



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – MATHEMATICS

SIXTH SEMESTER – NOVEMBER 2016

MT 6608 – DISCRETE MATHEMATICS

Date: 16-11-2016

Dept. No.

Max. : 100 Marks

Time: 09:00-12:00

PART – A

ANSWER ALL QUESTIONS

(10 x 2 = 20)

1. Give the truth table for the disjunction operation.
2. Write in symbolic form: The crop will be destroyed if there is a flood.
3. What is a disjunctive normal form?
4. Define Tautology.
5. What is a monoid?
6. Define semigroup homomorphism.
7. Define a lattice.
8. Give the Idempotent and Absorption laws of Lattices.
9. Define a Boolean Algebra.
10. What is a sub – Boolean algebra?

PART – B

ANSWER ANY FIVE QUESTIONS.

(5 x 8 = 40)

11. Construct the truth table for the formula $(P \wedge (P \rightarrow Q)) \rightarrow Q$.
12. Show that $((P \vee Q) \wedge \neg(\neg(P \wedge (\neg Q \vee \neg R)))) \vee (\neg P \wedge \neg Q) \vee (\neg P \wedge \neg R)$ is a tautology.
13. Find the principal conjunctive normal form of $(P \wedge Q) \vee (\neg P \wedge R)$.
14. Show that $S \vee R$ is tautologically implied by $(P \vee Q) \wedge (P \rightarrow R) \wedge (Q \rightarrow S)$.
15. Prove that the composition of semigroup homomorphisms is also a semigroup homomorphism.
16. Prove the isotonicity properties of lattices.
17. Prove the distributive inequalities on Lattices.
18. Define the switching algebra and show that it is a Boolean algebra.

PART – C

ANSWER ANY TWO QUESTIONS.

(2 x 20 = 40)

19. (i) Show that $(\neg P \wedge (\neg Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$.
(ii) Show that if any two formulas are equivalent then their duals are also equivalent to each other.
20. (i) Show that the following premises are inconsistent:
 - I. If Jack misses many classes through illness, then he fails in high school.
 - II. If Jack fails high school, then he is uneducated.
 - III. If Jack reads a lot of books, then he is not uneducated.
 - IV. Jack misses many classes through illness and reads a lot of books.(ii) Establish the existence of a homomorphism from the free semigroup with n generators to any semigroup with n generators.
21. (i) Prove that the set of idempotent elements of any commutative monoid M form a submonoid.
(ii) Define a sublattice of a lattice and show that every interval of a lattice is a sublattice.
22. (i) Write the following Boolean expressions in an equivalent sum – of- products canonical form in three variables x_1, x_2 and x_3 : (a) $x_1 * x_2$; (b) $x_1 \oplus x_2$; (c) $(x_1 \oplus x_2) * x_3$.
(ii) What is binary valuation process? How do you use this process to show the equivalence of two Boolean expressions?
