OS-Lab-07

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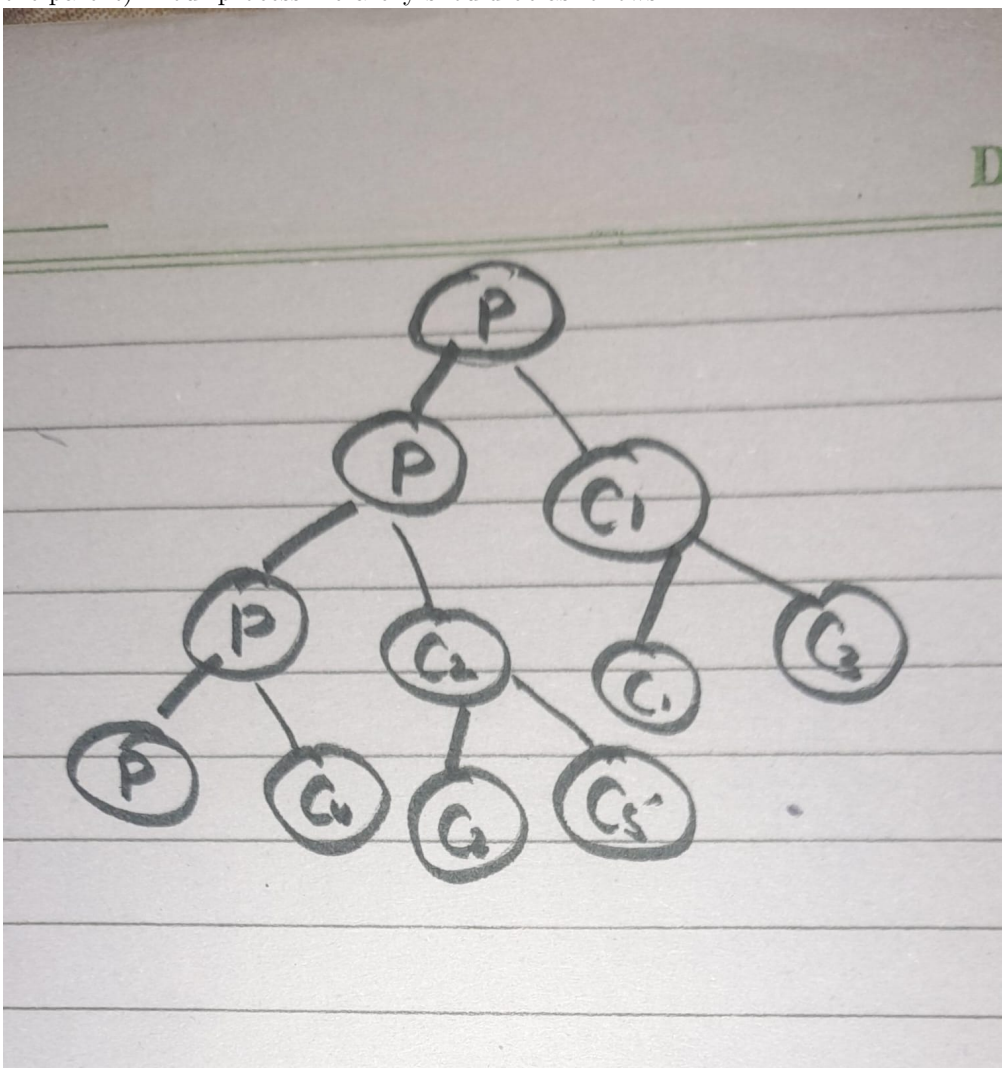
1 Exercise 2

Model a fork() call in C/C++ so that your program can create a total of EXACTLY 6 processes (including the parent). Your process hierarchy should be as follows:



2 Running States

2.1 Question 1

What is the 1st argument to the execv() call? What is it's contents?

The 1st argument to the execv() call is the path to the executable file. Its contents is the string representing the full path to the program you want to execute.

2.2 Question 2

What is the 2nd argument to it? What is its contents?

An array of character pointers to NULL-terminated strings. Your application must ensure that the last member of this array is a NULL pointer. These strings constitute the argument list available to the new process image. The value in argv[0] must point to a filename that's associated with the process being started. Neither argv nor the value in argv[0] can be NULL.

2.3 Question 3

What is arg?

Arg array of strings. It contains the arguments to be passed to the new process being executed.

2.4 Question 4

Look at the code of the child process (p==0). How many times does the statement "Child Process" appear? Why?

One time because once the exec() call is made, the current process is gone and a new process starts.

3 Exit Code output

If num > 25, the program exits using `exit(1)` in the main function.

If num ≤ 25, the program calls `anotherExit()`, which also exits using `exit(1)`.

3.1 Question 1

What is the difference between exit() and atexit()? What do they do?

exit() terminates the program immediately. atexit() registers functions to be called automatically when the program exits normally. How atexit stores functions: atexit uses an internal stack to store the functions registered with it. When you register a function using atexit.register(), it's added to this stack. Execution order: The functions are called in the reverse order of registration. This means the last function registered is called first, and the first function registered is called last.

3.2 Question 2

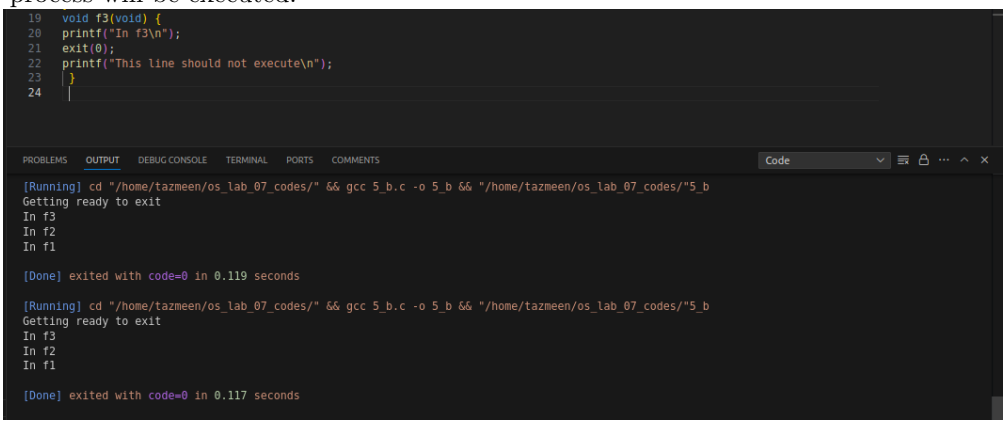
What does the 0 provided in the exit() call mean? What will happen if we change it to 1?

0 indicates successful termination. 1 (or any non-zero value) typically indicates an error condition.

3.3 Question 3

If we add an exit call to function f1, f2, or f3. What will happen to execution of our program?

If an exit() call is added to f1, f2, or f3, it will terminate only the function in which it is called rest of the process will be executed.



3.4 Question 4

Why do you think we are getting reverse order of execution of atexit calls?

atexit() functions are called in the reverse order of their registration. This is because they are typically stored in a stack-like structure, where the last registered function is called first.

4 ABORT

4.1 Question 1

Check the man pages for abort. How does the abort call terminate the program? What is the name of the particular signal?

The abort() function terminates the program abnormally by raising the SIGABRT signal.

4.2 Question 2

Execute your program. What is the output of our program?

The program will output "Aborted (core dumped)" to the console.

4.3 Question 3

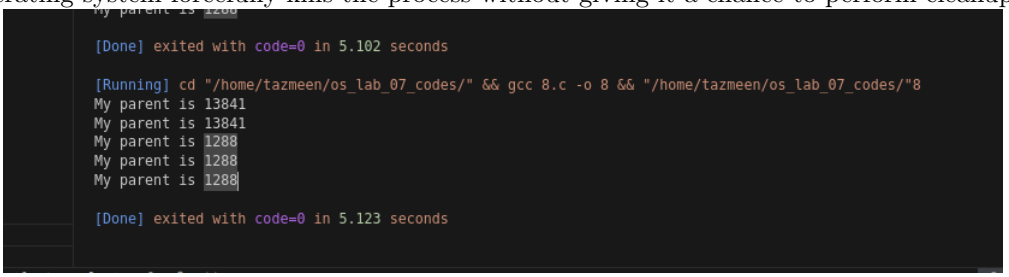
Include the abort call in function f3 in our code provided for Atexit() call. How does our program terminate using this?

If abort() is called in f3, the program will terminate abnormally when f3 is called during the atexit sequence. Any atexit functions registered after f3 will not be executed. Thus f2,f1 will not be executed.

5 KILL Call

In the kill(getpid(), 9); call, the number 9 is a signal number that corresponds to the SIGKILL signal. Here's what happens in detail: kill() function: This function is used to send a signal to a process. The first

argument is the process ID (PID) to which you want to send the signal, and the second argument is the signal number itself. getpid(): This function returns the process ID of the currently running process (the program itself in this case). 9: This is the signal number for SIGKILL, which is a signal that immediately terminates the process. It cannot be caught, blocked, or ignored. When SIGKILL is sent to a process, the operating system forcefully kills the process without giving it a chance to perform cleanup actions.



5.1 Question 1

What are the PPID values you are receiving from the for loop?

Initially, the child process prints 13841 as its PPID, which is the PID of its parent process. After the parent process terminates (after the second iteration), the PPID changes to 1288, which is the PID of the init process (or systemd) that adopts orphaned processes.

5.2 Question 2

What has happened when the PPID changes?

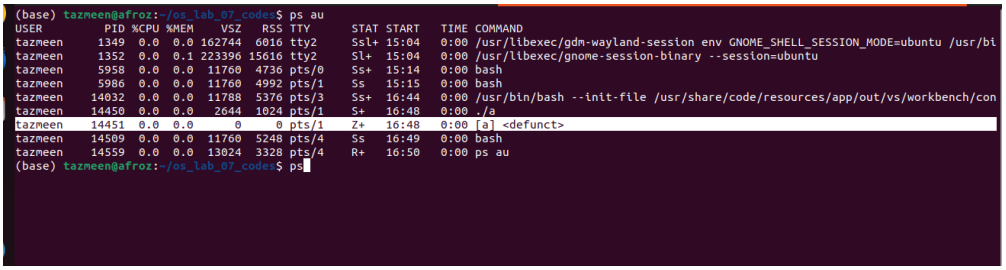
The change in PPID from 13841 to 1288 indicates that the parent process has exited. When this happens, the child process becomes orphaned, and the operating system assigns the child to the init process (systemd in modern systems). This is why the PPID becomes 1288, which is the PID of the init/systemd process.

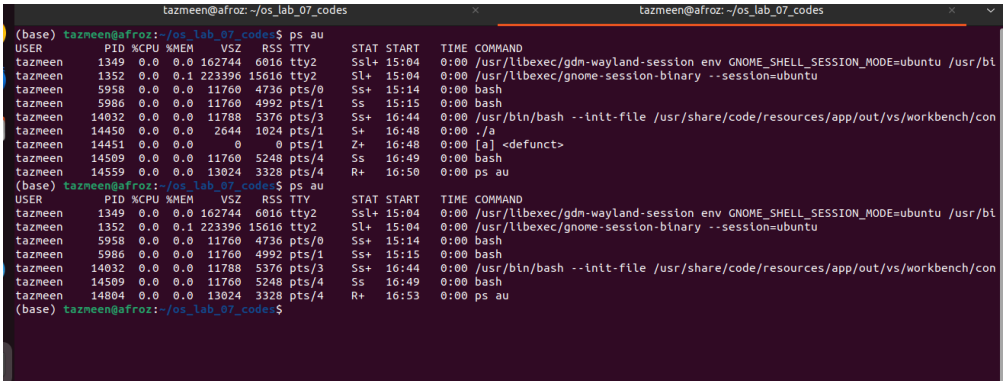
5.3 Question 3

What is now the PID of the init process?

The init/systemd process has a PID of 1288. This process takes over orphaned child processes, ensuring they can continue running if necessary.

6 Zombie process





Both parent and zombie process are gone now