II/IV B.Tech. DEGREE EXAMINATIONS, NOV/DEC- 2019
Second Semester
CSE/IT
LOGIC FOUNDATIONS OF COMPUTER SCIENCE

Time: Three Hours **Maximum marks:60**

Answer Question No.1 Compulsory **6X2=12 M**

Answer ONE Question from each Unit **4X12=48 M**

1. a) Brief on CNF and DNF

   b) Prove that p, p $\to$ q , q $\to$ r $\Rightarrow$ r.

   c) Give examples for conjuction & disjunction

   d) What is an Universal quantifier

   e) Weakest precondition for x=a+5 to get post condition x=10

   f) Give general form of 'if' command

UNIT-I

2. a) Obtain the principal disjunctive and conjunctive normal forms of the formula

   $$(\sim P \lor \sim Q) \to (P \leftrightarrow \sim Q)$$

   b) Prove that the proposition: $(P \to Q) \to (P \land Q)$ is a Contingency.

(OR)

3. a) Obtain PDNF and PCNF of the following formula $(\sim P \lor \sim Q) \to (P \leftrightarrow \sim Q)$

   b) Verify the validity of the following argument: Lions are dangerous animals, There are lions, There are dangerous animals.

UNIT-II

4. Write the quantifiers of the following statements, where predicate symbols denotes, F(x): x is fruit, V(x):x is vegetable and S(x,y):x is sweeter than y.

   a) Some vegetable is sweeter than all fruits.

   b) Every fruit is sweeter than all vegetables

c) Every fruit is sweeter than some vegetables

d) Only fruits are sweeter than vegetables

(OR)

5 a) Show that $R \wedge (PVQ)$ is a valid conclusion from premises PVQ, Q->R; P->M and ~M.

b) Explain the use of predicates with suitable examples.

UNIT-III

6. Explain the steps in converting an expression to prenex normal form. Find the prenex normal form of $\forall x \left(\exists y\ R(x,y) \wedge \forall y \neg S(x,y) \rightarrow \neg(\exists y\ R(x,y) \wedge P) \right)$

(OR)

7. Explain Dijkstra's Weakest Precondition Calculus technique for proving properties of imperative programs. What is meant by weakest pre and post condition. Find the weakest precondition to achieve weakest post condition {x=y} for the following statements.

$x = y + 1;$
if $(y >0)$ then $x = x + y$
else $x= y + 100;$
$x = x + y;$

UNIT-IV

8. What is a guarded command? Give the need of guarded commands. Explain why non-determinacy is particularly important for concurrent programs.

(OR)

9. a) Explain the purpose of a predicate transformer. Give properties of Wp.

b) Explain the Laws for Predicate Calculation.

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II/IV B.Tech. DEGREE EXAMINATIONS, APRIL/MAY- 2019
Second Semester
CSE/IT
LOGIC FOUNDATIONS OF COMPUTER SCIENCE

Time: Three Hours **Maximum marks:60**

Answer Question No.1 Compulsory **12X1=12 M**

Answer ONE Question from each Unit **4X12=48 M**

1. Briefly explain following

   a) What are well formed formulas?

   b) How to interpret the formula in predicate logic?

   c) Applications of propositional calculus.

   d) How to asses program correctness?

   e) Define reasoning

   f) What are free and bound variable?

   g) Principle of inclusion

   h) What is need of predicate transformer?

   i) What are guarded commands?

   j) Define contrapositive of $p \rightarrow q$

   k) Applications of resolution principle.

   l) Compare CNF and DNF.

UNIT-I

2. a) Explain the procedure of converting arbitrary propositional formula to DNF.

   b) Reduce the formula to Conjunctive Normal Form (CNF) $\neg(\neg p \vee q) \vee (r \rightarrow \neg s)$

(OR)

3. Formalize the following English sentences as Propositional logic formulas.

   a) "When the front and back doors are closed then the light is off"

   b) "Either the lift doors are open or the lift is moving and the lift doors are closed".

P.T.O

UNIT-II

4. a) What is substitution principle in predicate logic? Why is it used?

   b) What is the logical translation of the following statement?

   "None of my friends are perfect"

   c) What is the negation of

   $$\left[\forall x,\ \alpha \rightarrow \left(\exists y, \beta \rightarrow \left(\forall u,\ \exists v,\ y\right)\right)\right]$$

   (OR)

5. a) Prove that "Fido will die." from the statements "Fido is a dog."

   "All dogs are animals." and

   "All animals wiil die."

   b) Discuss about various steps in converting to clause fgorm.

UNIT-III

6. Describe the algorithm for converting any expression to prenex normal form. Convert the following to Prenex Normal Form

   i) $\left(\forall x\ \exists y\ P\left(x, y\right) \leftrightarrow \exists x\ \exists y\ \exists z\ R\left(x, y, z\right)\right)$

   ii) $\neg\left(\forall x\ P\left(x\right) \lor \forall x\ Q\left(x\right)\right)$

   (OR)

7. Describe the proof rules for while and repeat until statements.

UNIT-IV

8. a) Why there is a need for strong guards? Justify.

   b) Give the weakest precondition of if-related theorem.

   (OR)

9. a) List and explain the properties of weakest precondition.

   b) Illustrate the weakest precondition of do statement.