EEE335 – Assignment 1

Questions from the course textbook (Tanenbaum, 4th Ed)

Note: Assignments are to be completed and submitted individually

Chapter 1

1. [2 pts] What are the two main functions of an operating system? (Q1)
2. [2 pts] What is the difference between timesharing and multiprogramming systems? (Q3)
3. [2 pts] On early computers, every byte of data read or written was handled by the CPU (i.e., there was no DMA). What implications does this have for multiprogramming? (Q5)
4. [2 pts] There are several design goals in building an operating system, for example, resource utilization, timeliness, robustness, and so on. Give an example of two design goals that may contradict one another. (Q9)
5. [2 pts] What is the difference between kernel and user mode? Explain how having two distinct modes aids in designing an operating system. (Q10)
6. [2 pts] What is a trap instruction? Explain its use in operating systems. (Q17)
7. [2 pts] Can the `count = write(fd, buffer, nbytes);` call return any value in count other than nbytes? If so, why? (Q22)
8. [2 pts] To a programmer, a system call looks like any other call to a library procedure. Is it important that a programmer know which library procedures result in system calls? Under what circumstances and why? (Q28)

Chapter 2

9. [2 pts] On all current computers, at least part of the interrupt handlers are written in assembly language. Why? (Q3)
10. [2 pts] When an interrupt or a system call transfers control to the operating system, a kernel stack area separate from the stack of the interrupted process is generally used. Why? (Q4)
11. [2 pts] In Fig. 2-8, a multithreaded Web server is shown. If the only way to read from a file is the normal blocking read system call, do you think user-level threads or kernel-level threads are being used for the Web server? Why? (Q12)
12. [2 pts] In Fig. 2-12 the register set is listed as a per-thread rather than a per-process item. Why? After all, the machine has only one set of registers. (Q14)
13. [2 pts] What is the biggest advantage of implementing threads in user space? What is the biggest disadvantage? (Q18)

Programming exercises

For the programming exercises, you will need access to a Linux computer. You can use the virtual machine if the lab or install your own virtual machine at home using VirtualBox.

14. [4 pts] Write a shell script that attempts to create an unlimited number of child processes and observe what happens. Run the experiment in a virtual machine and take a live snapshot before running the script. Once the virtual machine freezes, revert to the last snapshot.
15. [10 pts] Write a C program using *pthreads* that will add up an array of 100 000 integers using 8 threads. To test you program, initialize the array to all 1's. Add cores to your virtual machine and comment on the performance gain. To compile your C program, use the following command:
    ```
    gcc MyProgram.c -o MyProgram -lpthread
    ```

Submissions

For this assignment you will need to submit the following:

1. PDF document that includes your answers to the questions **(include both the questions and answers);**
2. A copy of your shell script (.sh file); and
3. A copy of your c program (.c file).

The above files need to be submitted via a single compressed file (e.g. .zip or .7zip) with a meaningful name (e.g. `eee335assignment1_Your_last_name.zip`) and submitted via the course Moodle site. Recall that you set up the share folder in your home directory which allows you to share files between the host and guest OS.