Exercise 5: Logic Circuit Design

SECTION A

1. Logic diagrams and truth tables are equally powerful in expressing the processing of gates and circuits. **(True/False)**
2. Boolean expressions are more powerful than logic diagrams in expressing the processing of gates and circuits. **(True/False)**
3. A NOT gate accepts two inputs.
4. The output value of an AND gate when both inputs are 1 is 1. **(True/False)**
5. The AND and OR gates produce opposite results for the same input **(True/False)**
6. The output value of an OR gate when both inputs are 1 is 1. **(True/False)**
7. The output of an OR gate when one input is 0 and one input is 1 is 0. **(True/False)**
8. The output value of an XOR gate is 0 unless both inputs are 1. **(True/False)**
9. The NOR gate produces the opposite results of the XOR gate. **(True/False)**
10. A gate can be designed to accept more than two inputs. **(True/False)**
11. A transistor is made of semiconductor material. **(True/False)**
12. Inverting the output of an AND gate is equivalent to inverting the individual signals first, then passing them through an OR gate. **(True/False)**
13. The sum of two binary digits (ignoring the carry) is expressed by an AND gate. **(True/False)**
14. A full adder takes the carry-in value into account. **(True/False)**
15. A multiplexer adds all of the bits on its input lines to produce its output. **(True/False)**
16. Integrated circuits are classified by the number of gates contained in them. **(True/False)**
17. A CPU is an integrated circuit. **(True/False)**

SECTION B

For Exercises 18 - 29, match the gate with the diagram or description of the operation.

A. AND
B. NAND
C. XOR
D. OR
E. NOR
F. NOT

18. Inverts its input.

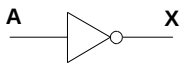
19. Produces a 1 only if all its inputs are 1 and a 0 otherwise.

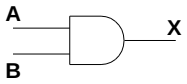
20. Produces a 0 only if all its inputs are 0 and a 1 otherwise.

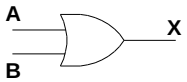
21. Produces a 0 only of its inputs are the same and a 1 otherwise.

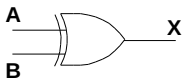
22. Produces a 0 of all its inputs are all 1 and a 1 otherwise.

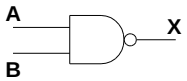
23. Produces a 1 if all its inputs are 0 and a 0 otherwise.

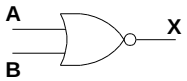
24. 

25. 

26. 

27. 

28. 

29. 

SECTION C

Exercises 30 - 47 are short answer or design questions.

30. Distinguish between a gate and a circuit.

31. What are the three notational methods for describing the behavior of gates and circuits?

32. Characterize the notations asked for in Exercise 31.

33. How many input signals can a gate receive and output signals can a gate produce?

34. Name six types of gates.

35. Compare and contrast the AND gate and the NOR gate.

36. Draw and label the symbol for a three input AND gate, then show its behavior with a truth table.

37. Draw and label the symbol for a three-input OR gate, then show its behavior with a truth table.

38. How can gates be combined into circuits?

39. What are the two general categories of circuits and how do they differ?

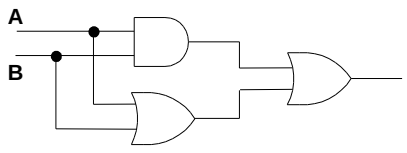
40. Draw a circuit diagram corresponding to the following Boolean expression:
(A + B)(B + C)

41. Draw a circuit diagram corresponding to the following Boolean expression:
(AB + C)D

42. Draw a circuit diagram corresponding to the following Boolean expression:
A'B + (B+C)'

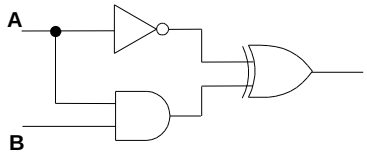
43. Draw a circuit diagram corresponding to the following Boolean expression:
(AB)' + (CD)'

44. Show the behavior of the following circuit with a truth table:



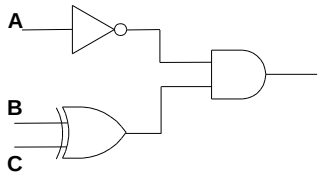
A	B	AB	A+B	AB + (A+B)

45. Show the behavior of the following circuit with a truth table:



A	B	A′	AB	A′ ⊕ (AB)

46. Show the behavior of the following circuit with a truth table:



47. Show the behavior of the following circuit with a truth table: