

# ICS EXE 7

April 14, 2021

## 1 File

What is the output of the following program?

```
1  #include <sys/types.h>
2  #include <sys/stat.h>
3  #include <sys/wait.h>
4  #include <fcntl.h>
5  #include <unistd.h>
6  #include <stdlib.h>
7  #include <stdio.h>
8
9  int main(void) {
10     int fd1, fd2, fd3, fd4;
11
12     fd1 = open("foo", O_RDONLY |
13               O_CREAT, S_IRWXU);
14     fd2 = open("foo", O_RDONLY);
15     if (!fork()) {
16         fd3 = open("foo", O_RDONLY);
17         close(fd2);
18         fd4 = open("foo", O_RDONLY);
19         printf("Child fd1=%d, fd2=%d, fd3=%d, fd4=%d\n",
20               fd1, fd2, fd3, fd4);
21         close(fd4);
22         close(fd3);
23         close(fd1);
24         exit(0);
25     }
26     waitpid(-1, NULL, 0);
27     close(fd1);
28     fd3 = open("foo", O_RDONLY);
29     fd4 = open("foo", O_RDONLY);
30     printf("Parent fd1=%d, fd2=%d, fd3=%d, fd4=%d\n",
31           fd1, fd2, fd3, fd4);
32     close(fd2);
33     close(fd3);
34     close(fd4);
35
36     return 0;
37 }
```

## 2 Standard I/O

Suppose the file `foo.txt` contains the text “123456”, `bar.txt` contains the text “abcdef”, and `baz.txt` does not yet exist. Examine the following C code, and answer the questions below. (For space reasons, we are not checking error returncodes, so assume that all functions return normally.)

```
1  int main() {
2      int fd1, fd2, fd3, fd4, fd5, fd6;
3      pid_t pid;
4      char c;
5      /* foo.txt has "123456" */
6      fd1 = open("foo.txt", O_RDONLY, 0);
7      fd2 = open("foo.txt", O_RDONLY, 0);
8      /* bar.txt has "abcdef" */
9      fd3 = open("bar.txt", O_RDWR, 0);
10     fd4 = open("bar.txt", O_RDWR, 0);
11     /* baz.txt does not exist initially */
12     fd5 = open("baz.txt",
13               O_WRONLY | O_CREAT | O_TRUNC,
14               S_IRUSR | S_IWUSR); /* r/w */
15     fd6 = dup(STDOUT_FILENO);
16     dup2(fd5, STDOUT_FILENO);
17     if ((pid = fork()) == 0) {
18         dup2(fd3, fd2);
19         read(fd3, &c, 1); printf("%c", c);
20         write(fd4, "!@#$%>", 6);
21         read(fd3, &c, 1); printf("%c", c);
22         read(fd1, &c, 1); printf("%c", c);
23         read(fd2, &c, 1); printf("%c\n", c);
24         exit(0);
25     }
26     wait(NULL);
27     read(fd1, &c, 1); printf("%c", c);
28     fflush(stdout);
29     dup2(fd6, STDOUT_FILENO);
30     printf("done.\n");
31     return 0;
32 }
```

1. What will the contents of `baz.txt` be after the program completes?
2. What will be printed on `stdout`?