

## Problem Sets on Logic

1. What do you understand by Logic gates?
2. Briefly describe the following operations
  - a. OR operation with OR gates
  - b. AND operation with AND gates
  - c. NOT operation with NOT gates
  - d. NOR operation with NOR gates
  - e. NAND operations with NAND gates
3. Complete the following truth tables

- a. AND operation: (\*)

A	B	A * B
True	True	
True	False	
False	True	
False	False	

b. OR operation: (+)

A	B	A + B
True	True	
True	False	
False	True	
False	False	

c. NOT operation: (!)

A	!A
True	
False	

d. Combination AND , OR and NOT gates:

A	B	A+B	A*B	A + (A*B)	A * (A+B)	!(A+B)	(A+B) *(A*B)
True	True						
True	False						
False	True						

False	False						
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4. Brown, Jones and Smith are suspected of a crime, they testify as follows:

Brown: Jones is guilty and Smith is innocent.

Jones: If Brown is guilty, then so is Smith.

Smith: I am innocent, but at least one of the others is guilty.

Let B, J and S be the statements below:

“Brown is innocent”

“Jones is innocent”

“Smith is innocent”

- a. Express the testimony of each suspect as a propositional formula. Construct a truth table for the three testimonies.
- b. Use the truth table to answer the following questions:
  - i. The testimony of one of the suspect follows from that of another suspect. Identify which is the implication of the other.
  - ii. Assuming everybody is innocent, who committed perjury.
  - iii. Assuming all testimony is true, who is innocent and who is guilty.
  - iv. Assuming that the innocent told the truth, and the guilty told lies, who is innocent and who is guilty.

5. Write each of the logical arguments in logical symbols and determine if the given **deductions** are valid:

- a. If my grandfather is smoking a pipe then he is reading the newspaper.

**Deduction**

Right now, my grandfather is smoking a pipe, so he must be reading a newspaper.

- b. I want to either eat ice cream at the movie theater or eat ice cream in front of the DVD.

**Deduction**

I want to eat ice cream and either go to the movie theater or rent a DVD.