# Indian Institute of Information Technology Vadodara
## MA 101: Introduction to Discrete Mathematics
### Tutorial 3

1. Which of these sentences are propositions? What are the truth values of those that are propositions?
   a) Answer this question.
   b) Close the door.
   c) 6+5=11.
   d) What time is it?
   e) $x = x$.
   f) This statement is true.

2. What is the negation of each of these propositions?
   a) Surya and Tejay are friends.
   b) The summer in Gandhinagar is hot and sunny.
   c) Shubham sent more than 100 whatsapp messages every day.
   d) $5 * 3 \geq 15$
   e) It is freezing and it is not snowing.

3. Let p and q be the propositions: p- Mahesh chooses MA401 as science elective; q-Mahesh likes MA101. Express each of these propositions as an English sentence.
   $p \vee q, \neg p \wedge \neg q, p \Rightarrow q$

4. Write these propositions using p and q and logical connectives. p- Mahesh chooses MA401 as science elective; q-Mahesh likes MA102.
   a) Mahesh does not choose MA401 and likes MA102.
   b) Either Mahesh does not like MA102 or he does not choose MA401.

5. Let $p, q, r$ be three propositions with truth values $F, T, F$ respectively. Find the truth values $p \Rightarrow \neg r, p \vee \neq r, (p \wedge \neg q) \Rightarrow r, (r \Rightarrow \neg p) \Rightarrow q$.

6. Suppose there is an island of knights and knaves, where knights always tell the truth and knaves always lie. You encounter two people, A and B. Determine, if possible, what A and B are if they address you in the ways described. If you cannot determine what these two people are, can you draw any conclusions?
   a) A says "At least one of us is a knave" and B says nothing.
   b) A says "The two of us are both knights" and B says "A is a knave."
   c) Both A and B say "I am a knight."

7. Let p and q be the propositions
   p : I have come to the institute.
   q : I attended a MA101 class.
   $p \rightarrow q, p \vee q, \neg p \wedge \neg q$

8. What is the value of x after each of these statements is encountered in a computer program, if $x = 1$ before the statement is reached?
   a) if (x + 1 = 3) OR (2x + 2 = 3) then x := x + 1
   b) if (x + 1 = 2) XOR (x + 2 = 3) then x := x + 1

9. The nth statement in a list of 100 statements is "Exactly $n$ of the statements in this list are false."
   What conclusions can you draw from these statements?