NYU, Tandon School of Engineering

Bridge to Computer Science Program

4th Exam

Thursday, 20 June 2019

- You have two hours
- There are 100 points total.
- Note that there are longer problems at the end. Be sure to allow enough time for these.
- We supplied you with a file, named 'solutions.txt', where you should type all your answers.
- For editing this file, you are allowed to use only plain text editors (Notepad for Windows users, or textEdit for Mac users).
- You may use Visual Studio, XCode or CLion for a compiler
- Calculators are not allowed.
- This is a closed-book exam. No additional resourced are allowed.
- Pay special attention to the style of your code. Indent your code correctly, choose meaningful names for your variables, define constants where needed, choose most suitable control statements, etc.
- In all questions you may assume that the users enter inputs as they are asked. For example, if the program expects a positive integer, you may assume that users will enter positive integers.
- No need to document your code in this exam, but you may add comments if you think they are needed for clarity.
- Read every question completely before answering it.

1) (3 pts)An environment in which multiple programs are running at the same time on a system and the CPU is switching between running all of them is.
    a. Batch multiprogrammming
    b. Time sharing
    c. The Clock algorithm
    d. The kernel

2) (3 pts) In which of the following would you find the "call stack pointer" if the OS supported kernel level threads
    a. Process control block
    b. System Bus
    c. Thread Control Block
    d. Page Map Table

3) (3 pts) In which state would you find a process which had all of its resources available?
    a. New
    b. Ready
    c. Blocked
    d. Exit
4) (3 pts) If a process frequently requests the same page from main memory, which of the following algorithms will result in the system having poor performance
    a. Clock
    b. LRU
    c. Optimal
    d. FIFO
5) (3 pts) In a system that supports kernel level threads if one thread requests suspension of the process what action taken to the other threads of the same process? (If you believe no action will be taken, write "No Action," otherwise list what state the other threads will be moved to)

6) (5 pts) Explain a situation which might cause a process to go into the ready/suspended state for a long period of time.

7) (10 points) Describe a situation, or explain why it would not be possible, to have both the Copy on Write bit and Modify (aka Dirty) bit set on a page at the same time.

8) (10 pts) In a system that supports paging, every memory access will require two memory lookups, one for the PMT and a second for the requested access. Explain how modern computers overcome prevent this from taking twice as long.

9) (10 pts) When writing network-based applications, some applications create sockets and then call the "bind" function, others call "connect." Explain the difference and describe when to use one or the other.

10) (10 pts) The TCP header contains a field called "Window size." Explain what the sliding window is and why the selection of an appropriate size is important (what happens if the size is small).

11) (15 pts) A company has setup two networks, one in New York and the Other in Westchester. There is a router and WAN link between these two offices. The IP address of a workstation in NY is 10.0.1.30/26 (255.255.255.192) and a printer is 10.0.1.34. Determine which of the two networks the printer is located, please show your work.

12) (10 pts) A slave DNS server is setup to replicate from the master for domain "FinalExam.com," and successfully does so and becomes authoritative for the domain. After a while, its discovered that the slave is no longer authoritative. Explain why this may have happened and what steps you would take to try to diagnose the problem.

13) (15 pts) A file on the hard drive contains information regarding software licenses in use by various machines in a company, this file is named "file.txt" and is guaranteed to exist. On each line of the file, you will find a Product Name, A serial number for that product and a machine name to which it is assigned. These are values separated by whitespace (see example, below). Please note, that the company owns many different serial numbers for the same product (the same product could have multiple serial numbers owned by the company) as well as many different products, some of which have the same serial number (two different products but the same serial number). The combination of product name AND serial number is important. To test to see if the company is within compliance for the number of licenses they purchased, you will need to write a program to read this data and store it appropriately.

First, you will need a class to represent one piece of software, call is "Software". The purpose is to store the name and serial number of the product, the number of licenses the company may legally use and a record of which machines it is installed on. The name and serial number are strings, and the machines should be a vector of strings. Upon construction, you will be given the name and serial number of the product as well as the number of valid licenses the company owns. You must provide a compound addition operator (operator+=) which takes a string as the RHS object and adds the string to the vector of machines which have this software. Also provide a "matches" function which takes, as parameters, two strings and returns true if the name and serial number "matches" that object's stored name and serial number. A third function called "inCompliance" will return true or false if the company is in compliance for this software/serial number (the number of installed systems is less than the number of licenses the company legally may use).

Second, you will write a function which is given an already created and filled vector of the above objects and will read in the data file and fill the machine names into the objects in the appropriate locations. If you encounter a name/serial number pair that does NOT exist in the vector, you should add it to the vector and indicate that the company has purchased ZERO of that name/serial number objects.

Example of the file.txt file:

```
Word 100 PI2000A
Excel 100 PI2000A
AutoCad A299 PI2000A
Word 100 DQ8004L
Word 100 PV821AQ
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(In the above example, “Word” is the name of a product, “100” is the serial number and “PI2000A” is the name of the machine it is installed on)