

SRI SIVASUBRAMANIYA NADAR COLLEGE OF ENGINEERING

(An Autonomous Institution, Affiliated to Anna University, Chennai)
Rajiv Gandhi Salai (OMR), Kalavakkam – 603 110

THEORY EXAMINATIONS

Register Number	205001085		
Name of the Student	V. Sabashivason		
Degree and Branch	BE CSE	Semester	V
Subject code and Name	UCS1524 Logic Programming		
Assessment Test No.	I	Date	22/9/2022

Details of Marks Obtained

Part A		Part B				Part C			
Question No.	Marks	Question No.	(a)	(b)	Total Marks	Question No.	(a)	(b)	Total Marks
			Marks	Marks			Marks	Marks	
1	✓	7			b	10			8
2	0					11			
3	1	8			40	12			
4	2					13			7
5	1	9			—				
6	0								
Total (A)	b	Total (B)			60	Total (C)			15
Grand Total (A+B+C)					Marks (in words)				
Signature of Faculty					312/50				

PART-C

SSN 3

(10)

$$(i) (\exists x) K(x) \wedge \text{Has}(Ayu, x) \Rightarrow (1)$$

$$(ii) \forall x (\exists y K(y) \wedge \text{Has}(x, y)) \rightarrow AL(x)$$

$$\sim (\forall x (\exists y K(y) \wedge \text{Has}(x, y)) \vee AL(x))$$

$$\exists x (\forall y (\sim K(y)) \wedge \sim \text{Has}(x, y)) \vee AL(x)$$

$$(\exists x \forall y) (\sim K(y) \wedge \sim \text{Has}(x, y)) \vee AL(x)$$

$$(\exists x \forall y) ((\sim K(y) \vee AL(x)) \wedge (\sim \text{Has}(x, y) \vee AL(x)))$$

\$\Leftrightarrow (2)\$

$$(iii) \forall x AL(x) \rightarrow \cancel{\forall y A(y)} \rightarrow \sim \text{Hurts}(x, y)$$

$$\sim (\forall x AL(x)) \vee \forall y A(y) \rightarrow \sim \text{Hurts}(x, y)$$

$$\exists x (\neg AL(x)) \vee \forall y A(y) \rightarrow \sim \text{Hurts}(x, y)$$

$$\exists x (\neg AL(x)) \vee \exists y (\neg A(y)) \vee \sim \text{Hurts}(x, y)$$

$$(\exists x \exists y) (\neg AL(x) \vee \neg A(y) \vee \sim \text{Hurts}(x, y))$$

$$(\exists x \exists y) (\sim (AL(x) \wedge A(y) \wedge \text{Hurts}(x, y)))$$

\$\Leftrightarrow (3)\$

SSN

(IV) Hurts (Ann, Ram) \vee Hurts (Sangay, Ram)
 $\Downarrow (4)$

(V) Puppy (Ram) $\Rightarrow (5)$

(VI) $\forall x$ Puppy (x) $\rightarrow A(x)$

$(\exists x)(\sim \text{Puppy}(x)) \vee A(x)$

$(\exists x)(\sim (\text{Puppy}(x) \wedge \sim A(x))) \Rightarrow (6)$

\Rightarrow Result: Hurts (Sangay, Ram)

\Rightarrow Negate Result: $\sim \text{Hurts}(\text{Sangay}, \text{Ram})$
 $\Downarrow (7)$

\Rightarrow Apply SNF to all CNFs:

(i) $K(A) \wedge \text{Has}(\text{Ann}, A) \Rightarrow (8)$

(ii)

$(\forall y)((\sim K(y) \vee \text{AL}(B)) \wedge (\sim \text{Has}(B, y) \vee \text{AL}(B))) \Rightarrow (9)$

(iii)

$$\neg (\text{AL}(c) \wedge A(d))$$

$$\neg (\text{AL}(c) \wedge A(d) \wedge \text{Hurts}(c, d)) \Rightarrow (10)$$

$$(vi) \neg (\text{Puppy}(e) \wedge \neg A(e)) \Rightarrow (11)$$

\Rightarrow Remove ($\forall y$) from equation (a)

$$(\neg K(y) \vee \text{AL}(B)) \wedge (\neg \text{Has}(B, y) \vee \text{AL}(B))$$

$\Downarrow (12)$

Apply Resolution:

$$\begin{array}{l} K(A) \\ \text{Has(Ann, A)} \\ (\neg K(y) \vee \text{AL}(B)) \\ \neg \text{Has}(B, y) \vee \text{AL}(B) \\ \neg (\text{AL}(c) \wedge A(d)) \\ \text{Hurts}(c, d) \end{array}$$

$$\left| \begin{array}{l} (\neg \text{K}(y) \vee \text{AL}(B)) \\ (\neg \text{Has}(B, y) \vee \text{AL}(B)) \end{array} \right.$$

Hurts (Ann, Ram)

Hurts (Sangay, Ram)

Puppy (Ram)

$\vee(A)$ $\boxed{A/y}$ $\sim K(y) \vee AL(B)$ $AL(B)$ $\boxed{B/c}$ $\sim AL(c) \vee \sim A(D)$ ~~$\sim A(D)$~~ $\text{Has}(Anu, A)$ $\boxed{\begin{matrix} Anu/B \\ A/y \end{matrix}}$ $\sim \text{Has}(B, y) \vee AL(B)$ $AL(B)$ $\sim \text{Hurts}(\text{Sangay}, \text{Ram})$ $\boxed{C/\cancel{\text{Sangay}}, \text{Sangay}/C}$ $\boxed{\text{Ram}/D}$ $\text{Hurts}(C, D)$ $\perp //$

\therefore The inference : " Hurts(Sangay, Ram)
 follows a N-resolution.



(*)

PART-B

$$(9) \Rightarrow ((A \vee (B \vee C)) \sim ((\sim A) \sim))$$

$$\equiv A \vee (B \vee C) \sim (\sim A \sim)$$

$$\equiv A \vee (B \vee C \sim) \vee (B \vee C \sim A)$$

(Distributive law)

$$\equiv A \vee (B \vee C) \vee (B \sim A) \vee C$$

$$\equiv (A \vee (B \vee C)) \vee (F \vee ((B \sim A) \vee C))$$

(Idempotent law)

$$\equiv F \vee (\sim (A \sim B \sim C)) \vee ((B \sim A) \vee C)$$

(De Morgan's Law)

$$\equiv T \wedge (\sim (A \sim B \sim C)) \vee ((B \sim A) \vee C)$$

(Inverse law)

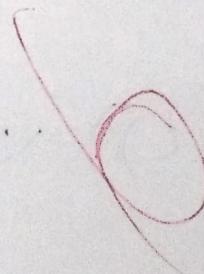
$$\equiv F \vee ((B \wedge \neg A) \vee C)$$

(Idempotent law)

$$\equiv (B \wedge \neg A) \vee C \rightarrow (\text{ip})$$

\therefore The above two formulas
are equivalent

Hence, proved.



8 (q) $(P \rightarrow Q) \rightarrow R$

P	Q	R	$\frac{P \rightarrow Q}{\alpha}$	$\alpha \rightarrow R$
1	1	1	1	1
1	1	0	1	0
1	0	1	0	1
1	0	0	0	1
0	1	1	1	1
0	1	0	1	1
0	0	1	1	0
0	0	0	1	0

CNF:

$$(P \vee Q \vee \neg R) \wedge (\neg P \vee Q \wedge \neg R) \wedge (\neg P \vee \neg Q \wedge R)$$

$$(11) \quad (R \rightarrow S) \rightarrow \neg(S \rightarrow Q)$$

R	S	Q	$\frac{R \rightarrow S}{a}$	$\frac{S \rightarrow Q}{b}$	$\neg b$	$a \rightarrow \neg b$
1	1	1	1	1	0	0
1	1	0	1	0	1	1
1	0	1	0	1	0	1
1	0	0	0	1	0	1
0	1	1	1	1	0	0
0	1	0	1	0	1	1
0	0	1	1	1	0	0
0	0	0	1	1	0	0

CNF:

$$(p \vee q \vee \alpha) \wedge (\neg p \vee q \vee \alpha) \wedge (\neg p \vee \neg q \vee \alpha)$$

$$\wedge (\neg p \vee \neg q \vee \neg \alpha) //$$

HW

PART-A

1

Propositional
logic

Uses truth values such as true or false only.

No usage of quantifiers.

Syntax involves literals and operations.

Using truth table, values can be calculated.

Predicate
logic

Uses values such as true, false or neither of them.

Using of quantifiers.

Syntax involves quantifiers, functions, relations, objects.

No such method.

✓

(2)

Formula: $\neg P \wedge (P \rightarrow Q)$

Semantics:

Negation of P and if
 P holds good, then Q holds good
 for all values.

(3)

(i) $\forall x (\exists y \alpha(x, f(y)) \rightarrow \alpha(x, y))$

\Rightarrow This formula is closed since
 The ~~predicat~~ quantifiers are
 mentioned along with the predicates

(ii) $\forall z \exists x \exists y (q(z, u, g(u, y)) \vee \alpha(u, g(z)))$

\Rightarrow This formula is not closed
 since all quantifiers are mentioned
 outside the main function.

(A)

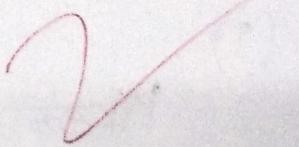
A : There is rain.

B : Climate is cool.

$\Rightarrow I) \text{ If there is rain, then climate is cool}$
 $\text{and if climate is cool, then there is}$
 a rain.

\Rightarrow Proposition logic

$$(A \rightarrow B) \wedge (B \rightarrow A)$$



$$\equiv \frac{(\neg A \vee B) \wedge (\neg B \vee A)}{\Downarrow \text{CNF}} //$$

(5)

Logic Programming is restricted to Horn clause program because logic programming needs all formulas to be converted in simple sub-formulas, whereas in Horn clause, all formulas are stated in terms of implied statements. Hence logic Programming is restricted to Horn clause program.