CSE-381: Systems 2

Homework #3 Part A

Due: Wed Sept. 18 2019 before 11:59 PM (Midnight)

Email-based help Cutoff: 5:00 PM on Tue, Sept 17 2019

Maximum Points for This Part: 18

Submission Instructions

This homework assignment must be turned-in electronically via Canvas. Type in your responses to each question (right after the question) in this MS-Word document. You may use as much space as you need to respond to a given question. Once you have completed the assignment, save it as a PDF file, and upload the PDF to Canvas.

Note that copy-pasting from electronic resources is plagiarism. Consequently, you must suitably paraphrase the material in your own words when answering the following questions.

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Objective

The objective of this homework is to review and recapitulate the basic concepts related to operating systems and C++ programming.

Review the Chapter #1 and Chapter #2 from the reference book "Operating System Concepts" (Link available off Syllabus page on Canvas) before proceeding with this exercise.

Mandatory videos to study -- **you will get questions in exams based on the content in these videos**:

1. Introduction to OS: https://youtu.be/PPSmAlnrJxo
2. Booting: https://youtu.be/7D4qiFIosWk

1. Briefly describe (with at least 4 to 5 sentences for each) the two major functions of an operating system using suitable examples for each one of the scenarios (watch first video) [**2 points**]
   a. Function #1 (with 2 examples):

      Hardware abstraction: This function deals with providing an interface to various devices. The operating system will provide data from the network or disk to be read as streams, and uses deicece drivers to encapsulate protocol details. It also provides access rights to its resources and imporves the effective use of devices.

b. Function #2 (with 2 examples):

Conceptual Abstractions: the operating system provides a logical organization of programs and data, and the API needed for program development and management. It also facilitates inter-process communication while managing to organize data on storeage as fiels and directories. It shares these resources to improve efficieny all without compromising privacy. It will also facilitate inter machine interactions and enables the operation in society with computers.

2. The following questions relate to Boot Loaders (from second video) [**2 points**]
   a. What is a boot loader and what is its primary purpose?

   A boot loader is a program that's primary purpose is to load an operating system.

   b. Where is a boot loader found on a permanent storage device such as a floppy disk?

   A boot loader is found on a permanent storage device in the boot sector located at the very beginning of th disk.

   c. What is a 2-stage boot loader?

   A 2 stage boot loader is an addition to the initial boot loader that allows for more size and space, and if used properly can hav no limitation in size.

   d. Why is 2-stage boot loading used?

   2 stage boot loading is used to ensure that all code can be loaded and executed despite its size.

3. What is a system call and how does it operate? **[1 point]**

A system call is the process a computer program useds to ask for a pervice from the operating system it is being executed on. It operates by forming an interface between user programs and the operating system.

4. Describe three general methods for passing parameters to the operating system in a system call (**exactly the same as question 2.13 from textbook so read the relevant section in the textbook**) **[2 points]**

The 3 general methods are passing in *registers*, but if there are more parameteres than registers, you can store them in a *block* and the address of the block is passed as a parameter to the register. Lastly the parameters can be *pushed* onot the stack by the program and popped off the stack by the operating system.

5. From a Linux perspective, briefly (2 sentences) describe the use of user id (a number) and group id (a number) [**1 points**]

The user id is used to identify the user to the system. The group id is used to keep records of the groups of users to determine which resources on the system the users are allowed to access.

6. Table at least 2 significant differences between batch processing and multiprocessing. [**1 points**]

Batch Processing	***Multiprocessing***
slower	faster
Groups several jobs to be executed one after the other by a computer without user interaction	Executes multiple programs at the same time

7. Briefly discuss a realistic scenario when designing an operating system as a virtual machine would be advantageous. [**1 points**]

A scenario in which designing an operating system as a virtual machine would be advantageous is in the need for a simple back up system for a large company with many users.

8. What is virtual memory? Why is it used on most modern operating systems? [**1 points**]

Virtual memory is a memory management tool of an operating system that usees hardware and software to stores things in order to compensate for lack of phsyical storage, and to each access for users. It is used on most operate systems now due to the need of more storage and added security.

9. What is the difference between a Type-1 and a Type-2 hypervisor? [**1 points**]

The main difference is that type 1 runs on purely hardware whereas type 2 runs on top of an operating system.

Review programming from CSE-278

The objective of the next few questions is to review pertinent programming concepts from CSE-278

Prior to answering the questions in this homework it may be beneficial to briefly following chapters from the E-book titled "C++ How to Program" (Link to e-textbook is in the Syllabus on Canvas):

- Chapter 1 (Introduction)
- Chapter 2 (Expressions & I/O)
- Chapter 3.1, 3.2 (String & methods)
- Chapter 4 (if-statements)
- Chapter 5.1 – 5.10 (loops & switch)
- Chapter 6 (functions/methods)

10. What is path to a file? Using suitable examples explain the differences between relative and absolute path? (answer in 2 or 3 separate sentences) [**1 point**]

    Path to a file is the name of a file or directory that specifies a unique lpcation. Relative path is a way to specifiy the location of a directory relative to anotehr directory such as the root directory. An absolute path is a complete path from the start of the file system.

11. Briefly (2 to 3 sentences each) discuss pass-by-value versus pass-by-reference mechanisms for passing parameters to methods. As per this course's conventions, which approach is preferred based on data type of parameters in C++? [**2 points**]

    Pass by vlaue mean the actual value is pass on whereas pass by reference the memory address of the value is passed on. The perferred approach for this course ofr data types of parameters in C++ is pass by reference.

12. List at least 3 unique properties that can be inferred from data type of a variable? [**1 point**]

    1. size
    2. range
    3. whether or not its value can be changed after initialization

13. What is the `size_type` or `size_t` data type? Illustrate its use with an example of a `for`-loop (do not write whole program, but just 1 line of the `for`-loop) [**1 point**]

    Size_t is an unsigned data type.

Example:

```
for (size_t i = 0; (i < str.size()); i++) {
      str[i] = doSomething(str[i]);
}
```

14. Given a constant string object `str` (`const std::string str`) what methods can be called on `str`? Give an example of 1 method that can and 1 method that cannot be called on the object `str`? [**1 point**]

    (a) Can call: str.length();

    (b) Cannot call: str.replace();