Mini Programming Assignment 1 Report

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Testing Procedure

Procedure run a test command 10 times and record the nanoseconds it takes to run commands. Start time is recorded before creating a child process. End time is recorded after child returns. No user operated processes were changed between testing the separate implementations.

System Results

Command: ls

Time (ns)	
3296245	
3290729	
3283060	
3360935	
3266484	
3303882	
2714523	
2543286	
3293746	Avg time taken (ns)
3193288	3154617.8

The default system() implementation takes a long time on average because more code is actually being timed.

FORK Results

Command: ls

Time (ns)	
2135440	
1920899	
1376326	
2097799	
1435624	
1989234	
2186507	
742410	
2097805	Avg time taken (ns)
1987316	1796936

Shorter than system(), likely due to timing just the fork() function and the child process, not the parsing and other overhead.

VFORK Results

Command: ls

Time (ns)	
924745	
1908873	
1634881	
1139766	
1728411	
1748665	
1670876	
1724540	
1733955	Avg time taken (ns)
1704711	1591942.3

The VFORK() implementation is faster on average than the FORK() implementation since it does not make a copy of memory for the child to use, instead its uses the same address space as its parent, which saves time.

CLONE Results

Command: ls

Time (ns)	
48532	
54944	
57062	
56881	
59780	
47972	
46038	
45365	
48626	Avg time taken (ns)
55800	52100

The CLONE() implementation is by far the shortest. I believe this is primarily due to my implementation, and that the timer is ending before the child process has completed.

```
tshell$ ls
nanoseconds: 55800
tshell$ core        hello.c     makefile              README.t
Grading  hello_seg  mini_PA1.pdf     test              ts
hello     input.txt  PA1_Report.odt  tiny_shell.c   ts
```

Looking out the output we can see that the timer prints out before the result of the command does. The command also prints out after the prompt is printed again, which leads me to believe the parent is not properly halted. The clone implementation also exits after every command, again leading me to believe there is an error somewhere.

PIPE and FIFO

I was unable to implement the FIFO component of this assignment thus there are no results.