

(An Autonomous Institution) Coimbatore-641035.

#### UNIT I-LOGICS AND PROOFS

THEORY OF INFERENCE

The Theory of Interence:

Argument:

augument & a sequence of Statements. All statements except the tripal one are called prentises (as assumption or hypothesis). The fixed statement is called conclusion.

ie, Let P, Pa, ..., Pn be a sequence of Statements that steld concludation a. It 98 denoted by  $(P_1 \land P_2 \land \dots, P_n) \rightarrow Q$  is a tautology.

Valled Argument:

An argument is called valid if the conclusion is true when all premposes one true.

Invalsed Assument:

An argument is called privaled 96 it is not valed argument.

Rules of Inference:

Rule P: A piemise may be introduced at any point in the declivation

Rule T: A formula smay be antroduced at any point on a decevation of S % tautologically empted by any one as more of the proceding formula's

Rule CP: If Swe can desilve & brom R and a set of Premases, then we can deserve R-> & brom the Set of premaces alone. EJ. Show that RVS follows

Types of Proof:

i). Dreet Proof TV 20279919

ii). Indirect peop (a) peop by contradiction

iii). conditional proof

iv) In consystem Proof





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#### **UNIT I-LOGICS AND PROOFS**

#### THEORY OF INFERENCE

when a conclusion is decived from a set of premises by using accepted only reasoning then such a process of developt con 95 called direct people High a good coule to my room would five mee pecen Imprication Rules: " my more would's give me > 1 dodn's gas a good goodes P, P+a >a J. Modus Phones: &J. modus Tollons: P+Q, 7A ⇒ 7P 3]. D9. Squactive Syllogism: TP, PV a → a 4]. Hypothetical Syllogien: P>Q, Q→R > P→Q (a) chain Rule 5. Sampfification Rule: P. a ⇒ PAR PAR > P. R. Q. Adde+con Rule: B. Q → PVQ J. Equivalence Rule: I Show that R is valled from the premises  $P \rightarrow Q$ ,  $Q \rightarrow R$  and P.

2]. Show that RVS follows logically from the premises CVD, CVD)  $\rightarrow 74$ ,  $TH \rightarrow (A M TB)$ , and  $(A M TB) \rightarrow RVS$ 





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| Step           | Plemises                            | Rule          |               |
|----------------|-------------------------------------|---------------|---------------|
| ) -            | CVD                                 | P             |               |
| 2.             | (CVD) -> TH                         | P             |               |
|                | <del>フ</del> H                      | P             |               |
| 71,29 3.       | TH - (ANTB)                         |               |               |
| 4.             | ANTB                                | 7             |               |
| §3, 43 B.      | ANTB -> PVS                         | P             |               |
| 6.             |                                     | 1 To          |               |
| 25,637.        | RVS                                 | -1 A          |               |
| (4)-5          | 9. (0/0)                            | s a valled    | D→R.          |
| 3]. Show that  | RA(PVQ)  Lot the prema              | ses PVQs      |               |
| conclusion f   | Loto Tole Par                       |               | 30            |
| P > M and      |                                     | Rule          |               |
| Step           | premises                            | P             |               |
| 1.             | TO                                  | Power         | Facility of T |
| 2.             | P+M                                 | T<br>Sid c. H | H PZ          |
| 31,27 3.       |                                     | P             |               |
| ₹1,23 3.<br>4. | Pyce                                | ANTA SE       |               |
|                | 6)                                  |               |               |
| £3,43 5.       | $a \rightarrow \kappa$              | ac Pr         | 7 Stort'w     |
| 9 4- 2 1 6. 9  | R                                   | y syllen      | d arma a      |
| 25,63 T.       | RA(PVQ)                             |               |               |
| 84,73 8.       | hayoon tiri g                       | n >           | (AVC), D      |
| ( )            | $A \rightarrow B$ , $C \rightarrow$ | Bs            |               |
| A. Show that   |                                     |               |               |
| B.             |                                     |               |               |
|                | . 3<                                | U             |               |
| Depay T        |                                     |               |               |
|                |                                     | ar            |               |
|                | ar.                                 | 13            | 1-(3.8)       |





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| Step Premases p   |
|---|
| 1. $D \rightarrow (AVC)$ $P$  |
| 2   |
| 引33 4. TA→C  「1,23 3. AVC RT [P→日中TPVQ]  「133 4. TA→C   |
| {3} 4. 7A→C   |
| 5. $\mathbb{Z} \to B$ $\mathbb{Z} \to \mathbb{Z}$   |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$   |
| $76$ 7. $7B \rightarrow A$ $P \rightarrow P \rightarrow R$                                      |
| $P$ $P \rightarrow R \rightarrow P$ $P \rightarrow R \rightarrow P \rightarrow R$               |
| 17.83 9. 7B→B TPVQ<br>193 10. BYB PYP 中P  |
| 793 10. PVF T   |
| Us.   |
| condu 7P from 2 P-2 8 76  |
| Indusect Proof: TO P-12, PVP=) R  |
| to open plemi   |
| and c's the conclusion there  |
| we get 7c ∧ (H <sub>1</sub> ∧ H <sub>2</sub> ∧∧Hm) ⇒F,  |
| where f is the contradiction.   |
| J. Prove by Product Method 70, P>Q, PVR=>R  |
| Stop Premises Rule  |
| TR Nogation of conclusion   |
| a. PVR  |
| {1,2} 3. P T, TP, PVQ→Q   |
| 4. P→Q P  |
| [3,4] 5. Q T, P, P→Q → Q  |
| 6. 7Q P   |
| $\{5,6\}$ 7. $\mathbb{Q}$ $\Lambda$ $\mathbb{T}$ $P,\mathbb{R} \Rightarrow P \wedge \mathbb{R}$ |
| ্বি ৪. F<br>Scanned With Camscanner   |





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| No.         |                             |  |
|-------------|-----------------------------|--|
| al Show.    | that TPATQ =                | > T(PAR) by  |
| 9 pdfle     | t peod.                     |  |
| Step        | Premises                    | Rule   |
| 1.          | PAR                         | regation of condustion                             |
| ₹13 &.      | Р                           | T PAQ → P  |
| 3.          | TPATR                       | ρ  |
| f33 4.      | 7P                          | T TPMQ SIP   |
| 52,43 5.    | PATP                        | T P,Q >PAQ   |
| 753 6.      | F                           | T  |
| 3 Show to   | ad $R \rightarrow 78$ , RY: | S, S > TQ, P > Q = TP                              |
| by 9nd      | rect method.                |  |
| Step        | Premacos                    | ragation of conclusion                             |
| 1.          | P                           |  |
| 2.          | P+Q                         | P P, P+A +Q  |
| रा,क्षु व . | Q                           | TRANSPORT OF THE PROPERTY OF                       |
| 4.          | R->7 R                      | T P>Q, TQ = TP                                     |
| 3,43 5.     | TR                          | parties and the second                             |
| 6.          | RVS                         | T TR, RVS => S                                     |
| {5,6} T.    | S                           | P  |
| 8.          | S→7R<br>7R                  | TP, P->0 => Q                                      |
| 57,839      | QATQ                        | T P, Q = PAQ                                       |
| {3,93 10.   | F                           | T PATP => F  |
| n.          | r                           |  |
|             | J 7a,                       | P707 17 (1500)                                     |
| Mas         | 2) (RAR) 11                 | P-70 => 7P<br>R+5), (2-77) A(S-10),<br>P-11) => 1P |
|             | A (14)                      | , +71) 71  |





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| 7              |                       |           |              | o <sub>res</sub>                   |
|----------------|-----------------------|-----------|--------------|------------------------------------|
| Conditional    | Proof:                |           |              |                                    |
| J. Show that R | +S can be             | derved    | been         | , the                              |
| Premases P-    | (Q~S), T              | RVP and   | 'Cl.         |                                    |
| Set<br>I.      | Premases<br>R. (Assem | P(ASSI)   | Rule<br>med. | premice)                           |
| ℚ.             | TRVP                  | F         |              |                                    |
| ₹1,&y 3.       | ₽                     | T         |              | TP, PVQ⇒Q                          |
| 4.<br>83,43 5. | P-> (Q->S)            | P         |              |                                    |
|                | 9-3                   | T         | •            | $P, P \rightarrow Q \Rightarrow Q$ |
| 6.<br>Sc (7    | Q                     | P         |              |                                    |
| ₹5,63 y.       | 3                     | os i surT | 5            | P, P→ Q → Q                        |
| ₹1,73 8.       | R+S                   | CF        |              |                                    |
| IJ. Delive the | 2 following           | using     | ep:          |                                    |
|                | · P > (PAR)           | U         |              |                                    |
|                | R→(RAS)               | > Q -> S  |              |                                    |
| ii) P+Q=       | 7 P -> (PAQ)          |           |              |                                    |
| ÎÎV). TPVQ, T  | QVR, R->S=            | + P+S     |              |                                    |
| i) P→a > P-    | · (PAQ)               |           |              | 6.7                                |
|                | feem9508              | Rule      |              | A man                              |
| 1.             | P .                   | PIASSO    | mod          | Plemile)                           |
| 2 2,7 6.9      | P->Q                  | Р         |              |                                    |
| રી, શ્રુ કે.   | ବ୍.                   |           | P. P.        | $a \Rightarrow q$                  |
| ₹1,33 4.       |                       |           |              | > PAQ                              |
| •              | · (PAQ)               | СР        |              |                                    |
|                |                       |           |              |                                    |





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| i) P. P-> (    | PA (RAS)               | ⇒ Q→S                                 | March Special                                     |
|----------------|------------------------|---------------------------------------|---|
| Step           | premises               | 9(41                                  | of promice)                                       |
| 1.             | R                      | Prass                                 | uned premise)                                     |
| 2.             | P                      | P                                     | Total 1   |
| 3.             | P->(A->(R/             | 15)) P                                | PRIADA  |
| 22,33A·        | Q -> (RAS)             | francis Tare                          | $P, P \rightarrow Q \Rightarrow Q$                |
| 11/23 S.       | RAS                    | and an Take                           | P, P>Q > Q  |
| 3177<br>553 6. | 3                      | Tara                                  | PAR > R   |
| {1,6}¶₹.       | Q>S                    | СР                                    |   |
|                | > P> (PAR              | ) TPV 9, 7QV                          | $/R, R \rightarrow S \Rightarrow P \rightarrow S$ |
|                | Premis 08              | D 10                                  | 100 M 10 10 10 Mg                                 |
| De la partir   | q ¬P                   | Plas                                  | ssumed PiemPse)                                   |
| 9-9 2.4-3 3.   | TPVQ                   | P                                     | - D. O. A. P. O.                                  |
| 523 3.         | P-> Q                  | T                                     | 7PVQ + P→Q  |
|                | Q                      | T                                     | P, P>O>Q  |
| ₹1,33 \$·      | TOVR                   | P                                     |   |
| \$.            |                        | (2-1,1)                               | F (1)   |
| 25y 6.         | $\Theta \rightarrow R$ | * * * * * * * * * * * * * * * * * * * | P, PAA > Q  |
| 74,63 7.       | R                      | SALLYCONDI                            | H Y31,164   |
| 8.             | R-JS.                  | P                                     | £1  |
| §7,83 9.       | 1.19.89 20             | Programmer T                          |   |
| 7,93. 6.       |                        | taste 930                             | J. Show Hall                                      |
|                | 9                      | q                                     |   |
|                |                        | Page 9                                |   |
| 为一日一日          |                        | 4                                     |   |
|                | 4                      | Y.                                    |   |
|                |                        |                                       |   |





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|                        | 1.30                              | Frank Charles  |  |
|------------------------|-----------------------------------|--|--|
| Topodal                | l-                                |  |  |
| Inconsisten            | Proof:                            |  | n is said  |
| A &c                   | et of premises                    | 3 H <sub>1</sub> , H <sub>2</sub> ,···, H <sub>r</sub> | which  |
| DE TRUBES              | CSTEDI IS HINF                    | da A··· A Hm ⇒f  |  |
| Stands for a           | Contradact con.                   | 1 01 0 A   | is any   |
| E, HINHR               | $\Lambda - \cdots \wedge H_m = A$ | 17A, where A   | laciable.  |
|                        |                                   |  |  |
| + J. Plove toat        | t the premace                     | & P-> Q, Q-7R  | ,, K-7   |
| $S \rightarrow TR$ and | PAS are Proces                    | negetent.  |  |
| Step                   | Premacos                          | Rule   |  |
| 1.                     | $P \rightarrow Q$                 | P  | Pie  |
| 2.                     | $Q \rightarrow R$                 | Р  | on P Pa  |
| £1, 23 3.              | $P \rightarrow R$                 | T Pag, 6   | P→R → P→   |
| Problem on A           | SITR                              | P  | TO 27 P  |
| {A} 5.                 | R -> 7S                           | T P+A  | → 78 → 7 P     → |
| 73,536.                | P->7S                             | T P+Q, 1   | 9->R => P+1  |
| 7.                     | R->S                              | P  |  |
| ZGY 8.                 | TPVTS                             | T P->6 4   | → TPVQ   |
| 7839.                  | 7 (PAS)                           | T 1PV16  | A TIPME  |
| a 6 8 10.              | PAS                               | P  | 0.0  |
| £9,109 11.             | (PAS) AT (PAS)                    | T P,Q =>   | MA   |
| 12.                    | ) F                               | T  | 1 201  |
|                        |                                   |  |  |
| J. Show that           | the premace                       | $8 P \rightarrow 9, P \rightarrow 8$                   | · 9->78,   |
| p are 900              | only stent.                       | 34-1   | 1,75. 10   |
| 1.                     | P                                 | P  |  |
| 2.                     | P->9                              | P  | 1. 1   |
| 21, 23 3.              | 9                                 | T P, P-  | 中旬中瓦   |
| 4.                     | 9.77                              | P  | - > -  |
| £3,4) 5.               | 78                                | T P, P>  |  |
| 6.                     | PT                                | P<br>T P-A   | \$ 7Q→7P   |
| ₹6°3 Т.                | Tr>TP                             | , , , ,  |  |





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| 25,73 8. 7P  | T P, P+Q >Q  |
|--|--|
| 11,83 9. PATP  | T PR > PAR   |
| 11/5)  | T PATP & F   |
|  |  |
| 3] prove that the prem   | PLOS ampspetent.   |
| d > (bATC), and the  | (i) w  |
| and  | T PAR > P. Q   |
| 213 2. a   | P  |
| 3. $a \rightarrow (b \rightarrow c)$   | T P, P > Q > P > Q   |
| {2,3} 4. b→C   |  |
| ₹13 5. d   | P  |
| 6. d > (b^7c)  | T P, P-> Q > Q   |
| ₹5,63 7. BATC  | T T(P+Q) \$ PATQ   |
| ₹73 8. 7 (b→c)   | T P, Q > PAQ   |
| $\{4,8\}$ 9. $(b \rightarrow c) \land 7 (b \rightarrow c)$   | T  |
| lo. F  | 9009 are   |
| AJ. Show that the follows  | ing premises   |
| AT. Show that the follows anconstatent.  Greenstent.  Jack masses many cla   | asses through all news then  |
| The Fack masses school.  | go uneducated.   |
| 9nconsisted many classes many c | of, then he is her her is  |
| 2 F Jack But a lot   | of books,  |
| he fagis light school 2. If Jack leads a lot 3. If Jack leads a lot not uneducated. A jack misses many cla   | nees through 91/ness   |
| not many ca  | Valid Statement 2 x as 1   |
| A Jack masses many and reads a lot of  | classes through allness  |
| P. Jack Mycles   | A STATE OF THE STA |
| P: Jack mills high Scho  R: Jack leads a lot a   | books  |
| R: Jack 18 weducated   | arca 202001019 out   |
| G: Gack is   |  |
|  |  |





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### THEORY OF INFERENCE

| The premises are                 |                      |
|----------------------------------|----------------------|
| P > Q, Q > R, S > TR             | , PAS.               |
| Hop Premases                     |                      |
| P→A                              | P I was in a         |
| $a \rightarrow R$                | P (many              |
| $^{\circ}$ 1,83 3. $^{\circ}$ 3. | T PAR, RAREDAR       |
| 4. S->TR                         | P                    |
| ₹43 S. R →7S                     | T P> Q (>) 7647P     |
| {3,5} 6. P→7S                    | T PAR, RAR PAR       |
| (63 T. 7PV7S                     | T P→a ←> TPVQ        |
| {7} 8. 7(PAS)                    | T 7(PAR) > 7PV7R     |
| 9. PAS                           | P                    |
| {8,9} 10. (PAS) AT(PAS           |                      |
| n. F                             | T PATP ←> F.         |
| · ·                              |                      |
| 5. 1). If there is a ball        | name than travelleng |
|                                  | all of same leads    |
| ii). If theig angred             | on time then         |
| toavelling was not do            | to colt.             |
| 111). They arrived on            | 19me                 |
| iv). Therefore there c           | was no ball game.    |
|                                  |                      |
| valed Statement.                 | Para -               |
| Let p: There was a               | ball game            |
| Q: Travelling wa                 | & d9ffqcult          |
| R: They arrived                  | on time.             |
| The premises and P-              | +a, R → Ta, R,       |
| The conclusion                   | 98. TP.              |





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THEORY OF INFERENCE

| Step              | Premaces         | Rule            |
|-------------------|------------------|-----------------|
| ).                |                  | P               |
| 2.                | R -> TQ          | P               |
| र्शि, क्षेत्र ठे. | Ta I senior some | T P, P > Q > Q  |
| 4.                | P->- Q           | P               |
| 93,47 な、          | TP               | T, P-P, TR=> TP |