B **B3B036S** **Pages: 2**

Reg. No.____________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER BTECH DEGREE EXAMINATION JULY 2017

Course Code**: CS 201**

Course Name**: DISCRETE COMPUTATIONAL STRUCTURES (CS, IT)**

Max Marks: 100 Duration: 3 hrs

PART A

Answer all questions, 3marks each.

1. Draw the Hasse diagram for the divisibility relation on the set A ={2,3,6,12,24,36}
2. Define equivalence relation? Give an example of a relation that is not an equivalence relation?
3. In how many different ways can the letters of the word 'MATHEMATICS' be arranged such that the vowels must always come together?
4. Define homomorhism and isomorphism?

PART B

Answer any 2 Questions, 9 marks each.

5. (a) Consider f,g and h are functions on integers $f(n) = n^2$, $g(n) = n + 1$, $h(n) = n-1$. Determine i) fogoh ii) gofoh iii) hofog (6)

   (b) State Pigeonhole Principle. Prove that at least two of the children were born on the same day of the week. (3)
6. (a) Solve the recurrence relation $a_n = 4a_{n-1} - 4a_{n-2} + (n+1)\,2^n$ (6)

   (b) Show that set of all integers is countable (3)
7. (a) Find the number of integers between 1 and 250 both inclusive that are not divisible by any of integers 2,3,5 and 7. (5)

   (b) If * is the binary operation on the set R of real numbers defined by a*b=a+b+2ab. Find if { R, *} is a semigroup. Is it commutative? (4)

PART C

Answer all questions, 3marks each.

8. Show that the set {1,2,3,4,5} is not a group under addition modulo 6.
9. Prove that every distributive lattice is modular.
10. Show that the set Q+ of all positive rational numbers forms an abelian group under the operation * defined by a*b= ½ ab; a,b ε Q+
11. Simplify the Boolean expression $a'b'c + ab'c + a'b'c'$

PART D

Answer any 2 Questions, 9 marks each.

12. For the set $I_4=\{0,1,2,3\}$,show that modulo 4 system is a ring. (9)
13. a) Prove that the order of each sub group of a finite group G is a divisor of the order of group G. (6)

    b) If A = (1 2 3 4 5) and B = (2 3)(4 5). Find product of permutation AB. (3)
14. If (L, ≤) is a lattice, then for any a,b,c εL, the following properties hold. If b ≤ c, then i) a v b ≤ a v c ii) a ^ b ≤ a ^ c (9)

PART E

Answer any 4 Questions, 10 marks each.

15. (a) Show that (P→Q) ∧ (Q→P) is logically equivalent to P↔Q. (5)

    (b) Suppose x is a real number. Consider the statement "If $x^2 = 4$, then $x = 2$." Construct the converse, inverse, and contrapositive (5)
16. (a) Prove that (P∧Q) → (P↔Q) is a tautology. (5)

    (b) Show that (a v b) follows logically from the premises $p \vee q$, $(p \vee q) \rightarrow \neg r$, $\neg r \rightarrow (s \wedge \neg t)$ and $(s \wedge \neg t) \rightarrow (a \vee b)$ (5)
17. (a) Represent the following sentence in predicate logic using quantifiers i) All men are mortal. ii) Every apple is red iii) Any integer is either positive or negative. (6)

    (b) Use the truth table to determine whether p →(q∧˥q) and ˥p are logically equivalent. (4)
18. Show that the premises "one student in this class knows how to write programs in JAVA" and "Everyone who knows how to write programs in JAVA can get a high paying job" imply the conclusion "Someone in this class can get a high paying job" (10)
19. (a) Prove the following statement by contraposition:

    If a product of two positive real numbers is greater than 100, then at least one of the numbers is greater than 10. (6)

    (b) Express the negation of the following statement in English using quantifiers

    i) If the teacher is absent, then some students do not keep quiet ii) All students keep quiet and teacher is present. (4)
20. (a) Prove that √2 is irrational using proof by contradiction. (6)

    (b) Find the truth table (∼ Q ⇒∼P) ⇒ (P ⇒ Q) (4)

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