ICS EXE 3

March 9, 2022

1 Process

Assume we have the following code:

```
1  int num = 3;
2  int main(void)
3  {
4    for (int i = 0; i < 2; ++i) {
5      pid_t pid = fork();
6
7      if (pid == 0) {
8        num++;
9        printf("child with i: %d, num: %d\n", i, num);
10     } else {
11       waitpid(pid, NULL, 0);
12       printf("parent with i: %d, num: %d\n", i, num);
13     }
14
15     num <<= 1;
16   }
17   return 0;
18 }
```

1.1

How many times will **fork()** be called in this program? How many times will **printf()** be called in this program?

1.2

If **waitpid()** in line 11 is removed, will the times that **fork()** is called change?

1.3

Please give a possible output of the program.

2 Signal1

Assume we have the following code:

```
1  void sig_han(int sig)
2  {
3    printf("signal handled\n");
4  }
5
6  int main()
7  {
8    sigset_t set ;
9    int i ;
10
11   signal(SIGKILL, sig_han);
12   signal(SIGINT, sig_han);
13   sigemptyset(&set);
14   sigaddset(&set, SIGINT);
15   sigprocmask(SIG_BLOCK, &set, NULL);
16
17   for (i = 0; i < 3; i++) {
18     printf("send signal\n");
19     kill(getpid() , SIGINT);
20   }
21
22   sigprocmask(SIG_UNBLOCK, &set, NULL);
23   return 0;
24 }
```

2.1

When run, the call at line 11 fails. Why? And what is the return value of this call? (You can refer to **Section 8.5** and the **man** page **signal(2)**)

2.2

What is the output of this program? Please explain your answer.

3 Signal2

Assume we have the following code

```
void handler(int sig) {
  static int beeps = 0;
  printf("BEEP\n");
  if (beeps < 4) {
    beeps += 1;
    fork();
    /* next SIGALRM will be delivered in 1s */
    alarm(1);
  } else {
    printf("BOOM!\n");
    exit(0);
  }
}
int main() {
  /* install SIGALRM handler */
  signal(SIGALRM, handler);

  /* next SIGALRM will be delivered in 1s */
  alarm(1);

  /* signal handler returns control here each time */
  while (1);

  exit(0);
}
```

3.1

How many seconds will this program remain approximately?

3.2

How many **BEEPs** and **BOOMs** will be printed if you run the above program?