1. Perform the binary subtraction operation of the two decimal signed integers -150 and -75 using two's complement representation. Show the step-by-step process in detail, including the conversion to two's complement, the subtraction, and any necessary adjustments. (10%)

2. Draw a deterministic finite automaton (DFA) diagram for the language accepting strings ending with 'abb' over input alphabets $\sum = \{a, b\}$. Present the step-by-step process in detail. (10%)

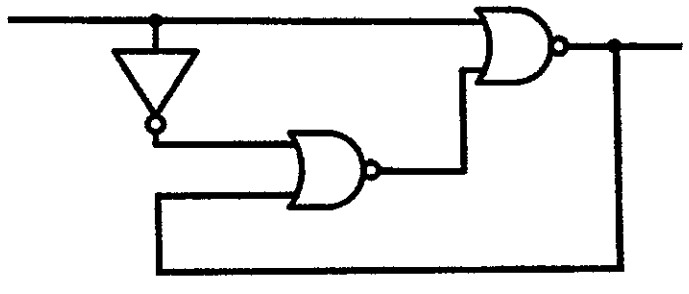
3. Suppose the numbers 7, 5, 1, 8, 3, 6, 0, 9, 4, 2 are inserted in that order into an initially empty binary search tree. The binary search tree uses the usual ordering on natural numbers. What is the inorder traversal sequence of the resultant tree? Draw the resultant tree with your answer. (10%)

4. Insert the keys 79, 69, 98, 72, 14, 50 into the hash table of size 13. Resolve all collisions using double hashing technique. The first hash-function is $h_1(k) = k \bmod 13$, and the second hash-function is $h_2(k) = 1 + (k \bmod 11)$. Show the step-by-step process of how the keys are hashed and inserted, and indicate the resulting structure of the hash table after all insertions. (10%)

5. Suppose that in a group of 5 people: A, B, C, D, and E, the following pairs of people are acquainted with each other.
   - A and C
   - A and D
   - B and C
   - C and D
   - C and E

   a) Draw a graph G to represent this situation. (3%)
   b) List the vertex set, and the edge set, using set notation. In other words, show sets V and E for the vertices and edges, respectively, in $G = \{V, E\}$. (4%)
   c) Draw an adjacency matrix for G. (3%)

6. Consider the following circuit. Assume that the input C is driven by a square wave signal with a 50% duty cycle. Draw a timing diagram that shows the waveforms at points A and B. Assume that the propagation delay through each gate is Δ seconds. (10%)



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7. Given the following set of characters and their frequencies:

Character	a	b	c	d	e
Frequency	5	12	9	4	7

a) Construct a Huffman tree for the given set of characters based on their frequencies. (4%)
b) Determine the Huffman codes for each character in the set. (4%)
c) Encode the message "bee" using the Huffman codes obtained in part (b). (2%)

8. Consider a hypothetical microcontroller with a simple assembly language. The microcontroller has three general-purpose registers: A, B, and C. The following instructions are supported:
   - MOV A, #5: Move the immediate value 5 into register A.
   - ADD B, A: Add the content of register A to register B.
   - SUB C, B: Subtract the content of register B from register C.
   - MUL B, C: Multiply the content of register C with register B.
   - JMP 5: Jump to the instruction at address 5.
   - HLT: Halt the microcontroller.

   Assume the program counter (PC) starts at address 0. Write a simple assembly program that calculates the following expression:

   $$(A+5)\times(B-3)$$

   Your program should store the final result in register C and then halt. (10%)

9. Write a program in a programming language of your choice to perform operations on an integer array with n elements ($n \leq 100$). Implement the following tasks using loops:
   a) Find and print the maximum element and its index in the array. (5%)
   b) Print the array in reverse order. (5%)

   Ensure your program uses loops for array traversals and include comments to explain the logic of your code. The array and its values can be predefined within the program.

10. Develop a program in a programming language of your choice to determine and display the prime factorization of a given positive integer. Prime factorization involves breaking down a number into its individual prime factors. Create a computer program that prompts the user to input a positive integer and then outputs its prime factorization. Make sure your program incorporates suitable loops and functions, and includes comments to elucidate the logic of your code. (10%)

    Example output:

    Enter a positive integer: 84
    Prime Factorization of 84: 2 * 2 * 3 * 7

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