

Date: November 06, 2023

Duration: 2.5 hours

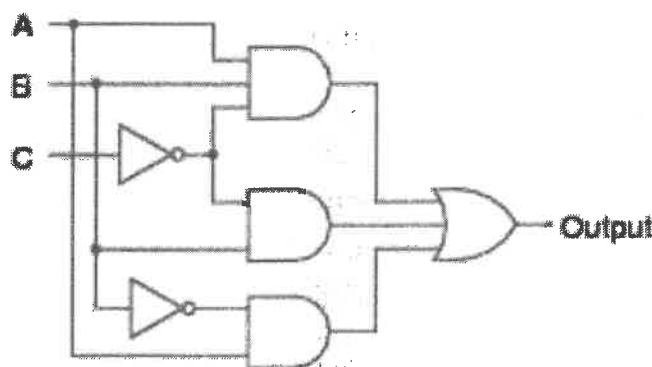
MM: 40

Course Instructor: Dr. Surbhi Chhabra

There are three questions in this paper with sub-parts. You have to attempt all the questions.

1. Convert the following into a given radix (base) form. (1x7+2x7 - CO 4)

- (a) $(3456)_{10} = (?)_2$
- (b) $(85)_{10} = (?)_8$
- (c) $(1111000.1010)_2 = (?)_8$
- (d) $(1973)_{10} = (?)_{16}$
- (e) $(F2.89)_{16} = (?)_2$
- (f) $(471)_{16} = (?)_8$
- (g) If given a binary number "1101001001", write its 1's and 2's complements.
- (h) Calculate the sum of 1101101 and 10101 in binary.
- (i) Subtract 10101 from 110110 in binary.
- (j) Calculate the one's complement subtraction of 11001 from 100110.
- (k) There are three fundamental operations in Boolean algebra: addition, multiplication, and inversion. Each of these operations has an equivalent logic gate function. Draw the corresponding gate, truth table, and output equation for each.
- (l) For the following Boolean expression, draw the equivalent logic gate implementation diagram: $F(W, X, Y, Z) = WX'Y + W'YZ' + YZ + WXY'Z'$
- (m) Use Boolean algebra to simplify the following logic gate circuit:



- (n) Suppose you needed an inverter gate in a logic circuit, but none were available. You do, however, have a spare (unused) NOR gate in one of the integrated circuits. Show how you would connect a NOR gate to function as an inverter. Use Boolean algebra to show that your solution is valid.

2. Write short descriptions for the following questions: (2 x 5 - COs 1,2,3,5)

- (a) What is Harvard architecture, and how does it differ from von Neumann's architecture?
- (b) Name and discuss some optical storage devices commonly employed as secondary memory.
- (c) What is system software, and how does it differ from application software? What role does system software play in a computer system?
- (d) You are tasked with implementing an operating system for a server that needs to support multiple users concurrently. Discuss the key considerations, challenges, and design choices you would make in this scenario.
- (e) Describe the difference between simplex, half-duplex, and full-duplex data transmission modes.

3. Explain in detail for the following questions:

(2+3+4 - CO 3,5)

- (a) Imagine you are designing a wireless sensor network for monitoring environmental parameters in a smart city. Discuss the considerations and topology you would employ to ensure reliable data transmission from the sensors to the central control system.
- (b) A business is deciding whether to invest in custom software development or use off-the-shelf solutions. Analyze the advantages and disadvantages of the approach, considering factors such as customization, cost, and time-to-market.
- (c) A university is redesigning its campus network to accommodate a large number of students, faculty, and connected devices. Discuss the considerations and design choices for creating a robust and scalable campus network.

Best Wishes