What are Logic Gates?

Worksheet

A logic gate is a digital circuit that performs a single Boolean logic operation (AND, OR, NOT, XOR, etc.) on one or more binary inputs to produce one binary output, defined by its truth table.

Questions

1. What is the output of an AND gate when A=1 and B=0?

A) 1
B) 0
C) Undefined
D) Depends on clock

2. Which gate outputs 1 whenever at least one input is 1?

A) AND
B) NOT
C) OR
D) XNOR

3. What does a NOT gate do to a single input of 0?

A) Outputs 0
B) Outputs 1
C) Outputs undefined
D) Outputs 2

4. Which gate is called 'universal' because any Boolean function can be built from it alone?

A) OR
B) XOR
C) NAND
D) Buffer

5. An AND gate has inputs A=1 and B=1. What is the output Y?

6. An OR gate has inputs A=0 and B=1. What is the output Y?

7. A NOT gate (inverter) receives input A=1. What is the output Y?

8. Define: What does an AND gate output?

9. Define: What does an OR gate output?

10. Define: What does a NOT gate do?

Answer Key

1. B) 0 - AND requires ALL inputs to be 1; since B=0, output is 0.
2. C) OR - OR outputs 1 if any input is 1.
3. B) Outputs 1 - NOT inverts the input, so 0 becomes 1.
4. C) NAND - NAND (and NOR) are functionally complete - any logic circuit can be built using only NAND gates.
5. AND rule: Y = A B (1 only if both inputs are 1) A=1, B=1 Y = 11 = 1 Output Y = 1
6. OR rule: Y = A + B, output 1 if at least one input is 1 A=0, B=1 at least one input is 1 Output Y = 1
7. NOT rule: Y = (flips the input) A = 1 flip to 0 Output Y = 0
8. 1 only when ALL inputs are 1; otherwise 0.
9. 1 when AT LEAST ONE input is 1; 0 only if all inputs are 0.
10. Inverts the input: 0 becomes 1, 1 becomes 0 (also called an inverter).