

NYU, Tandon School of Engineering

Bridge to Computer Science Program

4th Exam

Thursday 15 June 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) Each _____ Has it's own page map table?
 - a. Program
 - b. Process
 - c. Thread
 - d. Stack
- 2) (3 pts) Which of the following is a compromise between fixed and dynamic memory allocations and divides the space in half again and again?
 - a. Fixed Partitioning
 - b. Dynamic partitioning
 - c. Paging
 - d. Buddy System
- 3) (3 pts) Which of the following protocols would be used for obtaining an IP address?
 - a. HTTP
 - b. DNS
 - c. DHCP
 - d. TCP
- 4) (3 pts) _____ are a solution to the mutual exclusion problem and usually contain two essential functions, signal and wait.
- 5) (3 pts) In an _____ (type) DNS query, the local DNS server will make multiple queries to different servers in an attempt to obtain the response.
- 6) (10 pts) Network Address Translation is necessary for todays networks since we have run out of IPv4 addresses. If a local machine sends a TCP SYN packet from IP address 10.1.1.3 port 2222 to 4.2.2.2 port 80 and the network has a public IP address of 8.8.8.8, describe how the NAT device will change the packet going outbound and what reply would be expected from the server if the connection were to proceed as normal.
- 7) (15 pts) Batch Multiprogramming would not be possible to be used today because of the way we use our computers. Explain why this is true and explain what is done in todays environment..
- 8) (10 pts) Explain some of the downsides of using threads in a program. When should they not be used?
- 9) (10 points) HTTP is a protocol in which caching can have dramatic effects on end-user performance. Explain why a company may want to implement caching and why it can be so effective in HTTP.
- 10) (10 pts) If you were going to write a medium-term scheduling algorithm for an operating system, what information would you use to decide when to suspend a process and which processes to suspend or restore?
- 11) (10 pts) Weighted Fair Queueing is employed on a network interface to queue packets going outbound. Explain how this policy works citing an example with three priorities.

12) (20 pts) Friends often share clothing and we'd like to design a few classes to keep track of who has what articles of clothing and who is wearing what. Your job will be to create the following classes, you may not add extra parameters to ANY method however you may store extra data items in any class. You may add additional methods to the class, but they must be private.

- a. **Person:** The Person class will be used to represent a human who wears clothing.
 - i. Every Person has a name, which should be given at construction. If a name is not given at construction, the name should be "Jane Doe." For simplicity's sake, no one can change their name but you should provide an accessor method to get the Person's name.
 - ii. People can purchase articles of clothing. When a Person purchases clothing, the method will be passed a pointer to a Clothing object (which was previously created) and the Person then owns it. If the article is already owned by someone, you should not allow the Person to purchase it and the method will return false. (If the Clothing was not previously owned, you should allow the person to purchase it and return true)
 - iii. Two people can trade articles of clothing. Since we live in a fair world, there must be a fair trade, one article of clothing for one article of clothing. This method will be passed two pointers to articles of clothing that are already owned by two different people. The first parameter to the method will be a clothing article that is owned by the Person represented by the calling object, the second will be to another Person.
 - iv. You should overload the output operator to display the name of the person and the description of each article of clothing that person owns, one per line.
- b. **Clothing:** This class will be used to represent clothing which is worn by a Person.
 - i. Each article of clothing has a short description of it (string), this must be given at construction and never changed. Provide an accessor function to get this description.
 - ii. Clothing is owned by a Person but only after it has been purchased. You must provide a method (isOwned) which will return true if the article is owned by a Person.