

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]

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



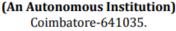
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UNIT I-LOGICS AND PROOFS

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	
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UNIT I-LOGICS AND PROOFS	PREDICATES AND QUANTIFIERS
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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 $\begin{array}{l} \left[4,73\right] & \mathcal{R} & \mathcal{R}(\mathbf{y}) \rightarrow \forall \mathcal{P}(\mathbf{y}) & \mathcal{C}\mathcal{P} \\ \left[83\right] & \mathcal{P} & (\forall \mathbf{x}) \left[\mathcal{R}(\mathbf{x}) \rightarrow \forall \mathcal{P}(\mathbf{x})\right] & \mathcal{U}\mathcal{G} \\ \end{array}$