MATHEMATICAL REASONING

1. Statements: A statement is a sentence which either true or false, but not both simultaneously.

For example: "A triangle has a four sides.", "New Delhi is the capital of India." are the statements.

2. Negaiton of a statement: Negation of a statement p: If p denote a statement, then the negation of p is denoted by $\sim$p.

3. Compound statement: A statement is a compound statement if it is made up of two or more smaller statements. The smaller statements are called component statements of the compound statement.

The Compound statements are made by:

(i) **Connectives**: "AND", "OR"

(ii) **Quantifiers**: "There exists", "For every"

(iii) **Implications:** The meaning of implications “If ”, “only if ”, “ if and only if ”.

(a) "p $\Rightarrow$ q" : p is sufficient condition for q or p implies q.

q is necessary condition for p.

The converse of a statement p $\Rightarrow$ q is the statement q $\Rightarrow$ p.

p$\Rightarrow$ q together with its converse, gives p if and only if q.

(b) "p ~~q~~"

A sentence with if p, then q can be written in the following ways.

- p implies q (denoted by $p \Rightarrow q$)
- p is a sufficient condition for q
- q is a necessary condition for p
- p only if q
- $\sim q$ implies $\sim p$

4. Contrapositive: The contrapositive of a statement $p \Rightarrow q$ is the statement $\sim q \Rightarrow \sim p$.

New statements, Special words/phrases

5. Contradiction : If to check whether p is true we assume negation p is true.

6. Validating statements: Checking of a statement whether it is true or false. The validity of a statement depends upon which of the special.

- The following methods are used to check the validity of statements:

(i) direct method

(ii) contrapositive method

(iii) method of contradiction

(iv) using a counter example.