

## Logic, Truth Tables, Logic Gates, and Number Systems Exam

**Instructions:** Answer all questions to the best of your ability. Show all work where applicable.

### Section 1: Number Systems (20 points)

1. **(4 points)** Convert the following decimal numbers to binary:
  - (a) 25
  - (b) 42
2. **(4 points)** Convert the following binary numbers to decimal:
  - (a) 11010
  - (b) 101111
3. **(4 points)** Convert the following hexadecimal numbers to decimal:
  - (a) 2A
  - (b) 1F
4. **(4 points)** Convert the following decimal numbers to hexadecimal:
  - (a) 35
  - (b) 60
5. **(4 points)** Perform the following binary addition:  $1011 + 1101$

### Section 2: Logic Gates (20 points)

1. **(5 points)** Draw the symbol for each of the following logic gates:
  - (a) AND gate
  - (b) OR gate
  - (c) NOT gate
  - (d) XOR gate
  - (e) NAND gate
2. **(5 points)** Write the truth table for an OR gate with two inputs (A and B).
3. **(5 points)** Write the truth table for a NOT gate.
4. **(5 points)** Draw a logic circuit that represents the Boolean expression:  $A \cdot (B + \overline{C})$

### Section 3: Truth Tables (30 points)

1. **(10 points)** Construct the truth table for the following Boolean expression:  $(A \cdot B) + \overline{C}$
2. **(10 points)** Construct the truth table for the following Boolean expression:  $A \oplus (B \cdot \overline{A})$
3. **(10 points)** Given the following truth table, write the Boolean expression:

A	B	C	Output
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

Section 4: Boolean Algebra (30 points)

- 1. **(10 points)** Simplify the following Boolean expression using Boolean algebra laws:  $A \cdot (A + B)$
- 2. **(10 points)** Simplify the following Boolean expression using Boolean algebra laws:  $\overline{(A \cdot B)}$
- 3. **(10 points)** Using De Morgan's theorem simplify the following boolean expression:  $\overline{A} + \overline{B}$