

SNS COLLEGE OF TECHNOLOGY (An Autonomous Institution) Coimbatore-641035.



UNIT I-LOGICS AND PROOFS

PREDICATES AND QUANTIFIERS

It is a palt of a sch-tance that certains A declassative sentence contains subject prede cate and predicate. that deecenbes what they Subject dees on it prote predecate descripping the A part of a declarative sentence proposition among object (03) relation among object is called a predicate.

Fg: Ram is an wild animal. It is denoted by P(G).

a] sam is poor and Ram is intelligent It is denoted by P(S) A I(r)

Quartages : Quantifier is the one which is used to quantify the nature of variables.

Types of quantifier: J. Universal quantifier (tr) or (x) The quartifier "for all x is called ungversal quantifiel.

Eq: I for all x, or is an integer In symbolic forms try, I(x)

2]. Every apple is red.

For all x, 96 x 18 an apple then x 18 red. $(\forall x) \left[A(x) \rightarrow R(x) \right]$



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2]. Exercitential quantifies: (Jx) The quantifier "for some x" is called the exactential quantifier. Eg: some men are intelligent There exist an or such that x is a man

and & is sn+elligent.

(FX) (M(X) A I (X))

Bound and Frile, vortables: The variable is said to be bound if It is concerned with either wriversal (+21) or existential (7x) quantifier.

Otherworse it is called free variable. Supe of the quantifier is the tormula torrowing the quantifier (x) $P(x, y) \Rightarrow x$ is bound variable E9 : y is free vooltable prx, y) 93 the scope of the

quantificon.

ing the first the first Theory of Inference for Predecate calculus J. Universal Specification [US Rule] $(\forall x) P(x) \Rightarrow P(y)$ 6 ward Per

2]. Universal Generalizzation [UG Rule]

 $P(y) = \gamma (\forall \alpha) P(\alpha)$ Existential speatfatten [ES Rule] 1) . Orf verified 3]. (Zx) P(x) = P(y) Happ out

H], Existential Concial?Toation [EGI Rule]

 $P(y) \Rightarrow (\exists x) P(x) = (lot a)$



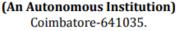
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UNIT I-LOGICS AND PROOFS

PREDICATES AND QUANTIFIERS 1. Show that (Jx) M(x) follows logg cally [x) [H(x) → M(x)], (Fx) H(x) Step premises Rule P $1. \quad (\infty) \left[H(x) \rightarrow M(x) \right]$ $\begin{cases} 1, & (x) \mid (y) \rightarrow M(y) \\ 3, & (\exists x) \mid (x) \end{cases}$ US P ES 233 4 HIY) 22,43 5. M(Y) + P, P+Q >Q EGI 6. (For M(21) 2. All humans are mortal. Sachen is a human Therefore he is martal. H(x): x 98 a human M(x): x "B Mostal H(6) : Sacher & a burnan The premeses ane. (+x) [H(x) -> M(x)], H(5) When : M(S) Premieses Pule (Yx) [H1x) ~ M[x)] P H(S) ~ M(S) D step 1. 713 2 HIS) , they by Tel 3. M(S) §2,3]4. 3. Show that the premises, "one Student in this class knows how to write programs 9n JAVA "a "Everyone who knows how to weste program 90 JANA can get a high - paying gob " amply the Conclusion "some one in this class can get a bagh - paying det . Scanned with CamScanner







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A(x): x 13 90 +1595 01093 J(21): 2 Knows how to write program 9n JAVA Let H(x): x can get a high paying job. The plempson are, (Ja) (A(ス) ハJ(ス)), (ヤス) (調オ)→ H(ス)) Condusion: Fx (A(x) AH(x)) Rule premisos Step (Jx) (A(x) A) (xE) P 1. ES fig 2. A(y) A J(Y) A14) ~7(4) =) A(4) T faz 3. A(y) $A(y) \wedge J(y) \Rightarrow J(y)$ T 523 4. J(Y) P 5. (4a) (J(x)-> H(x)) 753 6. US $J(y) \rightarrow H(y)$ 7. H(Y) A(y), H(y) => A(y) A H(y) T ALAN HIA) {z, TY 8. EG (JR) (A(2) AH(2)) 9. 4]. Veryly the validity of the following argument. "Every Aving thring is a plant of an animal" "John's gold fight is alshe and it is not a plant" "All ausimals have hearts". Therefore, " John's gold frest bas a beart". L(31): 26 38 a 191909 713909 [1(j): j33 allive PG) : jis not a P(a): x B a plant plant Self facto A(x): x is an animal has a H(]) : J beaut +1(71): 2 % a hoaset Give: $(\forall x) [L(x) \rightarrow P(x) \lor A(x)]$ L(J) ∧ TP(J), (+2) [H(21) → H(2)]



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| conclusion: | н(ј) | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------|--------|
| Step F | mennses | Rule | |
| 1. (420) | L(x) -> P(x) VA(x) | IP | |
| | -> p(j) VA(j) | S | |
| (P) | (Ball | P | |
| {3]4. L(j) | hildren i frind is | T PAR > P | |
| • | v AG) | T P, P=== | |
| 553 6. TP(j) | -> A(j) | T Proto 7P | 3 |
| T. (471) EAU | $(x) \rightarrow H(x)$ | P | |
| 1838. A() | | Shew seed 100 | |
| |)-> H(j) | | |
| 11-1 | 1 | T P, P->Q= | >Q |
| 1). | ну) | | |
| neg f.a. | | 763.75 E | |
| Bibain 1 | - nar 82 1000 | 1 mussic", "som | e |
| 5]. "AII LOCH | preset " Therefor | d mushc", " som re " some load n | |
| Locit music | 0. | | |
| R(x) | x B a Louic m | nusic | |
| T(x) | x is a loud r | - (G E) | \sim |
| GIV <u>n</u> . (+7x) [R | $L(x) \rightarrow L(x)$], (J | -72) R(71) | |
| Conclu ston | (Jx) ((x) | ford tradies | No. |
| 1. | (+x) (R(x) -> L(: | r) P Su | |
| <いう 2. | $R(Y) \rightarrow L(Y)$ | (r) · Province | e test |
| a . | (Fx) R(x) | ES | |
| {3} 4. | R(Y) L(Y) | Т | |
| રૂગ્ર,43 5. 6. | (Jx) L(x) | EG | |
| and the second of the second o | | Scanned with | Cam |



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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| 6] Establish the validity of any i). All integers are eathernal no. ii) some integers are power of iii) Therefore some sational numb power of 3. | trace |
| I(π): π is an $9n+eget$ R(π): π is an $2a+lonal$ number $P(\pi)$: π is power of 3. $O(10)$. $(+\pi)(I(\pi) \rightarrow R(\pi)), (+\pi)(1)$ $Conclusion: (+\pi)[R(\pi) \land P(\pi)]$ | $E(x) \wedge P(x))$ |
| Stop premises $Rule$.1. $(\forall x) [I(x) \rightarrow R(x)]$ P $\overline{\partial}I\overline{\partial}2$. $I(y) \rightarrow R(y)$ D $\overline{\partial}2$ $(\exists x) [I(x) \land P(x)]$ P $\overline{\partial}2$ $(\exists x) [I(x) \land P(x)]$ P $\overline{\partial}2\overline{\partial}4$. $I(y) \land P(y)$ ES $\overline{\partial}4\overline{\partial}5$. $I(y)$ T | PAQ > PER |
| ₹2,536. R(y) T ξ437. P(y) T ξ6,738. R(y)∧P(y) T 9. (Jx) [R(x)∧P(x)] EG | $F, \Theta \Rightarrow F \cap \Theta$ |
| J. Show that (x) [P(x) V.Q.(x)] > by Proderect Proof. Premases: (x) [P(x) V.Q.(x)] | (x) P(x) V(F) a(x) |

Conclusion : (x) P(x) V (Fx) Q(x)



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| Stop | Peamacos | Rule |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| 1. | (a) [P(2) V & (2)] | P |
| | $P(y) \vee Q(y)$ | US |
| 513 2. | FIGIV CON | Nogation of |
| 3 | [(x) P(x) V (Jx) Q(x)] | conclusion T T(PAG) |
| | (JX)7P(X) A (X)7Q(X) | T TPYTE |
| £33 A. | (32)11(2) | |
| | $(\neg \neg \neg \neg p(\alpha))$ | |
| 243 5. | (Jx)p(x) | ES |
| 2536. | 7 P(4) | T PARSO |
| 7. | (21) TR121) | S |
| | 7 0(4) | T P, a > Pra |
| 273 8. | 7P(4) 17Q(4) | - P. 7日 (PVE |
| 56,83 9. | -TP(g) / To(t) | |
| 293 10. | 7 (P(4) V & (4)) | T P,Q => PAQ |
| 29,103 11. | [PIYIVAIY] AT [PIYIVE | T PATP F |
| | F | |
| Eng 12. | | Emplecation |
| Line . | g cp sule, obtain the the | following the property |
| 8]. 0590 | g (VX) [RIX) > | TAIX) - TRIAN - TPIZN |
| (Ha)[P/2 | g cp lule, obtain the form in the | (M Elere |
| | | Rule |
| Stop | Piensisos | P |
| 1. | $(\forall x) [P(x) \rightarrow Q(x)]$ | Р |
| æ. | R(20) 7 | US |
| 5233 | $R(y) \rightarrow 7 R(y)$ | plassumed) |
| 12)0 | R(Y) | T P, P+ Q => Q |
| | 70.14) | |
| {3,435· | P(y) -> Q(y) | US T PAR, TR => 7P |
| g13 6. | | T Ha, ia |
| | 7 19(4) | |
| \$5,63 T. | 78(4) | |



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 $\begin{array}{l} \left[4,73\right] & \mathcal{R} & \mathcal{R}(\mathbf{y}) \rightarrow \forall \mathcal{P}(\mathbf{y}) & \mathcal{C}\mathcal{P} \\ \left[83\right] & \mathcal{P} & (\forall \mathbf{x}) \left[\mathcal{R}(\mathbf{x}) \rightarrow \forall \mathcal{P}(\mathbf{x})\right] & \mathcal{U}\mathcal{G} \\ \end{array}$