Operating Systems - Monsoon 2022

Practice Questions

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Student's Details

Name of the Student:

Roll Number:

Stream:

Question Structure and Instructions

This paper consists of three sections:

1. The first section consists of 8 short conceptual questions requiring at most 2 lines of answers, each carrying 3 points.
2. The second section consists of 2 longer questions requiring at most 4 lines of answers, each carrying 5 points.
3. The third section consists of 2 long questions, each carrying 8 points.

You are required to answer the questions in the question paper itself. We have given an additional 1 page at the end if extra space is needed, but please note that no extra sheets will be given. You need to write your roll number on each page of the question paper.

1 Short Conceptual Questions

There are 8 questions in this section each worth 3 points. You may write the answers to these questions succintly.

1. Is starvation possible using both FCFS and Shortest Job First policies? Justify.
2. Suppose your system does not have RAM installed. Which software/hardware has the responsibility to identify it?
3. Suppose you define a total of 4 cores within a system and 3 scheduling classes in the kernel. How many data structures are present in total in such a system?

4. Suppose you want to print two floating point numbers a and b using printf. Which registers would you need to set values before calling, and what would be those values?

5. Suppose you substitute the standard `fork()` system call by `myfork()`, which does NOT use copy-on-write. How would that affect the output of a program, and why?

6. Suppose you access the same variable x (initially set to 0) from two threads. In each thread, you increment the value by 1 and then print it. What is the output you are likely to get?

7. Suppose you want to write to a file from two processes at the same time. Is this possible using the modern Linux kernel

8. Suppose you want to add two integer arrays of size 100. What is the most efficient of doing it in Intel assembly? Assume that the arrays are defined, and specify the instructions that can be used.

2 Long Questions

1. Consider a hardware driver that has a bug in it created by a newbie kernel developer. Is it possible for this bug to crash programs that do not require the specific hardware? If yes, justify the reason and explain could be changed in the structure of the Linux kernel to avoid such problems.

2. Suppose a program has two threads. How many (1) user stacks, (2) task_struct's and (3) kernel stacks does this program have? If there are multiple stacks in either case, is it possible for one stack to expand and touch another stack?

3 Very Long Questions

1. (a) Is it possible for a C program compiled on an Intel machine to run on an ARM machine? Are any special directives needed for this purpose?

   (b) Suppose you write a C program with two different source files. Which program is used to create a single executable file?

   (c) Suppose you build the same C source code on both Intel and ARM machines. Which of the executable files would be larger in size and why?

   (d) Is it possible to build the same assembly program on both Intel and ARM machines? Justify.

2. Write a pseudo-code / snippet to create a new child process, and then ensure that the child process gets lower processor time than the parent process. Finally, the child process and the parent process should print their own process ID's before quitting. You also need to an error-check to ensure that the system calls have worked correctly.