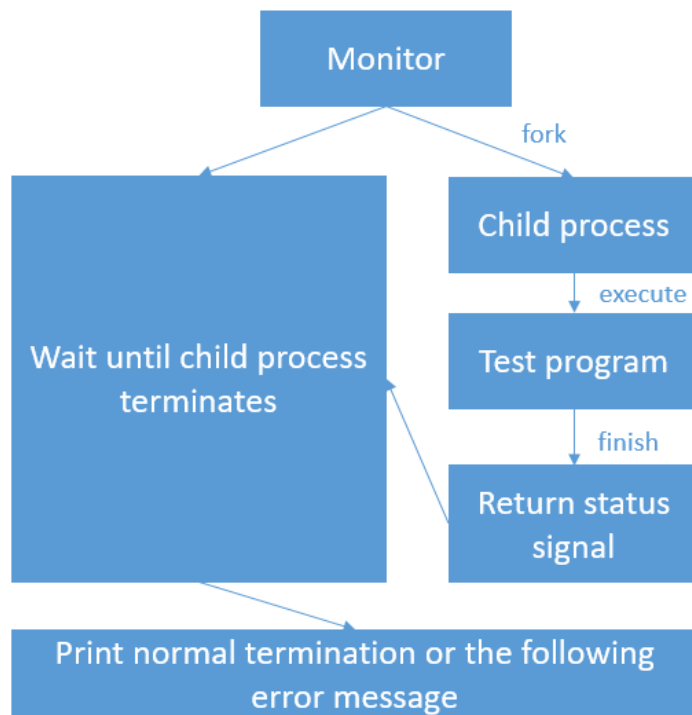


CSC3150 Assignment 1

Task 1 (30 points)

In this task, you should write a program ("program1.c") that implement the functions below:

- In user mode, fork a child process to execute the test program. (10 points)
- When child process finish execution, the parent process will receive the `SIGCHLD` signal by `wait()` function. (5 points)
- There are 15 test programs provided. 1 is for normal termination, and the rest are exception cases. Please use these test programs as your executing programs.
- The termination information of child process should be print out. If normal termination, print normal termination and exit status. If not, print out how did the child process terminates and what signal was raised in child process. (15 points)
- The main flow chart for Task 1 is:



- Demo output for normal termination:

```
[09/10/19]seed@VM:~/.../program1$ ./program1 ./normal
Process start to fork
I'm the parent process, my pid = 2887
I'm the child process, my pid = 2888
Child process start to execute the program
-----CHILD PROCESS START-----
This is the normal program

-----CHILD PROCESS END-----
Parent process receiving the SIGCHLD signal
Normal termination with EXIT STATUS = 0
[09/10/19]seed@VM:~/.../program1$
```

- Demo output for signaled abort:

```
[09/10/19]seed@VM:~/.../program1$ ./program1 ./abort
Process start to fork
I'm the parent process, my pid = 2916
I'm the child process, my pid = 2917
Child process start to execute the program
-----CHILD PROCESS START-----
This is the SIGABRT program

Parent process receiving the SIGCHLD signal
child process get SIGABRT signal
child process is abort by abort signal
CHILD EXECUTION FAILED!!
[09/10/19]seed@VM:~/.../program1$
```

- Demo output for stopped:

```
[09/10/19]seed@VM:~/.../program1$ ./program1 ./stop
Process start to fork
I'm the parent process, my pid = 2921
I'm the child process, my pid = 2922
Child process start to execute the program
-----CHILD PROCESS START-----
This is the SIGSTOP program

Parent process receiving the SIGCHLD signal
child process get SIGSTOP signal
child process stopped
CHILD PROCESS STOPPED
[09/10/19]seed@VM:~/.../program1$
```

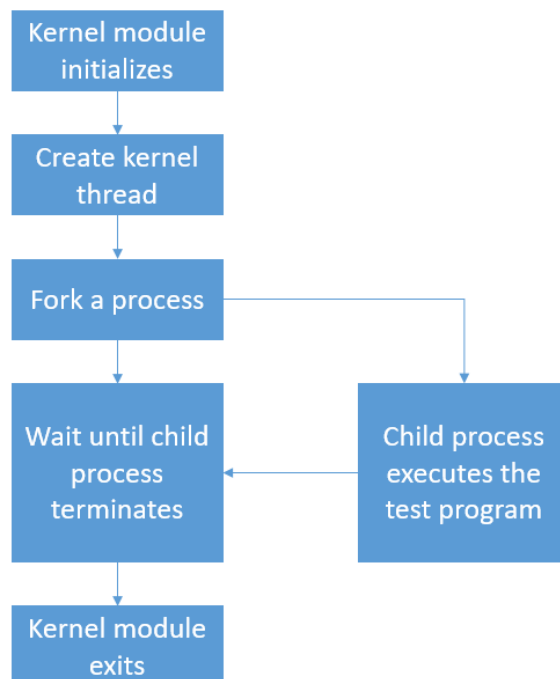
Task 2 (60 points)

In this task, a template ("program2.c") is provided. Within the template, please implement the functions below:

- When `program2.ko` being initialized, create a kernel thread and run `my_fork` function. (10 points)
- Within `my_fork`, fork a process to execute the `test` program. (10 points)
- The parent process will wait until child process terminates. (10 points)
- Print out the process id for both parent and child process. (5 points)
- Within this test program, it will raise signal. The signal could be caught and related message should be printed out in kernel log. (10 points)
- Follow the hints below to implement your function. If the function is non-static, you should firstly export this symbol so that it could be used in your own kernel module. After that, you should compile the kernel source code and install it. (Kernel compile: 15 points)

Hints:

- 1) Use "`_do_fork`" to fork a new process. (`/kernel/fork.c`)
 - 2) Use "`do_execve`" to execute the test program. (`/fs/exec.c`)
 - 3) Use "`getname`" to get filename. (`/fs/namei.c`)
 - 4) Use "`do_wait`" to wait for child process' termination status. (`/kernel/exit.c`)
- The main flow chart for Task 2 is:



- Demo output:

```
[ 6712.148627] [program2] : module_init
[ 6712.148628] [program2] : module_init create kthread start
[ 6712.148642] [program2] : module_init kthread start
[ 6712.151651] [program2] : The child process has pid = 17809
[ 6712.151651] [program2] : This is the parent process,pid = 17807
[ 6712.152335] [program2] : child process
[ 6712.152336] [program2] : get SIGBUS signal
[ 6712.152336] [program2] : child process has bus error
[ 6712.152337] [program2] : The return signal is 7
[ 6746.342276] [program2] : module exit
[09/10/19]seed@VM:~/.../program2$
```

Bonus Task (10 pionts)

In this task, you should create an executable file named “**myfork**” to implement the functions below:

- Execute “./myfork test_program” will show the signal message that child process executes **test_program**. (3 points)
- We can add multiple executable files as the argument of myfork, like “./myfork **test_program1 test_program2 test_program3**”. From second argument, the queue indicates the relationship of parent and child. The proceeding one is parent, and the tailing one is child. For example: test_program_1 is parent of test_program_2, and test_program_2 is the parent of test_program_3. (3 points)
- Print out a process tree, which can indicate the relationship of the test programs. For example: 1 -> 2 -> 3 (1/2/3 is the process ID) (4 points)
- Demo output

```
[09/10/19]seed@VM:~/.../bonus$ ./myfork hangup normal8 trap
-----CHILD PROCESS START-----
This is the SIGTRAP program

This is normal8 program
-----CHILD PROCESS START-----
This is the SIGHUP program

the process tree : 19918->19919->19920->19921
The child process(pid=19921) of parent process(pid=19920) is terminated by signal
Its signal number = 5
child process get SIGTRAP signal
child process reach a breakpoint

The child process(pid=19920) of parent process(pid=19919) has normal execution
Its exit status = 0

The child process(pid=19919) of parent process(pid=19918) is terminated by signal
Its signal number = 1
child process get SIGHUP signal
child process is hung up

Myfork process(pid=19918) execute normally
[09/10/19]seed@VM:~/.../bonus$
```

Report (10 points)

Write a report for your assignment, which should include main information as below:

- Your name and student id.
- How did you design your program?
- The environment of running your program. (E.g., version of OS and kernel)
- The steps to execute your program.
- Screenshot of your program output.
- What did you learn from the tasks?

Submission Requirement

- The report should be submitted in the format of **pdf**, together with your source code. Please compress all files into a single **zip** file and name it according to your **student id**. The project structure is illustrated as below:

- **Assignment_1_Student ID.zip**

- source
 - program1
 - ✓ program1.c
 - ✓ Makefile
 - ✓ abort.c
 - ✓ ...
 - program2
 - ✓ program2.c
 - ✓ Makefile
 - ✓ test.c
 - bonus
 - ✓ myfork.c
 - ✓ Makefile
 - ✓ abort.c
 - ✓ ...
- Report.pdf

- Please note that, teaching assistants may ask you to **explain the meaning of your program**, to ensure that the codes are indeed written by yourself. Please also note that we would check **whether your program is too similar to your fellow students' code** using plagiarism detectors.
- Violation against the format requirements will lead to grade deduction.
- Due on: **23:59, 11 Oct 2020**

Grading rules

Completion	Marks
Bonus	0 ~ 10 points
Report	10 points
Completed with good quality	80 ~ 90
Completed accurately	80 +
Fully Submitted (compile successfully)	60 +
Partial submitted	0 ~ 60
No submission	0
Late submission	Not allowed