NYU, Tandon School of Engineering

Bridge to Computer Science Program

4th Exam

Thursday 17 June 2021

- 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.
- Write your name, netID and NYU ID at the head of this file.
- For editing this file, you are allowed to use a C++ Compiler (Visual Studio, XCode or CLion) and any plain text editors (e.g. Notepad for Windows users, or textEdit for Mac users).
- 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.
- When done, please upload your answer file to Newclasses.nyu.edu, www.gradescope.com and email to dkatz@nyu.edu

1) (3 pts)After a thread in the running state calls “wait()” on a semaphore which has a signal waiting, the thread will be in which state?
    a. ready
    b. running
    c. blocked
    d. exit

2) (3 pts) If a system is employing a deadlock avoidance strategy
    a. Deadlocks are impossible due to the removal of one of the requirements
    b. Deadlocks are possible but constant vigilance is maintained so that a deadlock doesn’t occur
    c. Deadlocks are possible and allowed to occur but transactions are rolled back to prevent problems.
    d. Deadlocks are desirable in a system with a good avoidance strategy

3) (3 pts) Which of the following can be used to help determine when to change the “load factor” of the system
    a. When a process makes a blocking system call.
    b. When there are more than a given number of process in the system
    c. When the page fault rate exceeds the time to process one page fault
    d. When the clock algorithm cannot find a free frame
4) (3 pts)Upon receipt of a UDP packet, if the receiver determines that the checksum is incorrect, the receiver should
    a. Send the message to the application layer
    b. Recalculate the checksum and insert the new value
    c. Discard the entire message
    d. Send a NACK back to the sender

5) (3 pts) While monitoring the network, we see UDP traffic on port 443. What is the most likely cause?
    a. Someone is browsing a website
    b. Someone is sending an email
    c. Someone is querying DNS
    d. Someone is trying to exfiltrate (steal) data.

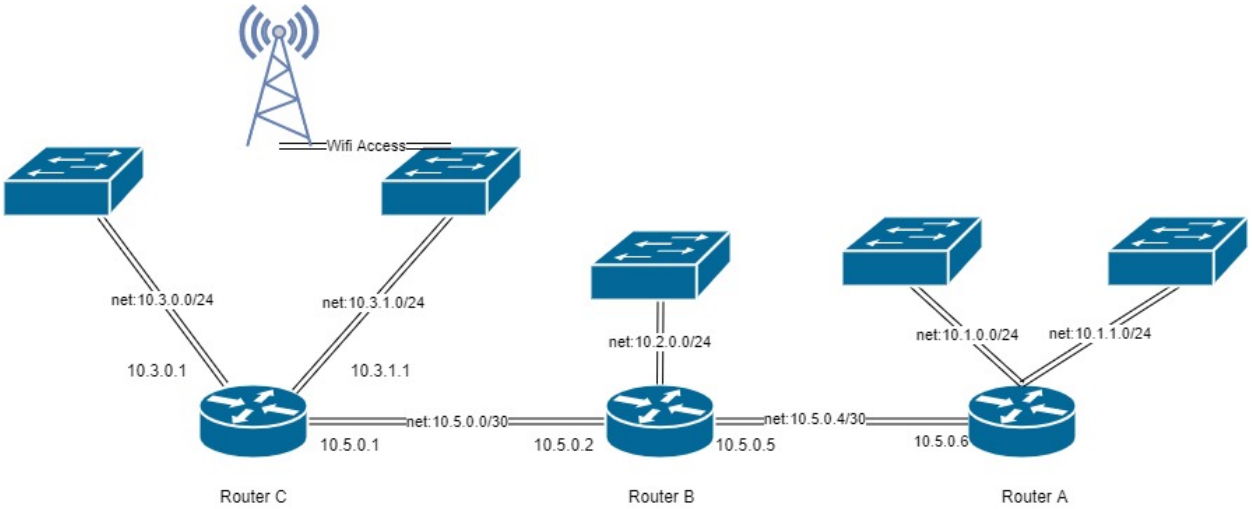
6) (10 pts) In a system that uses paging (page size of 4KB), explain what changes need to be made if the process is currently occupying its full amount of allocated memory (e.g. 40MB) and calls “new int” to create a new, 4 byte, integer on the heap.

7) (10 points) In the windows model, much of the code for the operating system is put into the user mode. Why do you think Microsoft did this and what some benefits of having the majority of code running in user mode?

8) (10 pts) DHCP is used for obtaining an IP address. Explain what would happen if we had two DHCP servers on our network and each gave out the same IP address to two different machines. How/would the two machines know this has occurred?

9) (10 pts) A network is being planned where delay must be minimized. The maximum distance from one side of the network to the other side is 10 "hops" (10 routers in between the ends). If processing delay on each router is 2ms and the distance between every router is 3000km, what would you expect for the total delay from one side of the network to the other.

10) (15 pts)

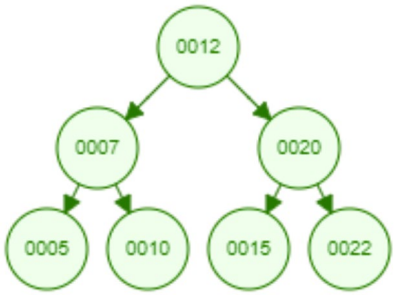


The network above uses RIP to distribute routing tables. Explain what RIP broadcasts you'd expect to see (including the subnets) if you were looking at Router B.

11) (10 pts)In a system with multiple CPUs, where all CPUs are the same model, a process may have an affinity (preference) for one CPU over another. Explain why this might be the case and explain a situation in which performance may be degraded if we don't allow the process onto the CPU it prefers.

12) (20 pts) Given a sorted vector of integers and a pointer to the first node of a perfectly balanced BinarySearchTree (BSTNode<int>* root), write a function to determine if the values in the vector match the values in the tree. (Pay very careful attention to the efficiency of your solution. There will be a significant reduction in your grade if your solution is inefficient). You may write additional, support, functions. You may assume everything in the BSTNode class is public.

TREE



Vector