CS 3305A: Operating Systems
Department of Computer Science
Western University
Assignment 1
Fall 2020
Due Date: September 30, 2020

Purpose

The goals of this assignment are the following:

- Get experience with the *fork()*, *wait()* and *execl()* system functions
- Learn more about how operating systems are structured
- Gain more experience with the C programming language from an OS perspective

Parent and Child Processes (100 points)

Write a program in C that will perform the following tasks:

1. Your program will create a *parent* process which will create two *child* processes (e.g., child_1, and child_2)
2. *parent* will wait for child_1 to complete before creating child_2
3. child_1 will create its own child child_1.1
4. Inside child_2, a system call to an external program will be made. child_2 must pass its PID to the external program "external_program.out." As a result of this external program call, child_2 will be replaced by external_program.out (hint: *execl()*). The path to the external program "external_program.out" will be passed into the program as a **command line argument**.

The expected output from your program should look like the following:

parent process (PID 2255) created child_1 (PID 2256)
parent (PID 2255) is waiting for child_1 (PID 2256) to complete before creating child_2
child_1 (PID 2256) created child_1.1 (PID 2257)
child_1 (PID 2256) is now complete
parent (PID 2255) created child_2 (PID 2258)
child_2 (PID 2258) is calling an external program external_program.out and leaving child_2…
From the external program: The PID of child_2 was 2258

Hints: fork(), wait(), getpid(), getppid(), execl()

Mark Distribution

This section describes a tentative allocation of marks assigned for the desired features. **(100 points)**

a) A Parent process will create two Child processes: 20 points
b) Child_1 will create its own child Child_1.1: 20 points
c) Parent will wait for Child_1 to complete before creating Child_2: 15 points
d) Child_2 will make a system call to an external program: 25 points
e) Parent process must not terminate until all child processes have completed: 20 points

Computing Platform for Assignments

You are responsible for ensuring that your program compiles and runs without error on the computing platform mentioned on below. **Marks will be deducted** if your program fails to compile or your program runs into errors on the specified computing platform (see below).

- Students have virtual access to the MC 244 lab, which contains 30 Fedora 28 systems. Linux machines available to you are: **linux01.gaul.csd.uwo.ca** through **linux30.gaul.csd.uwo.ca**.
- It is your responsibility to ensure that your code compiles and runs on the above systems. You can SSH into MC 244 machines.
- If you are off campus, you have to SSH to **compute.gaul.csd.uwo.ca** first (this server is also known as sylvia.gaul.csd.uwo.ca, in honour of Dr. Sylvia Osborn), and then to one of the MC 244 systems **(linux01.gaul.csd.uwo.ca** through **linux30.gaul.csd.uwo.ca**).
- https://wiki.sci.uwo.ca/sts/computer-science/gaul

Provided Files

- Two C files are provided: “assignment1.c” and “external_program.c”
- Your code should only be inside the provided C file “assignment1.c”
- Do not make any changes to “external_program.c”
- Hints and the necessary statements that need to be outputted have been included in “assignment1.c” file
- When running the program, you must provide the path to “external_program.out” as an argument (see assignment1.c for details)
- If you have any questions regarding the code provided to you, contact the TAs and/or the Instructor

Assignment Submission

You must submit your Assignment through OWL. Be sure to test your code on one of MC 244 systems (see “Computing Platform for Assignments” section above). **Marks will be deducted** if your program fails to compile or your program runs into errors on the computing platform mentioned above. You need to submit one file “assignment1.c”.

Assignment 1 FAQ will be made available on OWL. Also, consult TAs, and the Instructor for any question you may have regarding this assignment.