Answers to these review questions will not be provided electronically. If you would like to check your answers, go see Sam in CTLM 244. NOTE: the challenge/proficiency exam will also have true/false, fill in the blank, and multiple choice questions on the terminology covered in CSCI 101. The terminology covered is available here: https://quizlet.com/csci101/folders/csci-101-spring-2021/sets

1. Identify which type of instruction each one of the following steps belongs to:

   a) Display contents of register to screen.

   b) x > 0

   c) Take the cube root of *x.*

   d) while (x != 0), where x = 0

2. Assume your computer uses 8-bit 2's complement signed numbers. Find the sum of the two binary numbers below; give the result in binary and in (signed) decimal, and discuss your answer

   ```
     0 0 1 0 1 0 1 1
   + 0 1 0 0 1 0 0 1
   ```

   ```
     1 0 1 0 0 1 1 0
   + 1 1 1 1 0 0 1 0
   ```

3. If our machine stores a number in 4 bits. What is the smallest and largest number we can represent
   a. in unsigned binary

   b. in sign/magnitude

   c. in 2's compliment

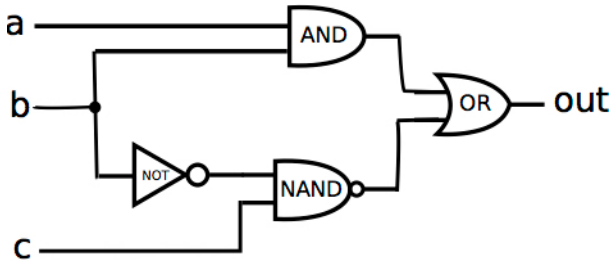
4. What is the binary equivalent of the decimal number 17.25?

5. Given the following 8-bit binary number: 1000 1001. What is its decimal representation in each of the following notations?
   a. Unsigned binary notation

   b. Sign/magnitude notation

   c. Two's complement

6. Create a truth table for the optimized circuit shown below.



7. Give a Boolean expression in the format of your choice (using only AND, OR, and NOT) that produces the truth table from problem #6.

8. Drawa circuit made only of AND, OR, and NOT gates that produces the truth table below. You do not need to optimize your circuit.

a	b	output
0	0	0
0	1	1
1	0	0
1	1	1

9. If the average access time for RAM is 40 nsec and the average access time for cache memory is 5 nsec, what is the overall average access time if our cache hit rate is 75%?

   Would it be better for a system designer to decrease RAM access time to 30 nsec, or increase the hit rate to 85%? Justify your response.

10. What color is the following RGB pixel? 00000000 11111111 11111111

11. Assuming the standard memory cell size of 1 byte, how big can our memory be if our computer uses 16 bit address?

    32 bit address?

12. Complete the table below.

Decimal	Binary	Octal	Hex
2	0000 0010	2	2
30			
	0001 1010		
		52	
			25

13. Suppose Simon designed a machine language with an opcode field of 4 bits. How many different instruction types can Simon's language contain?

    Caleb designed a system with 6 bits opcode. How many instructions does his language support?

14. List and describe the parts of a machine language instruction?

15. Using the op codes described in the table below. Write a program in assembly to compute the computation $z = \sqrt{\frac{x+y}{x-y}}$. The address of x, y, and z are M[5], M[6], and M[7]. Also, assume M[4] is available for any intermediate answer. Then convert your assembly program into machine language. Use 2 bit op codes and 3 bit address.

Code	Assembly	Operation
0	add	Addition
1	sub	Subtraction
2	div	Division
3	sqrt	Square root

16. Suppose Jo's digital camera has a storage capacity of 256MB. How many photographs could be stored in her camera if each picture is 1024 by 1024 pixels, and it each pixel requires three bytes of storage (RGB)?

17. List the five main process states (include exit) in an operating system and define each with one sentence.

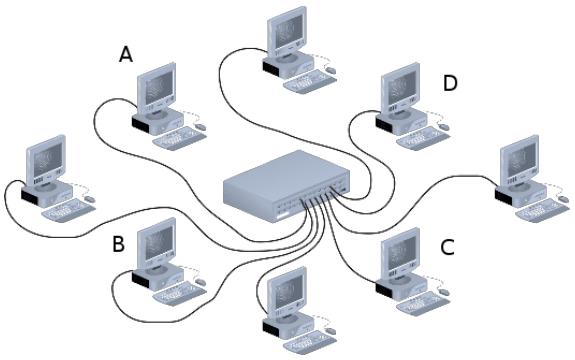
18. Define the difference between an I/O intensive and a compute intensive process. What does the OS do to ensure a compute intensive process does not “hog” the system?

19. Suppose the overhead to swap a running process with a ready process is 1 ms. Would a time slice of 1 ms be a good time slice amount?

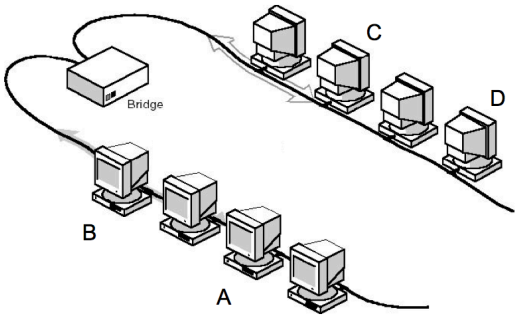
20. How long would it take to transmit a 10MB file using each of the following media. Assume 1 Kbps = 1024bps, etc.
    a. A 56 Kbps modem (dial up)
    b. A 1.5 Mbps DSL line (an older DSL line)
    c. A 100 Mbps Ethernet link (Fast Enternet)

21. Name the layers in the Internet Protocol Stack and describe the goal of each layer.

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



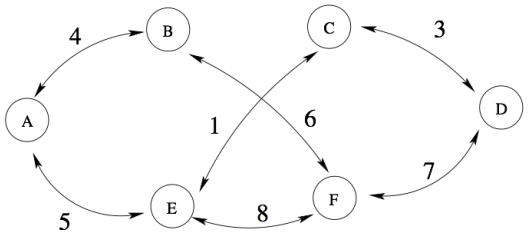
    a. If A is transmitting a packet to B, will D look at the packet and ask "is this for me"?
    b. If A is transmitting a packet to C, will D look at the packet and ask "is this for me"?
    c. Would your answers to a or b change if the bridge was a repeater instead? Explain.
    d. Would your answers to a or b change if the network was a star with a central switch connected to all nodes (see figure *above*)? Explain.



23. Suppose node A is sending node B a packet using the ARQ algorithm.
    a. Suppose packet 4 is lost from A to B. Which node(s) respond and how?

    b. Suppose the ACK for packet 7 is lost from B to A. Which node(s) respond and how?

24. Consider the network shown below with the current measured delays between two nodes.
    a. List all possible simple paths between nodes A and D; simple paths are those that do not repeat a node (i.e., no loop).
    b. Which path provides the shortest delay?



25. Explain the difference between authentication and authorization.

26. First, 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

27. Using Caesar Cipher with shift = 5, encrypt the word SIMPLE.

28. Using the block encoding matrix and encrypt the word NO with the following matrix:

$$x = \begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix}$$

29. Suppose you and I both have a picture of your cat, 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.
    a. How long of a message will I send you in bits?

    b. If we use ASCII (8 bits), how many characters will 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 is this way?