ICS EXE 7

April 6, 2022

1 File

What is the output of the following program?

```c
#include <sys/types.h>
#include <sys/stat.h>
#include <sys/wait.h>
#include <fcntl.h>
#include <unistd.h>
#include <stdlib.h>
#include <stdio.h>

int main(void) {
    int fd1, fd2, fd3, fd4;

    fd1 = open("foo", O_RDONLY |
               O_CREAT, S_IRWXU);
    fd2 = open("foo", O_RDONLY);
    if (!fork()) {
        fd3 = open("foo", O_RDONLY);
        close(fd2);
        fd4 = open("foo", O_RDONLY);
        printf("Child fd1=%d, fd2=%d, fd3=%d, fd4=%d\n",
            fd1, fd2, fd3, fd4);
        close(fd4);
        close(fd3);
        close(fd1);
        exit(0);
    }
    waitpid(-1, NULL, 0);
    close(fd1);
    fd3 = open("foo", O_RDONLY);
    fd4 = open("foo", O_RDONLY);
    printf("Parent fd1=%d, fd2=%d, fd3=%d, fd4=%d\n",
            fd1, fd2, fd3, fd4);
    close(fd2);
    close(fd3);
    close(fd4);

    return 0;
}
```

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, andanswer 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?