



H1

H5863

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH (HONS.) DEGREE EXAMINATION, DECEMBER 2017/18
(Common to 2015 and 2016 admissions)
Course Code: CS367

Course Name: LOGIC FOR COMPUTER SCIENCE

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks.

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| 1 What is partial interpretation for formula in Propositional Logic?. Give an example. (3) | (3) |
| 2 Define satisfiability, validity and logical consequence of a Propositional Logic formula. (3) | (3) |
| 3 Write the transitivity and contrapositive rule of Hilbert deductive system for Propositional Logic. (3) | (3) |
| 4 Give the steps for converting any Propositional Logic formula into CNF form (3) | (3) |

PART B

Answer any two full questions, each carries 9 marks.

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| 5 a) Write an algorithm to convert tree structure of Propositional Logic formula into string form. (4) | (4) |
| b) Construct a semantic tableaux for $(p \vee q) \wedge (\neg p \wedge \neg q)$ and decide its validity, satisfiability. (5) | (5) |
| 6 a) Prove $\vdash (A \rightarrow B) \rightarrow [(B \rightarrow C) \rightarrow (A \rightarrow C)]$ in Hilbert system. (5) | (5) |
| b) Prove that an empty clause is unsatisfiable and an empty set of clauses is valid. (4) | (4) |
| 7 a) Give an algorithm to construct semantic tableaux for Propositional Logic formula. (4) | (4) |
| b) What is 3CNF formula? Write an algorithm to convert CNF to 3CNF. (5) | (5) |

PART C

Answer all questions, each carries 3 marks.

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| 8 What are the dualities in Predicate Logic? (3) | (3) |
| 9 Check the truth values of the formula $A = \forall x p(a, x)$ under the Interpretations (3) | (3) |
| (i) $I_1 = (N, \{\leq\}, \{0\})$ (ii) $I_2 = (N, \{\leq\}, \{1\})$ (iii) $I_3 = (Z, \{\leq\}, \{0\})$. | |
| 10 Define Herbrand universes. Give one example. (3) | (3) |
| 11 Prove that ground resolution is sound and complete. (3) | (3) |

PART D

Answer any two full questions, each carries 9 marks.

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| 12 a) Construct a BDD for $A = p \oplus q \oplus r$ and then reduce it. (5) | (5) |
| b) What is a OBDD?. How to use OBDD to check $A \models B$?. (4) | (4) |
| 13 a) Write all the axioms and rules of inference of Hilbert deduction system for Predicate Logic. (4) | (4) |

- b) Write the unification algorithm. (5)
- 14 a) What is ground resolution rule? (4)
- b) What are the issues we encounter while constructing semantic tableaux for Predicate Logic? (5)

PART E

Answer any four full questions, each carries 10 marks.

- 15 a) If M is a model of K and x is a model proposition, what is the condition for $M \models x$? Give an example for such model and model proposition. (4)
- b) Let $M=(W, R, \Phi)$, where $W=\{u,v,w\}$, $R=\{(u,w),(u,v),(v,v),(v,w),(w,v)\}$, and $\Phi(u)=\{q\}$, $\Phi(v)=\{p,q\}$ and $\Phi(w)=\{p\}$. Draw the graph of the given model. Which of the following hold? (6)
- i) $M \models \Box(p \wedge q) \rightarrow (\Box p \wedge \Box q)$ ii) $M \models \Box p \wedge \Box q \rightarrow \Box(p \wedge q)$
- 16 a) $M=(W,R, \emptyset)$ be the model with $W=\{w,u\}$, $R=\{(w,u),(u,u)\}$, $\emptyset(w)=\emptyset$ and $\emptyset(u)=\{p\}$ for atomic p . Are the mps P , $\Box P$, $\Box\Box P$, $\Box P \rightarrow \Box\Box P$, $\Box\Box P \rightarrow P$ true at the world u ? (5)
- b) Define modal proposition, world and model of K (5)
- 17 a) List the laws in K . (5)
- b) i) Which are axiom schemes and rule of inference of KC ? (5)
- ii) Also write the rule of regularity in KC .
- 18 a) Define partial correctness of a program? Prove the partial correctness of a sample program. (10)
- 19 a) What is state transition diagram?. Explain with an example. (5)
- b) Define the deductive system for Linear Temporal Logic and write the derived rules in this system. (5)
- 20 a) Construct a tableaux and find a model for the negation of $\Box\Diamond p \rightarrow \Diamond\Box p$ (5)
- b) Define Linear Temporal Logic. How interpretation is done for an LTL formula (5)
