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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: CS367

Course Name: LOGIC FOR COMPUTER SCIENCE

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1		Write the algorithm for the in-order traversal of the tree for obtaining the string associated with a formula	(3)
2		Check the satisfiability using resolution rule S= { p¬q, q¬r ,rs ,p¬s}	(3)
3		Construct the Semantic Tableaux for (A V B) ∧ (¬A ∧ ¬B)	(3)
4		Prove ⊢ (¬P→false)→P in Hilbert System	(3)

PART B

Answer any two full questions, each carries 9 marks.

5	a)	Draw the formation tree and construct the truth tables for the (P0 ∧ P1)→(P2 V (P1 ↔¬P0))	(4)
	b)	Explain the procedure for resolution of Propositional Logic Formula	(5)
6	a)	Prove with the necessary steps the statement: "Every formula in CNF can be transformed into an equivalent formula in 3CNF."	(6)
	b)	Convert the following into 3CNF [(A V ¬B) ∧ (¬A → B) ∧ (¬B)]	(3)
7	a)	Prove ⊢A V (B ∧ C) → (A V B) ∧ (A V C) in Gentzen System	(5)
	b)	Write axioms and all rules used in Hilbert System	(4)

PART C

Answer all questions, each carries 3 marks.

8		Define an atomic formula in First Order Logic with examples	(3)
9		Prove ⊢ ∀xA(x) → ∃xA(x) in H for First Order Logic Formulas.	(3)

10 Define ground term, ground literal ,ground formula and instances with examples (3)

11 What do you mean by a Herband Base? Find the Herband base for the formula S={{¬p(a,f(x,y))},{p(b,f(x,y))}} (3)

PART D

Answer any two full questions, each carries 9 marks.

12 a) Write the derivation for ∀x(¬∃y P (x,y) V ¬∃y P(y,x)) using the formal grammar for First order logic Formulas (5)

b) Using Skolem's Algorithm transform into clausal form (4)

∀x y(∃z P(z) ∧ ∃u(Q(x,u) → ∃v Q(y,v)))

13 a) Let : Θ={x←f(g(y)),y←u,z←f(y)}, σ ={ u←y,y←f(a),x←g(u)} , (6)

E= p(x,f(y),g(u),z).Show that E(Θσ)=(EΘ)σ

b) Unify the following pairs of atomic formulas if possible: (3)

P(a,x,f(g(y))), P(y,f(z),f(z)))

P(x,g(f(a)),f(x)),P(f(a),y,y)

14 a) Construct the semantic tableaux for the formula (4)

∀x(P(x) V Q(x)) →(∀x P(x) V ∀x Q(x))

b) Construct the Reduced BDD for the formula (P V (Q ∧ R)) (5)

PART E

Answer any four full questions, each carries 10 marks.

15 a) Define the syntax and Semantics for the Temporal logic (4)

b) Write the algorithm for Construction of Semantic Tableaux of LTL and Construct the tableau for(P V Q) ∧ O(¬P ∧ ¬Q) (6)

16 a) Prove ⊢ O(P ∧ Q) ↔ (OP ∧ OQ) (6)

b) Define the Deductive Systems £ for LTL (4)

17 a) What is a state transition diagram? Explain with an example. (4)

b) Explain how interpretations-are defined in PTL. Define satisfiability and validity of formulas in PTL. (6)

18 a) Define the Deductive System Hoare Logic($\mathcal{HL}$) and the rules used in the system (5)

b) What is the total correctness of a program? Explain using example (5)

19 a) Define axiomatic system in KC and mention the axiom schemes in KC. (4)

b) What is Program Synthesis? Explain the process for following program for finding the integer square root of a non-negative integer expressed as: (6)

$\{0 \leq a\}S\ \{0 \leq x^2 \leq a < (x+1)^2\}$

20 a) Explain the concept of program verification with a sample program. (4)

b) Give "weakest" preconditions **P** for the following: (6)

(i) {**P**} $x := x + 2$ $\{x \geq 5\}$

(ii) {**P**} if $(y < 0)$ then $x := x+1$ else $x := y$ $\{x > 0\}$

(iii) {**P**} while $(x \leq 5)$ do $x := x+1$ $\{x = 6\}$

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