SL.NO:CAA 156757

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. Sabarivasan		
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) Marks	(b) Marks	Total Marks	Question No.	(a) Marks	(b) Marks	Total Marks
1	2	7			6	10			8
2	0					11			
3	1	8			4½	12			
4	2								
5	1	9			–	13			7
6	0								
Total (A)	6	Total (B)			10½	Total (C)			15

Grand Total (A+B+C)				Marks (in words)			
Signature of Faculty				31½/50			

(10)

(i) $(\exists x)\, K(x) \wedge Has(Anu, x) \Rightarrow (1)$

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

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

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

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

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

$\Rightarrow (2)$

(iii) $\forall x\, AL(x) \rightarrow \forall y\, A(y) \rightarrow \sim Hurts(x, y)$

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

$\exists x (\sim AL(x)) \vee \forall y\, A(y) \rightarrow \sim Hurts(x, y)$

$\exists x\, (\sim AL(x)) \vee \exists y (\sim A(y)) \vee \sim Hurts(x, y)$

$(\exists x\, \exists y)\, (\sim AL(x) \vee \sim (A(y) \vee \sim Hurts(x, y)))$

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

$\Rightarrow (3)$

SSN

(iv) Hurts (Anu, Ram) ∨ Hurts (Sanjay, Ram) ⤷ (4)

(v) Puppy (Ram) ⇒ (5)

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

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

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

⇒ Result: Hurts (sanjay, Ram)

⇒ Negate Result: ~ Hurts (Sanjay, Ram) ⤷ (7)

⇒ Apply SAF to all CNFs:

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

(ii)

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

(iii)

$\cancel{\sim (AL(C) \land A(D))}$

$\sim (AL(C) \land A(D) \land Hurts(C, D))) \Rightarrow (10)$

(vi) $\sim (Puppy(E) \land \sim A(E)) \Rightarrow (11)$

$\Rightarrow$ Remove $(\forall y)$ from equation (9).

$(\sim K(y) \lor AL(B)) \land (\sim Has(B, y) \lor AL(B))$

$\Rightarrow (12)$

Apply Resolution:

$K(A)$

$Has(Anu, A)$

$(\sim K(y) \lor AL(B))$

$\sim Has(B, y) \lor AL(B)$

$\sim (AL(C) \land A(D))$

$Hurts(C, D)$

$Hurts(Anu, Ram)$

$Hurts(Sanjay, Ram)$

$Puppy(Ram)$

$(\sim K(y) \land AL(B))$

$(\sim Has(B, y) \land \lor \land AL(B))$

$K(A)$

A/y

$\sim K(y) \vee AL(B)$

$AL(B)$

B/C

$\sim AL(C) \vee \sim A(D)$

$\cancel{\sim A(D)}$

$Has(Anu, A)$

Anu/B
A/y

$\sim Has(B,y) \vee AL(B)$

$AL(B)$

$\sim Hurts(Sanjay, Ram)$

$\cancel{C/Sanjay}$ $Sanjay/C$
Ram/D

$Hurts(C,D)$

$\perp$ //

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

7

PART - B

(i) $\Rightarrow$ $((A \vee (B \vee C)) \wedge ((C \vee \sim A))$

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

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

(Distributive law)

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

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

(Idempotent law)

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

(De Morgan's Law)

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

(Inverse law)

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

(Idempotent law)

$\equiv (B \wedge \neg A) \vee C \Rightarrow$ (ii)

$\therefore$ The above two formulas are equivalent

Hence, proved.

6

(8) (a) $(P \to Q) \to R$

P	Q	R	$\frac{P \to Q}{a}$	$a \to R$
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	0
0	0	1	1	1
0	0	0	1	0

CNF:

$(p \vee q \vee \sim r) \wedge (\sim p \vee q \vee \sim r) \wedge (\sim p \vee \sim q \vee \sim r)$ //

(ii) $(R \to S) \to \sim(S \to Q)$

R	S	Q	$\underset{a}{R \to S}$	$\underset{b}{S \to Q}$	$\sim b$	$a \to \sim b$
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:

$$(p \vee q \vee r) \wedge (\sim p \vee q \vee r) \wedge (\sim p \vee \sim q \vee r)$$
$$\wedge (\sim p \vee \sim q \vee \sim r) \; //$$

PART-A

(1)

Propositional logic	Predicate logic
Uses truth values such as true or false only.	Uses values such as true, false or neither of them.
No usage of quantifiers.	Using quantifiers.
Syntax involves literals and operations.	Syntax involves quantifiers, functions, relations, objects.
Using truth table, values can be calculated.	No such method.

2

(2) Formula: $\sim P \wedge (P \rightarrow Q)$

Semantics:

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

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

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

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

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

SSN 13

(4)

A : there is rain.

B : climate is cool.

⇒ If there is rain, then climate is cool and if climate is cool, then there is a rain.

⇒ Propposition logic

$(A \to B) \wedge (B \to A)$

$\equiv (\sim A \vee B) \wedge (\sim B \vee A)$ //

⇓

CNF

2

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