

Elements of Symbolic Logic

1. '~' for negation; called (curl or tilde)
2. 'V' for the relation of 'either, or' in inclusive sense ; called wedge. (disjunction)
3. '∧' for the relation of 'either, or' in exclusive sense called alternation.
4. '•' for the relation of 'and'; called dot.
5. '⊃' for the relation of 'if, then' and is called horse shoe.
6. '≡' for the relation of 'if and only if' and is called equivalent.

For example:

1. "She is poor yet she is honest".
P. H
2. "He is intelligent but could not clear this test."
I. ~ T
3. "Both Sita and Gita are students."
S. G
4. "Not both Sita and Gita are Students."
~ (S.G)
5. "Sita and Gita both are not students".
~ S. ~ G
6. "Neither Sita nor Gita are students."
~ S. ~ G

., V, ∧, ⊃, ≡, ~

- p. q is true when both or all the conjuncts (p, q etc.) are true.
- p v q is true when at least one of the disjuncts (p, q etc.) is true,
- p ∧ q is true when one alternate is true and the other is false.
- p ⊃ q is true in all cases except when antecedent (p) is true and consequent (q) is false.
- p ≡ q is true when either both p, q are true or both p, q are false.
- ~ p is true when p is false.

Disjunctive : (inclusive sense) :

When two simple propositions are combined by 'either, or' then the compound form is called disjunctive proposition. For example :

1. "Either I write to him or I will talk to him on telephone" is symbolized as :

W v T.

W, T are called disjuncts.

2. "Either the government will reduce the price of oil or it will have to increase the salary".

R v I

3. "Either it rains in time or the crops will not be good".

Rv~G

4. "Either S is not guilty or M is not telling truth".

~Sv~M

If 'unless' occurs between two components of a sentence, then they can be symbolically joined by the disjunctive sign. For example:

"I do not drive in night unless it is very necessary."

$\sim D \vee N$.

$\sim D$ - "I do not drive in night".

N - "It is very necessary."

'Neither, nor' relationship between two propositions can also be symbolized by using wedge (\vee) sign. For example:

"Neither the teachers nor the students are the members of this library."

$\sim (T \vee S)$

'neither, nor' relationship can be symbolized in two ways. The above example can be symbolized in an other way also such as:

$\sim T. \sim S$

Thus $\sim (T \vee S) = (\sim T. \sim S)$

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Alternative: (Exclusive sense)

Two simple propositions are joined by 'either, or' in exclusive sense also.

"Either I go to library or I will stay in the hostel."

$L \wedge H$. (L, H are alternates)

Implicative :

Simple propositions when combined by 'If, then' relation are called implicative, hypothetical or conditional propositions. Such propositions are symbolized by using ' \supset ' sign and the sign is read as

'horse-shoe' for it looks like shoe of a horse.

Example :

1. "If I get ticket of plane, then I will attend board meeting in Bombay", is symbolized as :

$T \supset A$.

2. "If you are not regular visitor to library, then you are not a serious student."

$\sim L \supset \sim S$

In $p \supset q$ proposition 'p' is antecedent, 'q' is consequent. Sometimes instead of 'if, then' some other words or phrases are used in implicative propositions.

For instance: the following propositions are implicative propositions and they all are symbolized as ' $p \supset q$ '.

1. p, only if q $p \supset q$

2. q if p $p \supset q$

3. q provided that p $p \supset q$

4. q on condition that p $p \supset q$

5. q in case p $p \supset q$

6. p hence q $p \supset q$

7. p implies q $p \supset q$

Questions

1. Symbolize the following propositions using given notations:

a. I sit on the chair but my cat sits on the floor.(C, F)

b. We will miss bus unless we run.(B, R)

c. Two triangles are formed if a square is divided diagonally.(T, S)

d. He is both fool and knave.(F, K)

e. A man is both rationalist as well as hedonist. (R, H)

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- f. Either the taxes rise or the inflation continues.(T, I)
 g. A doctor can diagnose this disease if and only if he has experience in the tropics. (D, T)
 h. If the market drops, Simon will borrow more money.(M, B)
 i. A will dance only if B sings.(A, B)
 j. Mr X can secure majority of votes if Mr X cares for the people.(S, C)
 k. She prepares to earn a good living only if her school days are well spent.(P, S)
 l. Neither the cost of living will rise nor will the public agitate.(C, A)
 m. We will go if it does not rain.(G, R)
 n. Be neither a borrower nor a lender.(B, L)
 o. Vinod failed though he tried. (F, T)
 p. A implies B, and C implies D. (A, B, C, D)
 q. If mathematics is difficult, then you will pass only if you work hard.
 (M, P, Q)
 r. Either she is too good and innocent, or she is pretending to be so.(G, I, P)
 s. Ram will go provided he is invited. (G,I)
 t. Geeta is intelligent as well as hard working (I,H)

2. Make the truth tables of the following and determine their logical status as tautology, contingent or contradictory

- a. $p \supset \sim q$
 b. $\sim p \vee q$
 c. $\sim(p \cdot q)$
 d. $(p \vee q) \supset r$
 e. $p \supset (p \vee q)$
 f. $(p \cdot \sim p) \supset q$
 g. $(p \vee q) \supset \sim p$
 h. $(p \cdot q) \equiv \sim p$
 i. $p \supset (q \sim q)$
 j. $p \vee (\sim p \supset p)$
 k. $p \supset (\sim p \supset \sim q)$
 l. $\sim (p \supset q) \vee \sim r$
 m. $p \supset \sim (q \vee r)$
 n. $(p \cdot q) \supset (r \vee p)$
 o. $(\sim p \cdot \sim q) \cdot \vee r$
 p. $p \supset \sim (q \supset \sim r)$
 q. $(p \vee q) \cdot (\sim p \cdot \sim q)$
 r. $\sim (p \cdot q) \cdot (q \supset p)$
 s. $(p \supset q) \supset \sim (\sim q \supset \sim p)$
 t. $(\sim p \vee \sim q) \equiv (p \equiv q)$
 u. $\sim (p \cdot \sim q) \supset (q \cdot \sim p)$
 v. $(p \equiv q) \equiv [(p \supset q) \cdot (q \supset p)]$
 w. $(p \supset q) \supset [(\sim p \vee q) \vee r]$
 x. $[(p \cdot q) \supset \sim r] \supset (p \supset r)$
 y. $[(p \supset q) \cdot (q \supset r)] \supset (p \supset r)$