

Master of Information Technology
1st year, 1st Semester examination, 2024
Subject: Linux Kernel Programming

Time - three hours

Full marks - 100

Instructions: Different parts of the same question should be answered together. Answer precisely and to-the-point. Irrelevant/duplicate answers are highly discouraged.

Answer question number 1(one) and any 5(five) form the rest.

1. 10x2 = 20
 - i) Which operations on directories are forbidden if write permission is withheld?
 - ii) How many file types are possible in Linux?
 - iii) If 0x81FF is passed as mode to `open()` system call, what will be the file permission?
 - iv) Write the name of *process descriptor* structure with a few fields in it.
 - v) Write the CPU scheduling algorithms used by Linux OS.
 - vi) What does 'nice' value of a process represent?
 - vii) How will you use a specific CPU to execute your process?
 - viii) Write the range of real time priorities and normal priorities.
 - ix) What does `fork()` system call return?
 - x) Write the difference between a process and a thread.

2. [4+4+(4+4)]
 - i) Write sample content of an *inode* for file.
 - ii) Why are two kinds of links(*hard* and *soft*) provided by the Linux OS?
 - iii) What are the different ways to change the permission of file? Write the format of 16-bit field used to implement file permission.

3. [4+4+(4+4)]
 - i) Describe how inode helps OS to find file data.
 - ii) What is file descriptor and file descriptor table?
 - iii) Distinguish between `write()` system call and `fprintf()` library function. Outline a program to read directory contents.

4. [4+4+(4+4)]
 - i) Difference between Device driver and ordinary programs.
 - ii) Explain major and minor number with respect to devices.
 - iii) Outline the simplest module you know. Write the function `file_operations` structure.

5. [4+4+(4+4)]
 - i) Suppose a pointer points to the current process descriptor. Outline how you will find all process descriptors.
 - ii) How does Linux OS find process descriptor from a given PID?
 - iii) What does 'nice' value of a process represent? How will set the nice value of a process?

[Turn over

6. [4+4+(4+4)]
- i) Which system call is used to change CPU scheduling algorithm? Explain its prototype.
 - ii) How fairness is achieved in CFS algorithm?
 - iii) Write the properties of a *Red-Black Tree*. Why Red-Black tree was preferred instead other AVL-Trees to implement *CFS* algorithm in Linux?
7. [4+4 +(4+4)]
- i) Explain with suitable example the function `wait()` system call.
 - ii) What is a *zombie* process? Write a program where zombies are created.
 - iii) File descriptors are copied to child process by `fork()` system call. What problem you might face due to this? Outline how parent and child processes can exchange data using this property.
8. [4+4+(4+4)]
- i) Explain with suitable example how `fork()` works.
 - ii) When will you use `exec` family of functions and `fork()` to start a process?
 - iii) What is the difference between *zombie* and *orphan* processes? Are orphan processes possible in Linux? If not, what measures are taken to avoid orphan process creation?