

Systems Programming (2024 Fall)

Handwritten Assignment 1

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1. No. If the current working directory is the root directory (/), then directories dot (.) and dot-dot (..) both refer to the root directory itself.

```
b12902110@ws6 [/] realpath .  
/  
b12902110@ws6 [/] realpath ..  
/
```

2. You can use `lseek` to read from anywhere, but cannot replace existing data in the file, because if the file is opened with the `O_APPEND` flag, the file offset is set to the end of file before each `write`.

```
2_append.c  
  
#include <assert.h>  
#include <fcntl.h>  
#include <stdio.h>  
#include <string.h>  
#include <unistd.h>  
  
int main() {  
    char buffer[16];  
  
    int fd = open("2_append.txt", O_RDWR | O_CREAT | O_APPEND,  
                  S_IRUSR | S_IWUSR | S_IRGRP | S_IROTH);  
    if (fd < 0) {  
        perror("open error");  
        return 1;  
    }  
    if (write(fd, "abcdefgh", 8) < 0) {  
        perror("write error");  
        return 2;  
    }  
  
    // Can read from anywhere.  
    if (lseek(fd, 2, SEEK_SET) < 0) {  
        perror("lseek error");  
        return 3;  
    }  
    if (read(fd, buffer, 3) < 0) {  
        perror("read error");  
        return 4;  
    }  
    assert(strncmp(buffer, "cde", 3) == 0);  
  
    // Writing will always append.  
    assert(lseek(fd, 0, SEEK_CUR) == 5); // Current offset == 5.  
    if (write(fd, "ijklmnop", 8) < 0) {  
        perror("write error");  
        return 5;  
    }  
}
```

```
assert(lseek(fd, 0, SEEK_CUR) == 16); // Confirm offset is at EOF.

// Read the entire file and confirm that the second write is indeed append.
if (lseek(fd, 0, SEEK_SET) < 0) {
    perror("lseek error");
    return 6;
}
if (read(fd, buffer, 16) < 0) {
    perror("read error");
    return 7;
}
assert(strncmp(buffer, "abcdefghijklmnop", 16) == 0);

return 0;
}
```

_____ 2_append.txt _____
abcdefghijklmnop

3. Yes, the test is necessary. We can see from the three `dup()` calls that the code wants to keep file descriptors 0, 1, and 2 open and pointed to the same file. However, if the test isn't performed, and `fd` is one of 0, 1, or 2, then it would be closed unintentionally.