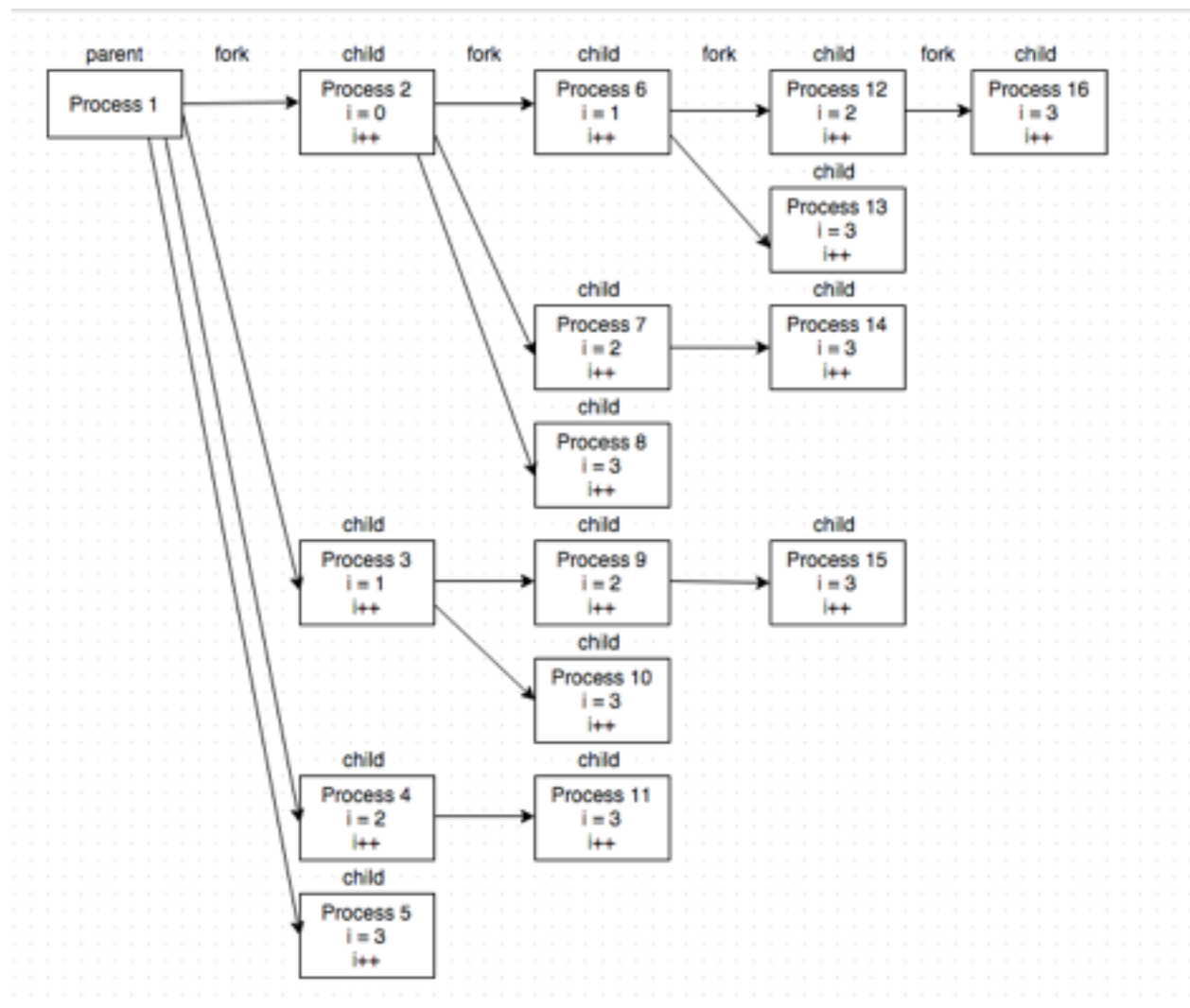# SJSU CS 149 HW1, FALL 2015

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Q1. (20 pts) Including the initial parent process, how many processes are created by the program? Please justify your answer.

```
#include<stdio.h>
#include<unistd.h>
int main() {
    int i;
    for(i=0; i<4; i++)
        fork();
    return 0;
}
```

ANSWER: There are 16 processes in total created by the program. As the figure shows below. When i<4 child process will fork his own child process.

Q2. (80 pts)

step a :

```
CHENGtekiMacBook-Air:HW1 chengjingyuan$ ./shell
CS149 Shell from Jingyuan Chen
Jingyuan-536>xyz
ERROR: ILLEGAL SHELL COMMAND
Jingyuan-536>date
Sun Sep 27 16:57:00 PDT 2015
Jingyuan-536>ls
a.out           shell              shell.c           shell.dSYM      test.c
Jingyuan-536>sleep 5m &
Jingyuan-536>ps -af
  UID   PID  PPID   C STIME    TTY            TIME CMD
    0 22705 22698   0  4:50PM ttys000      0:00.01 login -pf chengjingyuan
  501 22706 22705   0  4:50PM ttys000      0:00.02 -bash
  501 22744 22706   0  4:56PM ttys000      0:00.00 ./shell
  501 22748 22744   0  4:57PM ttys000      0:00.00 sleep 5m
    0 22749 22744   0  4:57PM ttys000      0:00.00 ps -af
Jingyuan-536>exit
CHENGtekiMacBook-Air:HW1 chengjingyuan$ ps -af
  UID   PID  PPID   C STIME    TTY            TIME CMD
    0 22705 22698   0  4:50PM ttys000      0:00.01 login -pf chengjingyuan
  501 22706 22705   0  4:50PM ttys000      0:00.02 -bash
  501 22748     1   0  4:57PM ttys000      0:00.00 sleep 5m
    0 22751 22706   0  4:57PM ttys000      0:00.00 ps -af
CHENGtekiMacBook-Air:HW1 chengjingyuan$ ▊
```

Step b:

In step a, the output from two executions of "ps –af" should include the same process "sleep 5m" with identical PID but with different parent PID (PPID). Explain the reason.

ANSWER: Because the first "sleep 5m" is forked by the binary shell. After "exit" command, shell(parent) terminate which lead process "sleep 5m" to be an orphan. So OS will set the "sleep 5m" to be the child of root(PID 1). That's the reason they have same PID but different PPID.