

**IS305**

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**M S RAMAIAH INSTITUTE OF TECHNOLOGY**

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE – 560 054

**SEMESTER END EXAMINATIONS – January 2013**

Course & Branch	: B.E.- Information Science and Engineering	Semester	: III
Subject	: Discrete Mathematical Structures	Max. Marks	: 100
Subject Code	: IS305	Duration	: 3 Hrs

**Instructions to the Candidates:**

- Answer one full question from each unit.

**UNIT – I**

1. a) In a survey of 260 college students, the following data were obtained: 64 had taken a math's course, 94 had taken a Computer course, 58 had taken a Business course, 28 had taken both a Mathematics and a Business course, 26 had taken both a Mathematics and Computer course, 22 had taken both a Computer and a Business course and 14 had taken all three types of courses. (08)
  - i) How many students taken none of the three types of courses?
  - ii) How many had taken only a Computer course?
  - iii) How many had taken exactly one of the subjects?
  - iv) How many had taken at least two subjects?
- b) Let  $n$  be an integer. Using Indirect method of proof, show that if  $n^2$  is odd, then  $n$  is odd. (06)
- c) If statement  $q$  has the truth value 1, Determine all truth value assignments for the primitive statements  $p$ ,  $r$  and  $s$  for which the truth value of the statement  $(q \rightarrow ((\sim p \vee r) \wedge \sim s)) \wedge (\sim s \rightarrow (\sim r \wedge q))$  is true. (06)
2. a) Define Sequence, Characteristic Functions, Regular expressions. Give one example for each. (06)
- b) Using Mathematical induction, Prove that  $1 + 2^1 + 2^2 + \dots + 2^n = 2^{n+1} - 1$  (06)
- c) Discuss two types of Quantifiers with an example for each. (04)
- d) Suppose that the symmetric difference of  $A$  and  $B$  is equal to symmetric difference of  $A$  and  $C$ . Does this guarantee that  $B=C$ ? Justify your conclusion. (04)



**UNIT – II**

3. a) How many different ways can  $n$  people are seated around a circular table? (06)  
Justify your answer for  $n=3$
- b) Define the following relation and give one example for each (06)
- i) Irreflexive relation
  - ii) Anti symmetric relation
  - iii) Connectivity relation
- c) Define Equivalence relation. Let  $S=\{1,2\}$  and  $A=S \times S$ . Define the following (08)  
relation  $R$  on  $A$ :  $(a, b) R (a', b')$  if and only if  $a + b = a' + b'$ . Show that  $R$  is  
an Equivalence relation and also compute  $A/R$
4. a) Define Pigeonhole principle. How many friends must you have to guarantee (06)  
at least five of them will have birthdays in the same month?
- b) List all partition of the set  $A=\{a, b, c\}$ . Write any three Equivalence relation (06)  
on  $A$  induced by partition.
- c) Differentiate between Explicit and Recursive formulas. Solve the Recurrence (08)  
relation to find  $n$ th Fibonacci number

**UNIT – III**

5. a) With an example explain the following types of Functions: (06)  
Everywhere defined, onto, Invertible
- b) Let  $A=\{1,2,3,4,5,6\}$  and  $p$  is a permutation where  $p=\{(1,4), (2,3), (3,5), (4,1), (5,2), (6,6)\}$ . Write  $p$  as a product of disjoint cycles. Find the (07)  
period of  $p$ , that is the smallest positive integer  $k$  such that  $p^k$  is an identity  
permutation. Also compute inverse of  $p$ .
- c) Define Lattice. Is the Poset  $A= \{2,3,6,12,24,36,72\}$  under the relation of (07)  
divisibility a Lattice? Justify your answer.
6. a) Discuss the application of hashing Functions. (06)
- b) Define Partial order relation. Let  $S= \{a,b,c\}$  and  $A= P(S)$ . Draw the Hasse (06)  
diagram of the Poset  $A$  with the Partial order set inclusion
- c) With an example define the following elements related to Hasse diagram. (08)
- i) Least element      ii) Greatest element      iii) Maximal element
  - iv) Minimal element      v) Upper bound      vi) Lower bound
  - vii) Least Upper bound      viii) Greatest lower bound

**UNIT – IV**

7. a) Define Graph. Show that an undirected graph has an even number of vertices of odd degree. (06)
- b) When can we say two graphs are Isomorphic? Give an example for isomorphic graphs (06)
- c) Write a note on: (08)
- i) Hamilton path and circuits
  - ii) Adjacency and Incidence matrices
8. a) Define Bipartite graph. Discuss some applications of special types of Graphs. (06)
- b) Define Euler circuit and Euler path. What are the necessary and sufficient conditions for Euler circuits and paths. (06)
- c) Discuss Isomorphism and Homomorphism between two semi groups. Let  $(S, *)$  and  $(T, *)'$  be monoids with identities  $e$  and  $e'$  respectively. Let  $f: S \rightarrow T$  be an isomorphism. Then show that  $f(e) = e'$  (08)

**UNIT – V**

9. a) Define Abelian Group. Let  $G$  be the set of all non zero real numbers and let  $a * b = ab/2$ . Show that  $(G, *)$  is an Abelian group (06)
- b) Define Commutative Ring. Let  $R$  be a commutative ring with identity  $0$  and multiplicative identity  $1$ . Then show that, For any  $x$  in  $R$ ,  $0 * x = 0$  and for any  $x$  in  $R$ ,  $-x = (-1) * x$  (06)
- c) Write a note on: (08)
- i) Fermat's Little theorem
  - ii) Monoids
10. a) Define Group. Let  $G$  be a group. Show that each element  $a$  in  $G$  has only one inverse in  $G$ . (06)
- b) Define Field. What are the properties of Field. (06)
- c) Write a note on: (08)
- i) Encoding Function
  - ii) Hamming distance

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