

Report

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Program 1:

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How did I design my program?

Program 1

- ▼ In program 1, I basically follow the tut slide.
- ▼ The total program can be divided into 3parts: Fork part, Child part and Parent part.
- ▼ In the fork part, program basically call `fork()` function and receive the return pid.
- ▼ In the child part, program receive the input file args and call the `execve()` function with the received files.
 - ▼ In the `execve()` function, code in the test file will be executed and return signals;
- ▼ when turns to parent part, program will wait until child process finished and receives signal passed by child process. Using determine functions like `WIFEXITED()` the parent process got to know the situation of how child process executed. Then output corresponding statement.

Program 2

▼ In program 2, referring to linux source code, the program can be divided into 4 parts: Init, fork, execute and wait.

▼ The first part, Initialization.

▼ In this part, what program basically do is to create a kernel thread and wake it up

▼ thread will be created using `kthread_create()`, if there is no error (`PTR_ERR()` / `IS_ERR()`), the `wake_up_thread()` will be called and thread starts to work.

▼ The second part, fork new process.

▼ `my_fork()` function will be called as the kthread create.

▼ in this part, struct `kernel_clone_args` will be created and passed into function `kernel_clone()`, which aims to create a new child process. The return value of `kernel_clone()` (child process pid) will be print out here.

▼ The third part, execute test file.

▼ `my_exec()` function will be called while setting the arguments of `kernel_clone_args`.

▼ the reading path of test file will be set in advance as `/tmp/test`. With the help of `getname_kernel()` function we are able to get access to the test file.

▼ using `do_exec()` function, the code in test.c will be execute and `do_execute()` return 0 if no error.

▼ The last part, wait for child process finish

▼ `my_wait()` will be called in `my_fork()` after `my_exec()`.

▼ In this part, struct `wait_opts` will created and initialized. Using this struct `do_wait()` enable parent process to wait until child process finished.

▼ The return value of `my_wait()` will be set as an integer related to signal raised by child process. Then the `my_fork()` will catch this return integer and print out relevant output.

How to set up my development environment, including how to compile kernel?

1. Set up virtual environment.
2. Install basic environmental components into virtual environment.
3. modify and compile linux kernel.

```
cd /linux xxx/kernel/  
sudo vim xxx.c  
add EXPORT_SYMBOL() after certain functions we need  
:wq  
make bzImage and so on (re compile linux kernel)
```

Screenshot of my program output

Program 1:

```
vagrant@csc3150:~/csc3150/assignment1/code/program1$ ./program1 abort  
Process start to fork  
I am the parent process, my pid = 10240  
Process start to fork  
I am the child process, my pid = 10241  
Child process start to execute test program:  
-----CHILD PROCESS START-----  
This is the SIGABRT program  
  
Parent process receiving the SIGCHLD signal  
Execution failed with signal: 6  
Execution failed with abort signal
```

```
● vagrant@csc3150:~/csc3150/assignment1/code/program1$ ./program1 alarm
Process start to fork
I am the child process, my pid = 10282
Child process start to execute test program:
Process start to fork
I am the parent process, my pid = 10281
-----CHILD PROCESS START-----
This is the SIGALRM program

Parent process receiving the SIGCHLD signal
Execution failed with signal: 14
Execution failed with alarm signal
```

```
● vagrant@csc3150:~/csc3150/assignment1/code/program1$ ./program1 bus
Process start to fork
I am the parent process, my pid = 10323
Process start to fork
I am the child process, my pid = 10324
Child process start to execute test program:
-----CHILD PROCESS START-----
This is the SIGBUS program

Parent process receiving the SIGCHLD signal
Execution failed with signal: 7
Execution failed with bus signal
```

```
● vagrant@csc3150:~/csc3150/assignment1/code/program1$ ./program1 floating
Process start to fork
I am the parent process, my pid = 10364
Process start to fork
I am the child process, my pid = 10365
Child process start to execute test program:
-----CHILD PROCESS START-----
This is the SIGFPE program

Parent process receiving the SIGCHLD signal
Execution failed with signal: 8
Execution failed with floating point exception signal
```

```
● vagrant@csc3150:~/csc3150/assignment1/code/program1$ ./program1 hangup
Process start to fork
I am the parent process, my pid = 10393
Process start to fork
I am the child process, my pid = 10394
Child process start to execute test program:
-----CHILD PROCESS START-----
This is the SIGHUP program

Parent process receiving the SIGCHLD signal
Execution failed with signal: 1
Execution failed with hang up signal
```

```
● vagrant@csc3150:~/csc3150/assignment1/code/program1$ ./program1 illegal_instr
Process start to fork
I am the parent process, my pid = 10434
Process start to fork
I am the child process, my pid = 10435
Child process start to execute test program:
-----CHILD PROCESS START-----
This is the SIGILL program

Parent process receiving the SIGCHLD signal
Execution failed with signal: 4
Execution failed with illegal signal
```

```
● vagrant@csc3150:~/csc3150/assignment1/code/program1$ ./program1 interrupt
Process start to fork
I am the parent process, my pid = 10477
Process start to fork
I am the child process, my pid = 10478
Child process start to execute test program:
-----CHILD PROCESS START-----
This is the SIGINT program

Parent process receiving the SIGCHLD signal
Execution failed with signal: 2
Execution failed with interrupt signal
```

```
● vagrant@csc3150:~/csc3150/assignment1/code/program1$ ./program1 kill
Process start to fork
I am the parent process, my pid = 10493
Process start to fork
I am the child process, my pid = 10494
Child process start to execute test program:
-----CHILD PROCESS START-----
This is the SIGKILL program

Parent process receiving the SIGCHLD signal
Execution failed with signal: 9
Execution failed with kill signal
```

```
● vagrant@csc3150:~/csc3150/assignment1/code/program1$ ./program1 normal
Process start to fork
I am the parent process, my pid = 10521
Process start to fork
I am the child process, my pid = 10522
Child process start to execute test program:
-----CHILD PROCESS START-----
This is the normal program

-----CHILD PROCESS END-----
Parent process receiving the SIGCHLD signal
Normal termination with EXIT STATUS = 0
```

```
● vagrant@csc3150:~/csc3150/assignment1/code/program1$ ./program1 pipe
Process start to fork
I am the parent process, my pid = 10549
Process start to fork
I am the child process, my pid = 10550
Child process start to execute test program:
-----CHILD PROCESS START-----
This is the SIGPIPE program

Parent process receiving the SIGCHLD signal
Execution failed with signal: 13
Execution failed with pipeline error signal
```

```
● vagrant@csc3150:~/csc3150/assignment1/code/program1$ ./program1 quit
Process start to fork
I am the parent process, my pid = 10589
Process start to fork
I am the child process, my pid = 10590
Child process start to execute test program:
-----CHILD PROCESS START-----
This is the SIGQUIT program

Parent process receiving the SIGCHLD signal
Execution failed with signal: 3
Execution failed with quit signal
```

```
● vagrant@csc3150:~/csc3150/assignment1/code/program1$ ./program1 stop
Process start to fork
Process start to fork
I am the child process, my pid = 10690
Child process start to execute test program:
I am the parent process, my pid = 10689
-----CHILD PROCESS START-----
This is the SIGSTOP program

Parent process receiving the SIGCHLD signal
CHILD PROCESS STOPPED
```

```
● vagrant@csc3150:~/csc3150/assignment1/code/program1$ ./program1 terminate
Process start to fork
I am the parent process, my pid = 10726
Process start to fork
I am the child process, my pid = 10727
Child process start to execute test program:
-----CHILD PROCESS START-----
This is the SIGTERM program

Parent process receiving the SIGCHLD signal
Execution failed with signal: 15
Execution failed with termination signal
```



```

vagrant@csc3150:~/csc3150/assignment1/code/program1$ ./program1 trap
Process start to fork
I am the child process, my pid = 10758
Child process start to execute test program:
Process start to fork
I am the parent process, my pid = 10757
-----CHILD PROCESS START-----
This is the SIGTRAP program

Parent process receiving the SIGCHLD signal
Execution failed with signal: 5
Execution failed with trap signal

```

Program 2:

```

[ 3571.568039] [program2] : Module_init Ting Wang 120090862
[ 3571.568040] [program2] : module_init create kthread start
[ 3571.568227] [program2] : module_init Kthread starts
[ 3571.568335] [program2] : The Child process has pid = 23009
[ 3571.568336] [program2] : This is the parent process, pid = 23008
[ 3571.568337] [program2] : child process
[ 3571.651429] [program2] : Execution failed with abort signal
[ 3571.651430] [program2] : The return signal is 6
[ 3571.651431] [program2] : The return signal is 134
[ 3572.868384] [program2] : Module_exit

```

```

[ 3305.153133] [program2] : Module_init Ting Wang 120090862
[ 3305.153151] [program2] : module_init create kthread start
[ 3305.153498] [program2] : module_init Kthread starts
[ 3305.153552] [program2] : The Child process has pid = 22937
[ 3305.153553] [program2] : This is the parent process, pid = 22936
[ 3305.153554] [program2] : child process
[ 3305.154116] [program2] : Execution failed with alarm signal
[ 3305.154117] [program2] : The return signal is 14
[ 3305.154118] [program2] : The return signal is 14
[ 3306.537403] [program2] : Module_exit

```



```
[ 3617.641492] [program2] : Module_init Ting Wang 120090862
[ 3617.641493] [program2] : module_init create kthread start
[ 3617.641783] [program2] : module_init Kthread starts
[ 3617.642333] [program2] : The Child process has pid = 23051
[ 3617.642350] [program2] : This is the parent process, pid = 23050
[ 3617.642351] [program2] : child process
[ 3617.726239] [program2] : Execution failed with bus signal
[ 3617.726242] [program2] : The return signal is 7
[ 3617.726242] [program2] : The return signal is 135
[ 3618.919051] [program2] : Module_exit
```

```
[ 3640.545069] [program2] : Module_init Ting Wang 120090862
[ 3640.545070] [program2] : module_init create kthread start
[ 3640.545324] [program2] : module_init Kthread starts
[ 3640.545418] [program2] : The Child process has pid = 23090
[ 3640.545419] [program2] : This is the parent process, pid = 23089
[ 3640.545420] [program2] : child process
[ 3640.628907] [program2] : Execution failed with floating point exception signal
[ 3640.628909] [program2] : The return signal is 8
[ 3640.628909] [program2] : The return signal is 136
[ 3641.554857] [program2] : Module_exit
```

```
[ 3660.899526] [program2] : Module_init Ting Wang 120090862
[ 3660.899527] [program2] : module_init create kthread start
[ 3660.899868] [program2] : module_init Kthread starts
[ 3660.901448] [program2] : The Child process has pid = 23118
[ 3660.901449] [program2] : This is the parent process, pid = 23116
[ 3660.901450] [program2] : child process
[ 3660.902208] [program2] : Execution failed with hang up signal
[ 3660.902209] [program2] : The return signal is 1
[ 3660.902210] [program2] : The return signal is 1
[ 3661.930996] [program2] : Module_exit
```

```
[ 3682.427598] [program2] : Module_init Ting Wang 120090862
[ 3682.427599] [program2] : module_init create kthread start
[ 3682.427786] [program2] : module_init Kthread starts
[ 3682.427897] [program2] : The Child process has pid = 23156
[ 3682.427898] [program2] : This is the parent process, pid = 23155
[ 3682.427899] [program2] : child process
[ 3682.504698] [program2] : Execution failed with illegal signal
[ 3682.504700] [program2] : The return signal is 4
[ 3682.504700] [program2] : The return signal is 132
[ 3683.457466] [program2] : Module_exit
```

```
[ 3701.699876] [program2] : Module_init Ting Wang 120090862
[ 3701.699878] [program2] : module_init create kthread start
[ 3701.700170] [program2] : module_init Kthread starts
[ 3701.700270] [program2] : The Child process has pid = 23185
[ 3701.700322] [program2] : This is the parent process, pid = 23184
[ 3701.700384] [program2] : child process
[ 3701.701428] [program2] : Execution failed with interrupt signal
[ 3701.701430] [program2] : The return signal is 2
[ 3701.701430] [program2] : The return signal is 2
[ 3702.786003] [program2] : Module_exit
```

```
[ 3724.752288] [program2] : Module_init Ting Wang 120090862
[ 3724.752309] [program2] : module_init create kthread start
[ 3724.752553] [program2] : module_init Kthread starts
[ 3724.752775] [program2] : The Child process has pid = 23211
[ 3724.752776] [program2] : This is the parent process, pid = 23210
[ 3724.752777] [program2] : child process
[ 3724.753730] [program2] : Execution failed with kill signal
[ 3724.753732] [program2] : The return signal is 9
[ 3724.753732] [program2] : The return signal is 9
[ 3725.807349] [program2] : Module_exit
```

```
[ 3758.319435] [program2] : Module_init Ting Wang 120090862
[ 3758.319436] [program2] : module_init create kthread start
[ 3758.319632] [program2] : module_init Kthread starts
[ 3758.319820] [program2] : The Child process has pid = 23249
[ 3758.319821] [program2] : This is the parent process, pid = 23248
[ 3758.319821] [program2] : child process
[ 3758.320359] [program2] : CHILD PROCESS CONTINUED
[ 3758.320360] [program2] : The return signal is 0
[ 3758.320360] [program2] : The return signal is 0
[ 3759.399329] [program2] : Module_exit
```

```
[ 3790.133161] [program2] : Module_init Ting Wang 120090862
[ 3790.133162] [program2] : module_init create kthread start
[ 3790.133384] [program2] : module_init Kthread starts
[ 3790.133582] [program2] : The Child process has pid = 23299
[ 3790.133583] [program2] : This is the parent process, pid = 23298
[ 3790.133584] [program2] : child process
[ 3790.134785] [program2] : Execution failed with pipeline error signal
[ 3790.134787] [program2] : The return signal is 13
[ 3790.134787] [program2] : The return signal is 13
[ 3791.289731] [program2] : Module_exit
```

```
[ 3814.875784] [program2] : Module_init Ting Wang 120090862
[ 3814.875786] [program2] : module_init create kthread start
[ 3814.876148] [program2] : module_init Kthread starts
[ 3814.876305] [program2] : The Child process has pid = 23334
[ 3814.876306] [program2] : This is the parent process, pid = 23333
[ 3814.876306] [program2] : child process
[ 3814.958563] [program2] : Execution failed with quit signal
[ 3814.958565] [program2] : The return signal is 3
[ 3814.958565] [program2] : The return signal is 131
[ 3816.015532] [program2] : Module_exit
```

```
[ 3835.538662] [program2] : Module_init Ting Wang 120090862
[ 3835.538664] [program2] : module_init create kthread start
[ 3835.538900] [program2] : module_init Kthread starts
[ 3835.539327] [program2] : The Child process has pid = 23364
[ 3835.539328] [program2] : This is the parent process, pid = 23363
[ 3835.539328] [program2] : child process
[ 3835.623471] [program2] : Execution failed with invaild memory reference signal
[ 3835.623490] [program2] : The return signal is 11
[ 3835.623491] [program2] : The return signal is 139
[ 3837.549958] [program2] : Module_exit
```

```
[ 3855.803002] [program2] : Module_init Ting Wang 120090862
[ 3855.803003] [program2] : module_init create kthread start
[ 3855.803237] [program2] : module_init Kthread starts
[ 3855.803518] [program2] : The Child process has pid = 23404
[ 3855.803519] [program2] : This is the parent process, pid = 23403
[ 3855.803519] [program2] : child process
[ 3855.804011] [program2] : CHILD PROCESS STOPPED
[ 3855.804012] [program2] : The return signal is 127
[ 3855.804012] [program2] : The return signal is 4991
[ 3856.884333] [program2] : Module_exit
```

```
[ 3876.720864] [program2] : Module_init Ting Wang 120090862
[ 3876.720865] [program2] : module_init create kthread start
[ 3876.721473] [program2] : module_init Kthread starts
[ 3876.721575] [program2] : The Child process has pid = 23430
[ 3876.721576] [program2] : This is the parent process, pid = 23429
[ 3876.721576] [program2] : child process
[ 3876.722588] [program2] : Execution failed with termination signal
[ 3876.722590] [program2] : The return signal is 15
[ 3876.722590] [program2] : The return signal is 15
[ 3877.752012] [program2] : Module_exit
```

```
[ 3908.084522] [program2] : Module_init Ting Wang 120090862
[ 3908.084533] [program2] : module_init create kthread start
[ 3908.084738] [program2] : module_init Kthread starts
[ 3908.084925] [program2] : The Child process has pid = 23457
[ 3908.084945] [program2] : This is the parent process, pid = 23456
[ 3908.084946] [program2] : child process
[ 3908.167193] [program2] : Execution failed with trap signal
[ 3908.167194] [program2] : The return signal is 5
[ 3908.167195] [program2] : The return signal is 133
[ 3909.161145] [program2] : Module_exit
```