

Name: _____

Student ID: _____

Score : _____ / 50

1. (5 points) Fig. 1 shows the UNIX operating system architecture. Fill in following blanks
(1) kernel (2) system calls (3) library routines (4) shell (5) applications

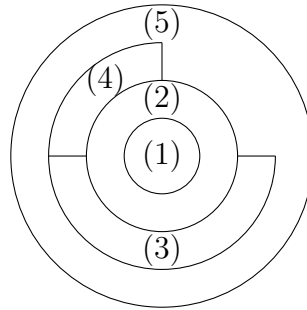


Figure 1: Architecture of the UNIX operating system

2. (5 points) Following is a part of man page.

SEE ALSO

`fork(2)`, `sigaction(2)`, `wait(2)`, `exit(3)`

If you want to read more about `exit`, then how would you search for the information using the shell command.

Solution: `$ man 3 exit` the number indicates the section in the man page.

3. (5 points) `int create()` is deprecated and is replaced with `int open()` function. What flags would you use to make `open()` equivalent to `create()` function.

Solution: `open(path, O_WRONLY | O_CREAT | O_TRUNC, mode);`

4. (5 points) An file's offset can be set explicitly by calling `lseek`. *whence* argument can receive one of three values. Explain them in detail.

Solution: `SEEK_SET` file's offset is set to offset bytes from the beginning of the file
`SEEK_CUR` file's offset is set to current value plus the offset. offset can be positive or negative.
`SEEK_END` file's offset is set to the size of the file plus the offset.

5. (5 points) What is the difference of sequential and random I/O operation. Give an example using system calls.

Solution: sequential read : `read(fd, buf1, 2048) != 2048`
random read : `lseek(fd, offset, SEEK_CUR; read(fd, buf1, 4) != 4;` offset is renewed at every I/O operation

6. (5 points) There are three data structures to represent an open file. What are they, explain them in detail?

Solution: Every process has an entry in the process table. The kernel maintains a file table for all open files. Each open file has a v-node structure that contains information about the type of file and pointers to functions that operate on the file.

7. (5 points) Describe what happens when a file is opened with `O_APPEND` flag.

Solution: a corresponding flag is set in the file status flags of the file table entry. Each time a `write` is performed for a file with this append flag set, the current file offset in the file table entry is first set to the current file size from the i-node table entry

8. (5 points) Calling `__pwrite__` is equivalent to calling `lseek` followed by `write`; there is no way to interrupt the two operations that occur when we call the function. These functions are called `__atomic__`
9. (10 points) Alice wants to change the file permission to `rw-r--r-x`. How can you help Alice to change the permission (both shell and with system call is required for full credit)?

Solution: `chmod 645`
`chmod (FILENAME, S_IRUSR | S_IWUSR | S_IRGRP | S_IROTH | S_IXOTH)`