

Boolean Algebra and Logic Gates Exercises

For Exercises 1- 17, mark the answers true and false as follows:

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

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. **NOT**

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

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

21. Produces a 0 only if its inputs are the same and a 1 otherwise. **XOR**

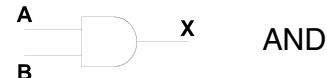
22. Produces a 0 if all its inputs are all 1 and a 1 otherwise. **NAND**

23. Produces a 1 if all its inputs are 0 and a 0 otherwise. **NOR**

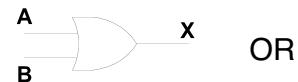
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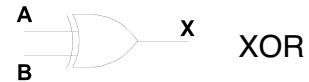
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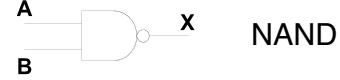
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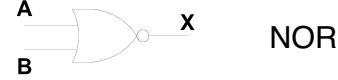
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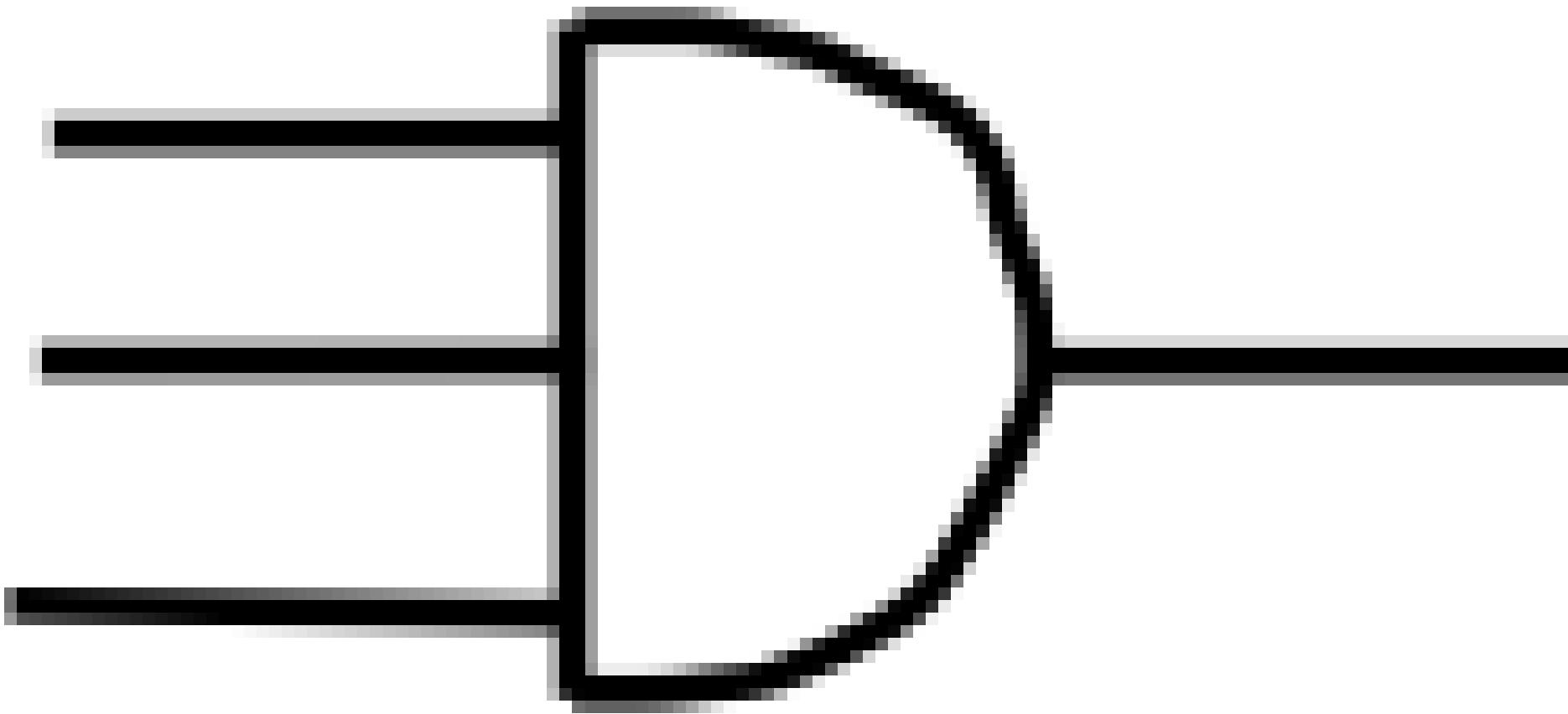


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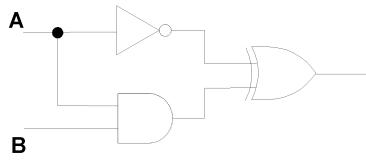


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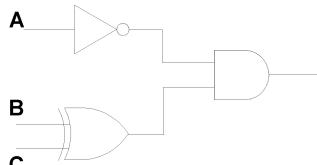


50. Show the behavior of the following circuit with a truth table:



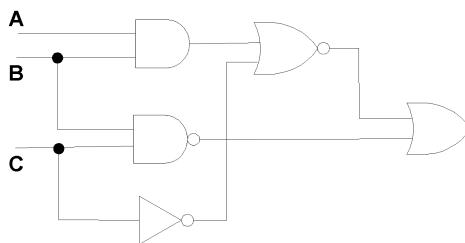
A	B	Output
0	0	1
0	1	1
1	0	0
1	1	1

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



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

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

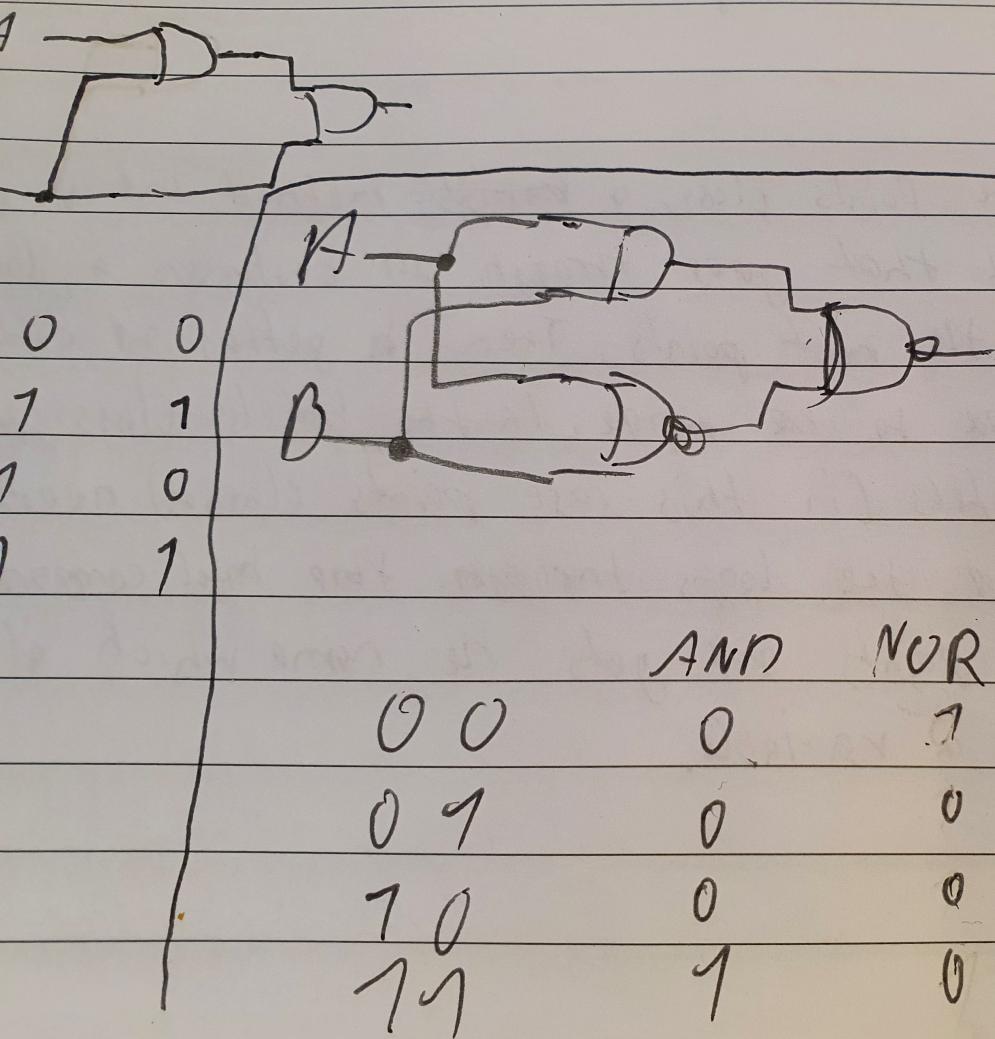


A	B	C	Output
0	0	0	1
0	0	1	1
0	1	1	0
1	1	1	0

53. Name six properties of Boolean algebra and explain what each means.

Absorbtion
Adjacency
Commutative
Consensus
Identity
Involution

54. How can the XOR operation be expressed using other operators?



AND NOR N.O.R.

AND	NOR	N.O.R.	
0 0	0	1	0
0 1	0	0	1
1 0	0	0	1
1 1	1	0	1