UNP Lab
Lab Exercise - 3

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1) q1.c

```
#include "apue.h"
#include<sys/wait.h>
void main(){
    pid_t pid;
    int status;
    if ((pid = fork()) < 0) {
      err_sys("Fork error");
    }
    else if (pid == 0) { //child
      printf("Hello from child\n");
    }
    else { //parent
      if(wait(&status) != pid){
           err_sys("wait error");
      }
      printf("Hello from parent\n");
    }
}
```

Output:

```
sista@ubuntu:~/NP/lab/ex3$ gcc -o q1 -L . q1.c libapue.a
sista@ubuntu:~/NP/lab/ex3$ ./q1
Hello from child
Hello from parent
sista@ubuntu:~/NP/lab/ex3$
```

2) q2.c

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

void main(){
    int n,status;
    pid_t pid;
    n = 5;

    for(int i=0; i<n; i++) {
      if ((pid = fork()) < 0) {
           err_sys("Fork error");
```

```
        }
        else if (pid == 0) { //child
              exit(i);
        }
        else { //parent
              if(wait(&status) != pid){
                    err_sys("wait error");
              }
              printf("status:%d, pid:%d\n",
WEXITSTATUS(status),pid);
        }
     }
}
```

Output:

```
sista@ubuntu:~/NP/lab/ex3$ gcc -o q2 -L . q2.c libapue.a
sista@ubuntu:~/NP/lab/ex3$ ./q2
status:0, pid:38813
status:1, pid:38814
status:2, pid:38815
status:3, pid:38816
status:4, pid:38817
sista@ubuntu:~/NP/lab/ex3$
```

3) q3.c

Code from figure 8.3 on page 235

Output:

With _exit(0) in child

```
sista@ubuntu:~/NP/lab/ex3$ gcc -o q3 -L . q3.c libapue.a
q3.c: In function ‘main’:
q3.c:9:13: warning: implicit declaration of function ‘vfork’; did you mean ‘fork’? [-
it-function-declaration]
    9 |  if ((pid = vfork()) < 0) {
      |             ^~~~~
      |             fork
sista@ubuntu:~/NP/lab/ex3$ ./q3
before vfork
pid = 41481, glob = 7, var = 89
sista@ubuntu:~/NP/lab/ex3$
```

With exit(0) instead of _exit(0) in child

```
sista@ubuntu:~/NP/lab/ex3$ gcc -o q3 -L . q3.c libapue.a
q3.c: In function ‘main’:
q3.c:9:13: warning: implicit declaration of function ‘vfork’; did you mean ‘fork’? [-
it-function-declaration]
    9 |  if ((pid = vfork()) < 0) {
      |             ^~~~~
      |             fork
sista@ubuntu:~/NP/lab/ex3$ ./q3
before vfork
pid = 41560, glob = 7, var = 89
sista@ubuntu:~/NP/lab/ex3$
```

There is no difference in the output.

Simulating to get printf to return -1
This is not possible with exit because modern implementations of exit do not close I/O streams because of unnecessary overhead.

4) q4.c

```
#include "apue.h"
#include<sys/wait.h>
void main(){
    pid_t pid;
    int status;
    if ((pid = fork()) < 0) {
      err_sys("Fork error");
    }
    else if (pid == 0) { //child
      exit(0);
    }
    else { //parent
      sleep(5);
    }

    if((status = system("ps -al")) < 0 ) {
      err_sys("system() error");
    }
}
```

Output:

```
sista@ubuntu:~/NP/lab/ex3$ gcc -o q4 -L . q4.c libapue.a
sista@ubuntu:~/NP/lab/ex3$ ./q4
F S   UID     PID    PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
4 S  1000    1306    1304  2  80   0 - 91252 ep_pol tty2     00:29:56 Xorg
0 S  1000    1352    1304  0  80   0 - 47055 do_sys tty2     00:00:00 gnome-sess
0 S  1000   38905   35667  0  80   0 -   591 do_wai pts/0    00:00:00 q4
1 Z  1000   38906   38905  0  80   0 -     0 -      pts/0    00:00:00
0 S  1000   38907   38905  0  80   0 -   654 do_wai pts/0    00:00:00 sh
4 R  1000   38908   38907  0  80   0 -  2854 -      pts/0    00:00:00 ps
sista@ubuntu:~/NP/lab/ex3$
```

5) q5.c

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

void main(){
    pid_t pid;
    int status, count;
    char *token, *arg[20], input[100];

    while(1) {
      if ((pid = fork()) < 0) {
           err_sys("Fork error");
      }
      else if (pid == 0) { //child
           printf("shell>");
           scanf("%[^\n]s", input);

           if(strcmp(input,"exit") == 0) {
                exit(1);
           }
           token = strtok (input, " ");
           count = 0;
           while (token != NULL) {
                arg[count++] = token;
                token = strtok (NULL, " ");
           }

           if(execvp(arg[0],arg) < 0) {
                err_sys("Exec error");
           }
      }
      else {
           if(wait(&status) != pid){
                err_sys("wait error");
```

```
            }

            if(WEXITSTATUS(status) == 1) {
                exit(0);
            }
        }
    }
}
```

Output:

```
sista@ubuntu:~/NP/lab/ex3$ gcc -o q5 -L . q5.c libapue.a
sista@ubuntu:~/NP/lab/ex3$ ./q5
shell>pwd
/home/sista/NP/lab/ex3
shell>which head
/usr/bin/head
shell>ls
apue.h  capture.txt  libapue.a  q1  q1.c  q2  q2.c  q3  q3.c  q4  q4.c  q5  q5.c  q6  q6.c
shell>ls -l
total 232
-rw-rw-r-- 1 sista sista  4631 Aug 24 17:06 apue.h
-rw-rw-r-- 1 sista sista   747 Aug 27 19:14 capture.txt
-rw-rw-r-- 1 sista sista 75232 Aug 24 17:06 libapue.a
-rwxrwxr-x 1 sista sista 17616 Aug 26 12:13 q1
-rw-rw-r-- 1 sista sista   313 Aug 24 17:07 q1.c
-rwxrwxr-x 1 sista sista 17616 Aug 27 18:59 q2
-rw-rw-r-- 1 sista sista   370 Aug 27 18:59 q2.c
-rwxrwxr-x 1 sista sista 17664 Aug 28 10:50 q3
-rw-rw-r-- 1 sista sista   610 Aug 28 10:50 q3.c
-rwxrwxr-x 1 sista sista 17640 Aug 27 19:02 q4
-rw-rw-r-- 1 sista sista   288 Aug 27 19:02 q4.c
-rwxrwxr-x 1 sista sista 17800 Aug 28 15:51 q5
-rw-rw-r-- 1 sista sista   675 Aug 28 15:45 q5.c
-rwxrwxr-x 1 sista sista 17704 Aug 27 19:12 q6
-rw-rw-r-- 1 sista sista   729 Aug 27 19:11 q6.c
shell>exit
sista@ubuntu:~/NP/lab/ex3$
```

6) q6.c

```
#include "apue.h"
#include <fcntl.h>

void main(int argc, char *argv[]){
    char output[10000], input[10000];
    if(argc != 2){
      printf("One argument is required. The file path.\n");
      exit(0);
    }

    int fd = open(argv[1], O_RDWR | O_TRUNC);
    if(fd == -1){
      err_sys("open error");
```

```
    }

    //Read from STDIN and write to file
    if(read(STDIN_FILENO,input,10000) == -1) {
      err_sys("read error1");
    }

    if(write(fd,input,strlen(input)) == -1) {
      err_sys("write error1");
    }

    //Read from file and write to STDOUT
    if(lseek(fd,0,SEEK_SET) == -1) {
      err_sys("lseek error");
    }

    if(read(fd,output,10000) == -1) {
      err_sys("read error2");
    }

    if(write(STDOUT_FILENO,output,strlen(output)) == -1) {
      err_sys("write error2");
    }
}
```

Output:

```
sista@ubuntu:~/NP/lab/ex3$ gcc -o q6 -L . q6.c libapue.a
sista@ubuntu:~/NP/lab/ex3$ who | ./q6 capture.txt | sort
sista    :0           2023-08-22 19:18 (:0)
sista@ubuntu:~/NP/lab/ex3$ ps | ./q6 capture.txt | sort
  35667 pts/0    00:00:00 bash
  39073 pts/0    00:00:00 ps
  39074 pts/0    00:00:00 q6
  39075 pts/0    00:00:00 sort
    PID TTY          TIME CMD
sista@ubuntu:~/NP/lab/ex3$ ps | ./q6 capture.txt | wc -l
5
sista@ubuntu:~/NP/lab/ex3$ pwd | ./q6 capture.txt | wc
      1       1      23
sista@ubuntu:~/NP/lab/ex3$ ls -l | ./q6 capture.txt | sort
-rw-rw-r-- 1 sista sista     0 Aug 27 19:14 capture.txt
-rw-rw-r-- 1 sista sista   288 Aug 27 19:02 q4.c
-rw-rw-r-- 1 sista sista   313 Aug 24 17:07 q1.c
-rw-rw-r-- 1 sista sista   370 Aug 27 18:59 q2.c
-rw-rw-r-- 1 sista sista  4631 Aug 24 17:06 apue.h
-rw-rw-r-- 1 sista sista   613 Aug 24 17:54 q3.c
-rw-rw-r-- 1 sista sista   631 Aug 27 18:55 q5.c
-rw-rw-r-- 1 sista sista   729 Aug 27 19:11 q6.c
-rw-rw-r-- 1 sista sista 75232 Aug 24 17:06 libapue.a
-rwxrwxr-x 1 sista sista 17616 Aug 26 12:13 q1
-rwxrwxr-x 1 sista sista 17616 Aug 27 18:59 q2
-rwxrwxr-x 1 sista sista 17640 Aug 27 19:02 q4
-rwxrwxr-x 1 sista sista 17664 Aug 24 17:41 q3
-rwxrwxr-x 1 sista sista 17704 Aug 27 19:12 q6
-rwxrwxr-x 1 sista sista 17872 Aug 27 18:55 q5
total 228
sista@ubuntu:~/NP/lab/ex3$
```