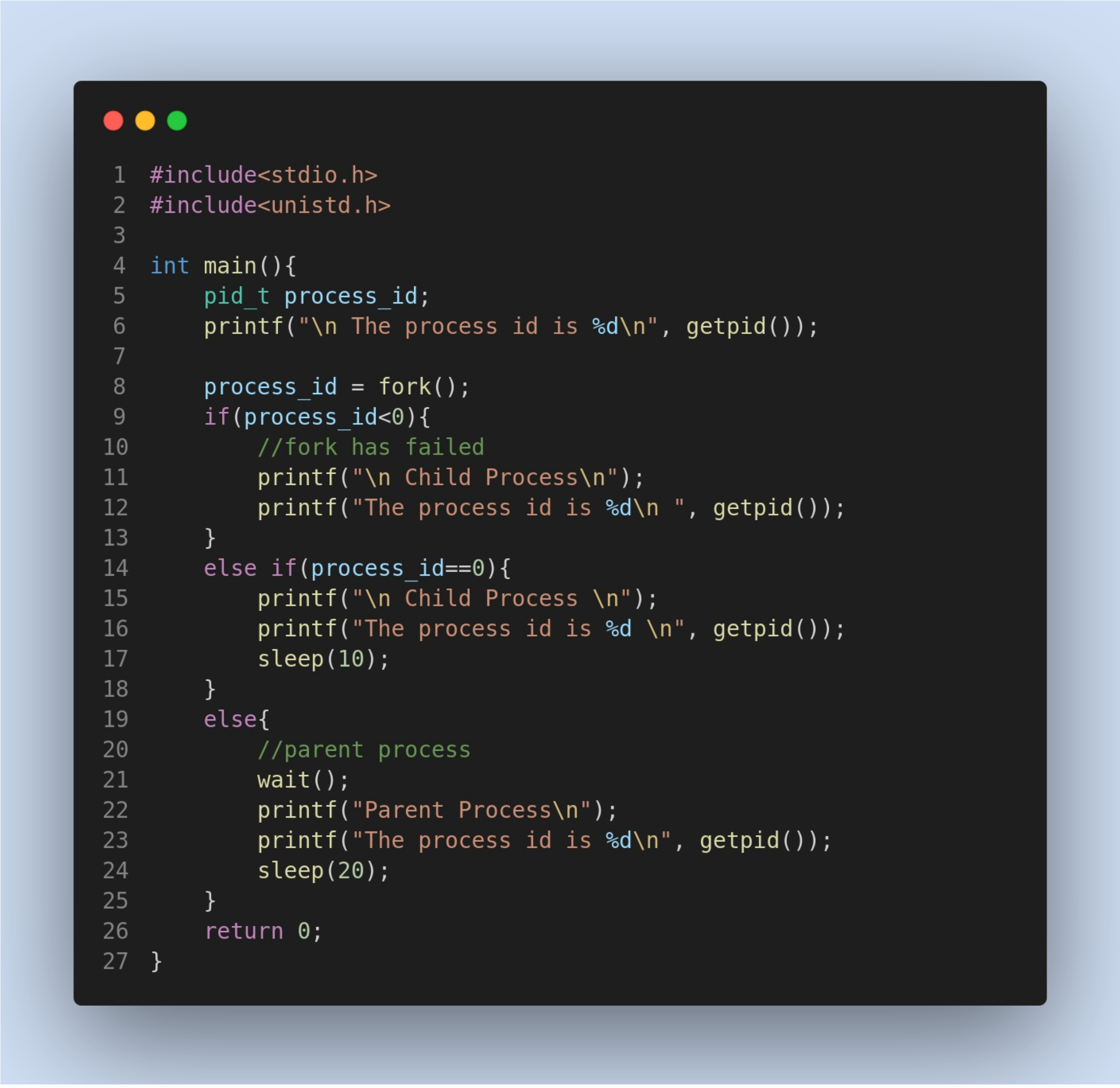
Submitted to:
Mr. Dhiraj Shrestha
Department of Computer Science and Engineering

Submission Date:

August 20, 2021

(Understanding Process Concepts)

1. **Write a C program to implement process System calls ? [Hint use fork()]**
   Code:

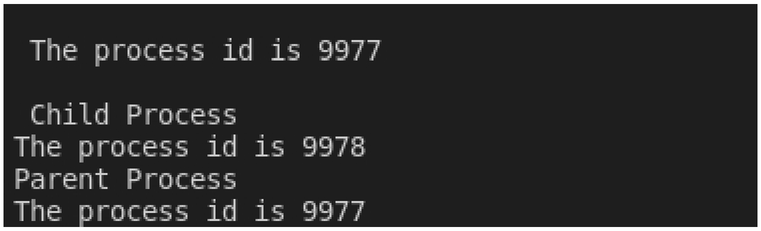


```c
#include<stdio.h>
#include<unistd.h>

int main(){
    pid_t process_id;
    printf("\n The process id is %d\n", getpid());

    process_id = fork();
    if(process_id<0){
        //fork has failed
        printf("\n Child Process\n");
        printf("The process id is %d\n ", getpid());
    }
    else if(process_id==0){
        printf("\n Child Process \n");
        printf("The process id is %d \n", getpid());
        sleep(10);
    }
    else{
        //parent process
        wait();
        printf("Parent Process\n");
        printf("The process id is %d\n", getpid());
        sleep(20);
    }
    return 0;
}
```

Output:



```
 The process id is 9977

 Child Process
The process id is 9978
Parent Process
The process id is 9977
```

After getting an output, we assure that a child process is called first. Only after it's termination, parent process is called.

2. How many processes are created in a given program?

```
#include <stdio.h>
#include <unistd.h>
int main()
{
int i;
for (i = 0; i < 4; i++)
fork();
return 0;
}
```

Solution:

As fork() method is called 4 times, calculated number of child processes is 15. i.e. 2^n - 1 = 2^4 - 1 = 15 processes. Including parent process, the total number of processes is 16.

When fork gets executed, a new process is created whereas 3 forks are left to be executed. The first fork call creates a child process p1 and remaining 3 more fork calls have to be executed. When the second fork calls gets executed, the parent process creates 3 more processes p2, p3, p4. The child process also creates another 3 processes p5, p6, p7. Subsequently, the total fork calls left is two. To sum up, 15 forks are created.

3. When will line J be reached?

```
#include <sys/types.h>
#include <stdio.h>
#include <unistd.h>
int main()
{
pid_t pid;
/* fork a child process */
pid = fork();
if (pid < 0) { /* error occurred */
fprintf(stderr, "Fork Failed");
return 1;
}
else if (pid == 0) { /* child process */
execlp("/bin/ls","ls",NULL);
printf("LINE J");
}
else { /* parent process */
/* parent will wait for the child to complete */
wait(NULL);
printf("Child Complete");
}
return 0;
}
```

Solution:

The fork system call creates a new child process and runs parallel with parent process. The process waits for the child to completely finish its processes. The child process, pid = 0 executes the statement,

execlp("/bin/ls","ls",NULL);

When this statement is called, the child processes are completely replaced with a new program that displays the directory contents. So, new statements in the child process are not executed. Thus, line J will not be reached.

4. **What are the pid values?**

```
#include <sys/types.h>
#include <stdio.h>
#include <unistd.h>
int main()
{
pid_t pid, pid1;
/* fork a child process */
pid = fork();
if (pid < 0) { /* error occurred */
fprintf(stderr, "Fork Failed");
return 1;
}
else if (pid == 0) { /* child process */
pid1 = getpid();
printf("child: pid = %d",pid); /* A */
printf("child: pid1 = %d",pid1); /* B */
}
else { /* parent process */
pid1 = getpid();
printf("parent: pid = %d",pid); /* C */
printf("parent: pid1 = %d",pid1); /* D */
wait(NULL);
}
return 0;
}
```

Solution:

The pid values for child processes are: pid = 0 and pid1 = 13062.
The pid values for parent processes are: pid = 13062 and pid1 = 13061

i. parent :pid = 13062
It is returned by the fork system call to recognize it as a parent process with a positive value which is equal to the process id of child process.
ii. parent :pid = 13061
It is less than the process id of the child process.
iii. child : pid = 0
It is returned by the fork system call to represent it as the child process.
iv. child: pid = 13062
It is returned by the fork system call to represent it as the child process.

5. What will be at Line X and Line Y?

```
#include <sys/types.h>
#include <stdio.h>
#include <unistd.h>
#define SIZE 5
int nums[SIZE] = {0,1,2,3,4};
int main()
{
int i;
pid t pid;
pid = fork();
if (pid == 0) {
for (i = 0; i < SIZE; i++) {
nums[i] *= -i;
printf("CHILD: %d ",nums[i]); /* LINE X */
}
}
else if (pid > 0) {
wait(NULL);
for (i = 0; i < SIZE; i++)
printf("PARENT: %d ",nums[i]); /* LINE Y */
}
return 0;
}
```

Solution:

```
At line X,CHILD: 0
               CHILD: -1
               CHILD: -4
               CHILD: -9
               CHILD: -16
At line Y,PARENT: 0
               PARENT: 1
               PARENT: 2
                PARENT: 3
               PARENT: 4
```

At first, line X was executed where fork executed child processes; therein ran print statement 5 times in a loop. In the loop, ith index of nums array was updated to a new value in each iteration of the loop. Then, the line X was displayed on the screen.

Similarly, parent processes were executed by the fork and obsequently, output is displayed.