Code No: I5801/R16

M. Tech. I Semester Regular Examinations, December -2016

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Computer Science & Engineering (58)

Time: 3 Hours **Max. Marks: 60**

Answer any FIVE Questions
All Questions Carry Equal Marks

1. a Use De Morgan's laws to find the negation of each of the following statements. 6 M
   (a) Jan is rich and happy.
   (b) Carlos will bicycle or run tomorrow.
   (c) Mei walks or takes the bus to class.
   (d) Ibrahim is smart and hard working.

   b Using truth tables, 6 M
   (a) Show that $p \leftrightarrow q$ and $(p \wedge q) \vee (\neg p \wedge \neg q)$ are logically equivalent.
   (b) Show that $(p \wedge q) \rightarrow r$ and $(p \rightarrow r) \wedge (q \rightarrow r)$ are not logically equivalent.

2. a Let f be a function from the set A to the set B. We denote the inverse image of S by $f^{-1}(S)$, so that $f^{-1}(S) = \{a \in A / f(a) \in S\}$.Let S and T be subsets of B. Show that 6 M
   (i) $f^{-1}(S \cup T) = f^{-1}(S) \cup f^{-1}(T)$
   (ii) $f^{-1}(S \cap T) = f^{-1}(S) \cap f^{-1}(T)$.

   b For each of the following relations on the set {1, 2, 3, 4}, list the properties of each relation. (reflexive, symmetric, antisymmetric, irreflexive, asymmetric, or transitive) 6 M
   a. {(2, 2), (2, 3), (2, 4), (3, 2), (3, 3), (3, 4)}
   b. {(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (4, 4)}
   c. {(2, 4), (4, 2)}
   d. {(1, 2), (2, 3), (3, 4)}
   e. {(1, 2), (2, 2), (3, 3), (4, 4)}
   f. {(1, 3), (1, 4), (2, 3), (2, 4), (3, 1), (3, 4)}.

3. a i. How many bit strings are there of length six or less? 6 M
   ii. How many strings of four decimal digits
   (a) do not contain the same digit twice?
   (b) end with an even digit?
   (c) have exactly three digits that are 9s?
   iii. How many numbers must be selected from the set $\{1; 3; 5; 7; 9; 11; 13; 15\}$ to guarantee that at least one pair of these numbers add up to 16?

   b Discuss the principles of Inclusion – Exclusion & give its applications. 6 M

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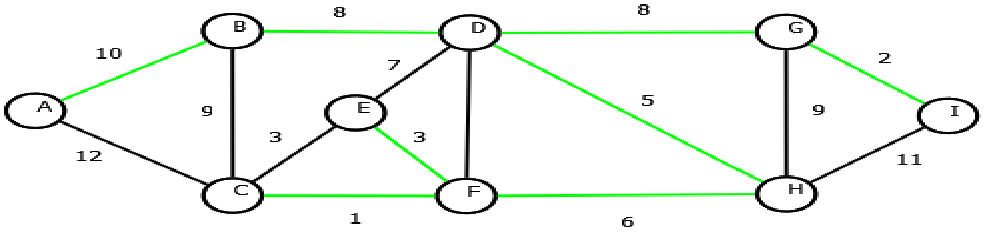
4. a Solve $a_n - 3\,a_{n-1} = 2$, $n \geq 2$, with $a_0 = 1$. 6 M
   b Find the reccurence relation with initial condition for the following: 6 M
   (i) 2, 10, 50, 250, ……. (ii) 1, 1, 3, 5, 8. 13. 21, …..

5. a i. Define Eulerian Graph and prove that a non empty connected graph G is Eulerian iff its vertices are all of even degree. 6 M
   ii. Differentiate between Eulerian graph & Hamiltonian graph with example.
   b Find the Minimal Spanning Tree for the following graph using Kruskals & Prims Algorithm . 6 M



6. a Let Q(x,y) denote "x + y = 0". What are the truth values of the quantifications $\exists y \forall x Q(x,y)$ and $\forall x \exists y Q(x,y)$, where the domain for all variables consists of all real numbers 6 M
   b Show that R is logically derived from $P \rightarrow Q$, $Q \rightarrow R$, and P 6 M

7. a Prove that the relation “congruence modulo m” over the set of positive integers is an equivalence relation 6 M
   b Draw the Hasse Diagram for the partial ordering set (D (128), $\leq$) and $\leq$ is the relation “is a Divisor of”. 6 M

8. a Solve the function using recursive substitution $f(n)=f(n/2)+1; f(1)=1$. 6 M
   b Show that : i) $nC_0+nC_1+nC_2+nC_3+\ldots..nc_n=2^n$ 6 M
   ii) $nC0-nC1+nC2-+\ldots\ldots(-1)^n nCn=0$.

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