

CN4004: Maths for Computing: Tutorial

Mathematical Logic (Part 1)

1. If P , Q and R represent the following statements:

P : $2 \times 25 = 50$

Q : Germany is in Asia.

R : 3.65 is an integer

What is the value of: a) $P \wedge R$ b) $P \vee Q$ c) $Q \vee R$?

2. Let P be "It is summer" and Q be "Leon is playing tennis". Give simple sentences which represent the following statements:

- a) $\neg P$
- b) $P \wedge \neg Q$
- c) $\neg P \vee Q$
- d) $\neg \neg Q$

3. Let P be "She is a scientist" and Q be "She is intelligent". Express each of the following statements symbolically:

- a) She is intelligent, but she is not a scientist.
- b) She is a scientist, and she is intelligent.
- c) She is a scientist, or she is not intelligent.
- d) It is not true that she is a scientist or that she is intelligent.

4. Construct a truth table for the following expression:

$$\neg(P \wedge Q) \vee \neg Q$$

5. Show that the expression $P \Rightarrow (P \vee Q)$ is a tautology by constructing a truth table.

6. Consider the following statement: $P \Rightarrow \neg Q$

What is

- a) the converse;
- b) the inverse;
- c) the contrapositive?

7. Use De Morgan's law to show that:

$$\neg(\neg P \wedge (P \vee Q)) \equiv P \vee (\neg P \wedge \neg Q)$$

8. Use the distributive law to simplify the following expression:

$$\neg Q \wedge (\neg P \vee Q)$$

9. Negate the following expression, and simplify your answer (hint: use De Morgan's Law):

$$(P \Rightarrow Q) \wedge Q$$

10. In question 5 you drew a truth table to show that $P \Rightarrow (P \vee Q)$ is a tautology.

Now do this using algebra.

11. (If there is time)

Draw a truth table for the following expression, using **3-valued** logic: $P \vee \neg Q$