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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 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 Using Truth table check whether the given statement is valid or not. (3)
"If it rains there won't be cricket match and cricket will be played if no rain"

2 Prove $((A \rightarrow B) \rightarrow A) \rightarrow A$ in Hilbert system (3)

3 Convert the formula $[(a \vee b) \wedge (d)]$ into 3CNF . (3

4 Draw the tree representation of the formula $(p \rightarrow (q \rightarrow r)) \rightarrow ((p \rightarrow q) \rightarrow (p \rightarrow r))$ (3)

PART B

Answer any two full questions, each carries 9 marks.

5 a) Explain the clausal representation of propositional formulas and the concept of resolution. (5)

b) Resolve the set of clauses, $S_1 = \{pqr, \neg q, p\neg rs, qs, p\neg s\}$ and $S_2 = \{p \neg q, q\neg r, rs, p \neg s\}$ (4)

6 a) Prove $\vdash (A \rightarrow B) \rightarrow [(B \rightarrow C) \rightarrow (A \rightarrow C)]$ in Hilbert system. (5)

b) Explain the following cases for a Propositional logic formula i) Satisfiability ii) Validity iii) Falsifiability iv) Contradiction (4)

7 a) Give an algorithm to construct semantic tableaux for Propositional Logic formula. (5)

b) Prove that construction of semantic tableaux for a formula A in propositional logic always terminates. (4)

PART C

Answer all questions, each carries 3 marks.

8 Construct the formation tree for the formula $\exists x(\neg\forall y\, P(x,y) \wedge \neg\forall y\, P(y,x))$ (3)

9 Define any 3 possible interpretations for the formula $\exists x\, P(a,x)$ and find the truth value of the formula under each of the interpretations. (3)

10 Explain the concept of ground resolution with an example. (3)

11 What are Herbrand bases?. Give the Herbrand bases for the following set of clauses $S=\{ P(a, f(x,y)) , \neg P(b, f(x,y))\}$ (3)

PART D

Answer any two full questions, each carries 9 marks.

12 a) What is the relevance of Binary Decision Diagrams? (3)

b) Create a reduced ordered BDD for the formula $(p \vee q) \wedge (\neg q \vee r)$ with an order (p,q,r). Check the satisfiability of the formula. (6)

13 a) Write down the algorithm for construction of semantic tableaux for first-order logic. (5)

b) Using tableaux check the satisfiablility of the formula $\forall x\, (p(x) \vee q(x)) \rightarrow (\forall x\, p(x) \vee \forall x\, q(x))$ (4)

14 a) Explain unification algorithm (4)

b) Check whether the following sets of clauses are unifiable with the help of unification algorithm (5)

$\{p(f(a), f(x,y,z)), \neg p(x, f(y,f(a),g(b))\}$

If unifiable find out most general unifier σ.

PART E

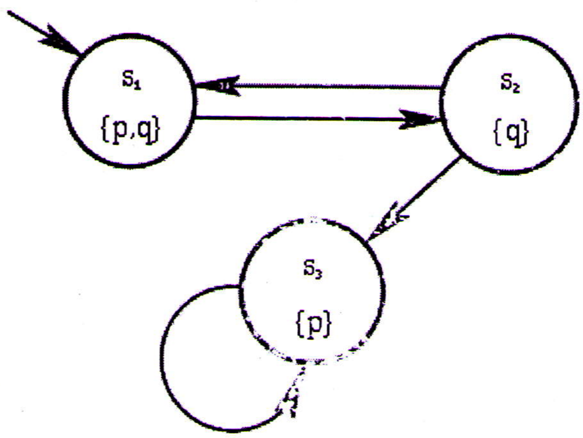
Answer any four full questions, each carries 10 marks.

15 a) What are the similarities and differences between PTL and LTL formulas. (4)

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

16 a) Explain PTL formulas with examples. What are the operators used in PTL (5)

b) Check the satisfiability of the formula $\Diamond p \wedge \Box q$ for the following state transition diagram given (5)



17 a) Explain the algorithm for construction of semantic tableaux for LTL formulas (5)

b) Check the satisfiability of $(p \wedge q) \wedge \bigcirc(\neg p \vee \neg q)$ using semantic tableaux (5)

18 a) Explain correctness of formulas with an example. (4)

b) Explain the axioms of Hoare Logic. (6)

19 a) Use Hoare Logic to prove partial correctness of following program (7)

$\{a \geq 0\}$

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x = 0; y = 1;
while (y <= a)
{
x = x + 1;
y = y + 2*x + 1;
}
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$\{0 \leq x^2 \leq a < (x+1)^2\}$

b) How to perform program synthesis using program correctness? (3)

20 a) Explain axiom schemes and axiomatic systems in KC. (6)

b) Draw the parse tree for $\Box(\Diamond(\neg p \leftrightarrow p) \wedge (\Box(p \rightarrow q) \vee \neg q))$ (4)

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