

NYU, Tandon School of Engineering

Bridge to Computer Science Program

4th Exam

Thursday 14 December 2023

- 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 the solutions file.
- For editing this file, you are allowed to use only plain text editors (Notepad for Windows users, or textEdit for Mac users).
- You are permitted to use Visual Studio (C++) or XCode as compilers. And Textedit/Notepad for text editing but should copy/paste your answers to the TXT file.
- 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 Brightspace.nyu.edu, Gradescope and email to dkatz@nyu.edu

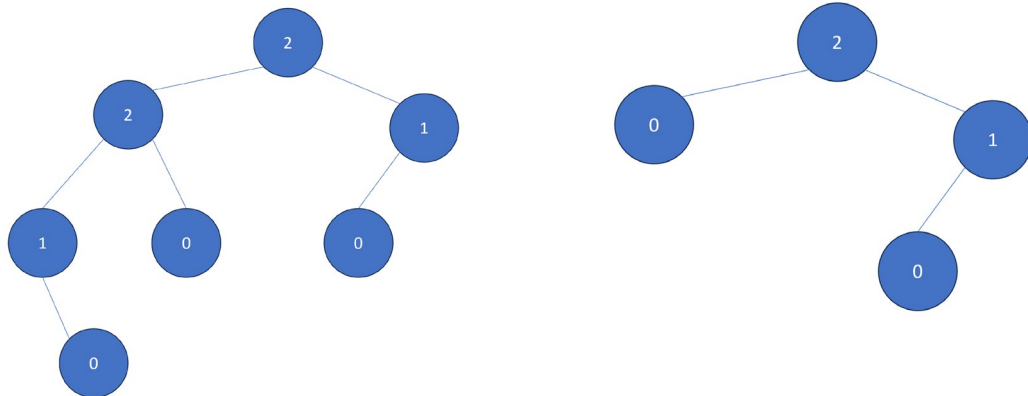
- 1) (3 pts) Which of the following might be useful information for a medium-term scheduling algorithm to make a decision about a process.
 - a. When it was most recently interrupted
 - b. When it will be exit the blocked state
 - c. Where it's Page-Map table is located in RAM
 - d. When it started.
- 2) (3 pts) Which of the following would have direct access to system hardware?
 - a. All operating system applications (i.e. Windows Explorer)
 - b. An application which uses the webcam (i.e. Zoom)
 - c. A device driver (i.e. for a mouse)
 - d. My "Hello world" application so I can print to the screen.
- 3) (3 pts) Which of the following protocols has a minimum of overhead?
 - a. UDP
 - b. ESP
 - c. TCP
 - d. RDP
- 4) (3 pts) The _____ cycle explains how the CPU performs one instruction.
- 5) (3 pts) When performing an iterative query on DNS, the local server will ask the root servers for a(n) _____ (Type) record for the domain.
- 6) (5 points) When connecting to an HTTP website, the destination port will be 80 but how will the source port be determined?
- 7) (10 pts) Since UDP doesn't have "connections" how could a server respond if it receives UDP traffic for a port that is not registered to receive any traffic?
- 8) (10 pts) The memory management requirements of "sharing" and "protection" seem to conflict. Explain a situation in which sharing is useful and how protection can still be maintained.
- 9) (10 pts) Explain the steps that the OS must take to resolve a "page fault?"
- 10) (10 pts) IP fragmentation and reassembly is an important concept in IPV4. Explain a situation in which an IP packet will need to be fragmented and when the fragments are reassembled?
- 11) (10 pts) In a multi-threaded OS, describe the steps to perform a context switch from one running thread to another thread of the same process.
- 12) (10 pts) During a DHCP discover, multiple DHCP servers may respond. When the DHCP client selects an offer explain how all DHCP servers know which is chosen and which is not.

- 13) (20 pts) Our system will store a Binary Tree with integers using a class similar to the one we used in the course (left, right, parent and data) except everything will be public. We have been asked to see if the values in the tree are sufficient to consider this a “ChildrenTree.” In a ChildrenTree, the value in each node describes the number of children that node has (0, 1 or 2).

Write a function (“is_valid”) which will receive a pointer to the root of a tree and will return true if the tree is a valid ChildrenTree. You may not pass additional parameters to the function and your solution must run in linear time or better.

Some examples are below:

Valid Trees



Invalid Trees

