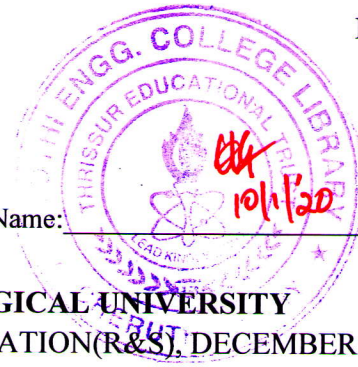


Reg No.: _____

Name: _____



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 $S = \{ p \neg q, q \neg r, rs, p \neg s \}$ | (3) |
| 3 | Construct the Semantic Tableaux for $(A \vee B) \wedge (\neg A \wedge \neg B)$ | (3) |
| 4 | Prove $\vdash (\neg P \rightarrow \text{false}) \rightarrow P$ in Hilbert System | (3) |

PART B

Answer any two full questions, each carries 9 marks.

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|---|---|-----|
| 5 | a) Draw the formation tree and construct the truth tables for the $(P0 \wedge P1) \rightarrow (P2 \vee (P1 \leftrightarrow \neg P0))$ | (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 $[(A \vee \neg B) \wedge (\neg A \rightarrow B) \wedge (\neg B)]$ | (3) |
| 7 | a) Prove $\vdash A \vee (B \wedge C) \rightarrow (A \vee B) \wedge (A \vee C)$ 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 $\vdash \forall x A(x) \rightarrow \exists x A(x)$ 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 Herbrand Base? Find the Herbrand base for the formula (3)
 $S = \{\{\neg p(a, f(x, y))\}, \{p(b, f(x, y))\}\}$

PART D

Answer any two full questions, each carries 9 marks.

- 12 a) Write the derivation for $\forall x(\neg \exists y P(x, y) \vee \neg \exists y P(y, x))$ using the formal (5)
 grammar for First order logic Formulas
- b) Using Skolem's Algorithm transform into clausal form (4)
 $\forall x y(\exists z P(z) \wedge \exists u(Q(x, u) \rightarrow \exists v Q(y, v)))$
- 13 a) Let : $\Theta = \{x \leftarrow f(g(y)), y \leftarrow u, z \leftarrow f(y)\}$, $\sigma = \{u \leftarrow y, y \leftarrow f(a), x \leftarrow g(u)\}$, (6)
 $E = p(x, f(y), g(u), z)$. Show that $E(\Theta\sigma) = (E\Theta)\sigma$
- 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)
 $\forall x(P(x) \vee Q(x)) \rightarrow (\forall x P(x) \vee \forall x Q(x))$
- b) Construct the Reduced BDD for the formula $(P \vee (Q \wedge R))$ (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 (6)
 Construct the tableau for $(P \vee Q) \wedge \bigcirc(\neg P \wedge \neg Q)$
- 16 a) Prove $\vdash \bigcirc(P \wedge Q) \leftrightarrow (\bigcirc P \wedge \bigcirc Q)$ (6)
 b) Define the Deductive Systems \mathcal{L} 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 (6)
 of formulas in PTL.
- 18 a) Define the Deductive System Hoare Logic(\mathcal{HLL}) and the rules used in the (5)
 system
- 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) $\{P\} \text{if } (y < 0) \text{ then } x := x+1 \text{ else } x := y \{x > 0\}$
 - (iii) $\{P\} \text{while } (x \leq 5) \text{ do } x := x+1 \{x = 6\}$
