

3. Define the difference between an I/O intensive and a compute intensive process. What does the OS do to ensure a compute intensive process does not “hog” the system?

4. Suppose the overhead to swap a RUNNING process with a READY process is 1 ms. Is a time slice of 2 ms a good time slice amount? Justify your response.

5. Each process in a system spends 75% of its time in the BLOCKED state.
 - a. If we are running 5 processes at once, what is the processor utilization in this system?

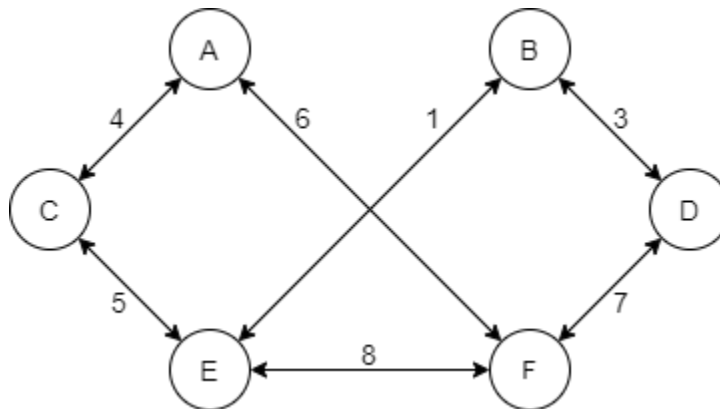
 - b. How many processes should be run to guarantee 90% processor utilization?

6. What is the difference between a physical address and a virtual address? Can they ever be the same number?

11. Suppose node A is sending node B a packet using the ARQ algorithm.
- If packet 4 is lost on the way from A to B, which node(s) respond and how?

- If the ACK for packet 7 is lost on the way from B to A, which node(s) respond and how?

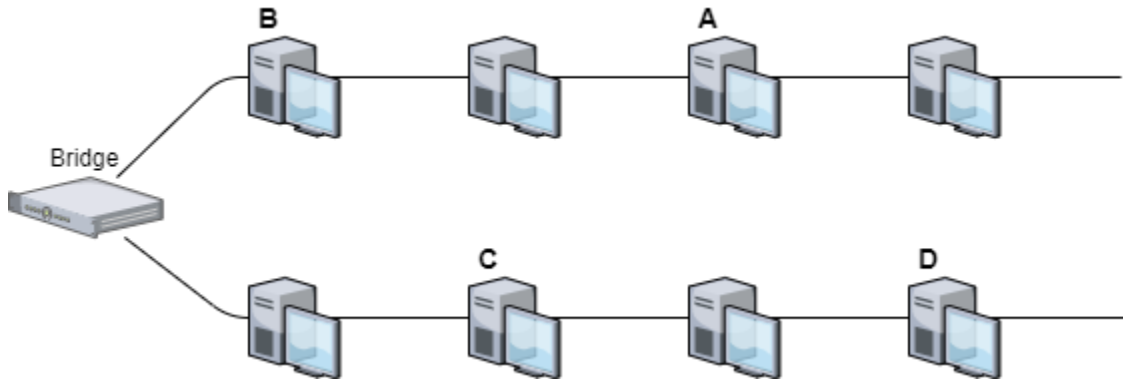
12. Consider the network shown below with the current measured delays between two nodes.



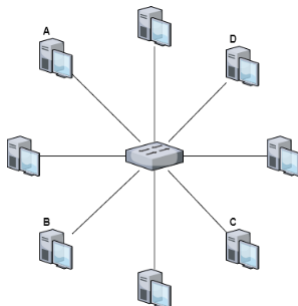
- List all possible simple paths between C and D; simple paths are those that do not repeat a node (i.e., no loops).

- Which path provides the shortest delay?

13. The figure below shows two shared bus networks connected via a bridge.



- If A is transmitting a packet to B, will D look at the packet and ask “is this for me”? Briefly justify your response.
- If A is transmitting a packet to C, will D look at the packet and ask “is this for me”? Briefly justify your response.
- Would your answers to part (a) or part (b) change if the bridge was a repeater instead? Explain your answer.
- Would your answer to a or b change if the network was a star with a central switch connected to all nodes as in the image below? Explain your answer.



Chapter 8/9: Privacy and Security

14. Explain the difference between a symmetric encryption algorithm and an asymmetric encryption algorithm. Then, define which type of algorithm each of the following are:
- a. Caesar Cipher
 - b. DES
 - c. AES
 - d. RSA
15. Here is another simple hash algorithm, different from the one we discussed in class.
- 1. Convert all characters to numbers (a = 1, ...)
 - 2. Add 2 to every number
 - 3. Add together all the numbers
 - 4. Divide by 13 and keep the remainder
 - 5. Multiply the remainder by 19 and then add 5
 - 6. Reverse the digits
 - 7. Convert all numbers to characters (a = 1, ...)
- a. My account is protected by the password “cherry”. Use the hash function to determine the hashed password.
 - b. Someone is attempting to log into my account by entering the password “cantaloupe”. Will they be granted access to my account? Explain why or why not, and discuss why this might be possible for some attempts.

16. Using a Caesar Cipher with shift = 18, encrypt the word "MANGO". Then, by hand, decrypt the message "CDBKGLOBBI" and state the shift (may not be 18).

You've received a secret message from your friend detailing their favorite fruit! To keep it secret, they have encoded it using the block encoding scheme. For questions 17 and 18, use the encoding and decoding matrices provided below.

$$X = \begin{bmatrix} 4 & 3 \\ 9 & 7 \end{bmatrix} \quad X' = \begin{bmatrix} 7 & 23 \\ 17 & 4 \end{bmatrix}$$

17. Decrypt the following message you received to figure out the fruit: URQB

18. Reply to your friend by encoding the message: NEAT

19. Bob and Alice both have their own public key and private key. Bob wants to send Alice a message that only she can read and which she will know was written by him. How should Bob encrypt the message? How should Alice decrypt it?

20. Suppose you and I both have a picture of a fruit basket, and this picture contains 1200 x 1800 RGB pixels. To send you a hidden message, I will reduce the intensity of each red, green, and blue value by one (and instead use those bits to hide my message).
- a. How long of a message can I send you in bits?

 - b. If we use ASCII (8 bits), how many characters can I send you?

 - c. If we assume approximately 3,000 characters on a single-spaced page, how many pages of text can I hide in the image this way?

 - d. What is the technical term for hiding a message in this way?