Virginia Tech - ECE 5484 - Summer 2020

Homework 6

Before starting this homework assignment, please be sure that you have completed all of the following activities.

- View the relevant online lectures and read associated sections in the textbook before or while you work on this homework assignment.
- Review the course syllabus. Note the grading policies, including policies for submitting assignments.
- Review the course schedule. Note the due dates for course assignments, including this one.
- Review the Graduate Honor System at https://graduateschool.vt.edu/academics/expectations/graduate-honor-system.html. Review the Graduate Honor System Constitution, especially Articles I (Sections 1, 2, and 3), V, VI, VII, VIII, and IX.

Please note the following.

- Solutions must be clear and presented in the order assigned. Solutions must show work needed, as appropriate, to derive your answers. Written answers should be concise, but sufficiently complete to answer the question. Neat hand drawings, where needed, are acceptable. Your final solution for each problem must be easily identified.
- At the top of the first page, include: your name (as recorded by the university); your email address; and the assignment name ("ECE 5484, Homework 6"). Do *not* include your Virginia Tech ID number or your social security number.
- Homework must be submitted as a PDF (.pdf) file with the file name *lastname_firstname*_HW6.pdf, where *lastname* is your last or family name and *firstname* is your first or given name. Submit a single file.
- Submit your assignment using the Assignments area of the class website. You must submit your assignment by 11:55 p.m. on the due date.

This homework consists of the following problems. All problems cover material from the textbook chapters 7, 8, and 12.

1. Calculate the overall speedup of a system that spends 65% of its time in calculations with a processor upgrade that provides for 125% greater throughput.
2. Suppose your company has decided that it wants to make certain servers faster. Processes in the workload spend 60% of their time using the CPU and 40% on I/O. In order to achieve an overall system speedup of 25%:
   a) How much faster does the CPU need to be?
   b) How much faster does the disk need to be?
3. Suppose the daytime processing load consists of 70% CPU activity and 30% disk activity. Your customers are complaining that the system is slow. After doing some research, you have learned that you can upgrade your disks for $1,500 to make them 2.75 times as fast as they are currently. You have also learned that you can upgrade your CPU to make it 1.5 as fast for $2,000.
   a) Which would you choose to yield the best performance improvement for the least amount of money?
   b) Which option (the CPU or the disk) would you choose if you don't care about the money, but want a faster system?
   c) What is the break-even point for the upgrades? That is, what price would we need to charge for the CPU (or the disk – change only one) so the result was the same cost per 1% increase for both?
4. Name four types of I/O architectures. Where are each of these typically used and why are they used there?

5. a) Which of the RAID systems described in this chapter cannot tolerate a single disk failure?

   b) Which can tolerate more than one simultaneous disk failure?

6. a) What is the difference between multiprogramming and multiprocessing?

   b) What is the difference between multiprogramming and multithreading?

7. Why is the execution environment of a Java class called a virtual machine? How does this virtual machine compare to a real machine running code written in C?

8. We stated that the performance of a Java program running in the JVM cannot possibly match that of a regular compiled language. Explain why this is so.

9. Into which class of networks do the following IP addresses fall?

   a) 52.230.7.1
   b) 222.17.44.39
   c) 129.255.255.255

10. Scavenger Hunt: *In your own words*, write a short paragraph to answer the following: Who is Vinton Cerf and why/when did he win the ACM Turing Award?