Assignment 1 - Process Management **LE, Nhat Hung**
COMP 310 - Operating Systems McGill ID: 260793376
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Library system() version:

Does your shell crashes when a command crashes?
Linux's system() implements fork(), which provides memory isolation and thus protection. Upon testing, the parent did not crash when the child crashed.

Determine the system calls that are used in implementing the system() library function.
Using strace, we can identify that the main system call used by system() is clone(), due to the fact that even though system() calls fork(), fork() in turn calls clone().

Fork version:

If there are differences between system() and my_system(), explain them.
There was no noticeable differences between system() and my_system() which implements fork(). This can be explained by the fact that system() itself also calls fork().

Vfork version:

Compare the time taken for executing the same commands with the previous implementations. Report this timing in the report you handover with the code.

Timing results:

```
FORK:

ls
Timing:1316458.250000

pwd
Timing:655963.375000

VFORK:

ls
Timing:2057665.875000

pwd
Timing:703606.312500
```

It seems the fork implementation yields better performance.

Clone version:

Which flags can we set for clone() to achieve best performance?
The program uses the following flags:

- CLONE_FS, so cd (change directory) applies for both child and parent

- SIGCHILD, so the parent can receive a termination signal from the child, thus being able to wait until the latter ends its execution
- CLONE_VFORK, which from testing yielded better performance.

FIFO (pipe) version:

How is the FIFO implemented?

The main idea is to modify the correct file descriptor in the child process, very similar to the material we had to review for the first midterm.

To write into the FIFO, we disconnect the screen from stdout with close(1), and connect it with the pipe by open(fifo, O_WRONLY). And vice-versa to read from the FIFO: close(0) and open(fifo, O_RDONLY).