

# Maths for CS

## Tutorial 1

1. Think of some sentences that are neither questions nor instructions, but still not propositions.
2. Determine the truth value of the following statements.
  - a) If  $1 + 1 = 2$ , then  $2 + 2 = 5$ .
  - b) If  $1 + 1 = 2$ , then dogs can fly.
  - c) If  $1 + 1 = 3$ , then unicorns exist.
3. State the converse, contrapositive, and inverse of each of these conditional statements.
  - a) I come to class if there is going to be a quiz.
  - b) A positive integer is a prime only if it has no divisors other than 1 and itself.
4. Construct a truth table for the following statements.
  - a)  $(p \rightarrow q) \rightarrow (q \rightarrow p)$
  - b)  $(\neg p \leftrightarrow \neg q) \leftrightarrow (p \leftrightarrow q)$
5. An ancient Sicilian legend says that the barber in a remote town who can be reached only by traveling a dangerous mountain road shaves those people, and only those people, who do not shave themselves. Can there be such a barber?
6. Construct a compound proposition that corresponds to exclusive OR.
7. An island has two kinds of inhabitants, knights, who always tell the truth, and their opposites, knaves, who always lie. You encounter two people A and B. What are A and B if A says "B is a knight" and B says "The two of us are opposite types?"
8. Determine whether the following statements are tautology, contradiction or contingency
  - a)  $(\neg p \wedge (p \rightarrow q)) \rightarrow \neg q$
  - b)  $(p \vee q) \wedge (\neg p \vee r) \rightarrow (q \vee r)$
9. Determine whether following pairs of propositions are logically equivalent.
  - a)  $(p \rightarrow q) \rightarrow r$  and  $p \rightarrow (q \rightarrow r)$
  - b)  $p \leftrightarrow q$  and  $\neg p \leftrightarrow \neg q$