**Subject Code: G0501/R13**

**M. Tech –I Semester Regular Examinations, March, 2014**

**MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE**

**(Common to CS and CS&E)**

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

**Answer any FIVE questions**

**All questions carry EQUAL marks**

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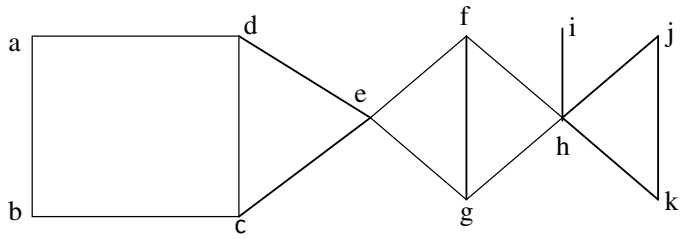
1. a) Using a conjunctive normal form, show that $\mathbf{q \vee ( p \wedge \sim q ) \vee ( \sim p \wedge \sim q )}$ is a tautology.
   b) Prove the logical equivalence
   $\mathbf{\exists x, [\ p(x) \rightarrow q(x)\ ] \Leftrightarrow \forall x, p(x) \rightarrow \exists x, q(x)}$

2. a) Let A={1,2,3,4,5}. Define a relation R on A X A by $(x_1, y_1)$ R $(x_2, y_2)$ if and only if $x_1+y_1=x_2+y_2$.
   b) Let R be a relation on a set A. Prove the following:
   i) *R* is reflexive if and only if and only if $\bar{R}$ is irreflexive.
   ii) If R is transitive, so is $R^c$.
   iii) If R is reflexive, so is $R^c$

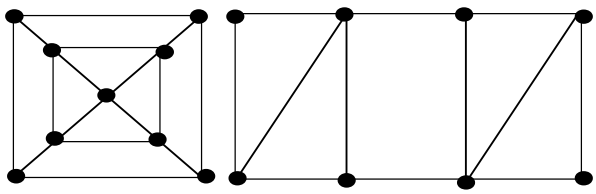
3. a) Find the number of ways of giving 10 apples to 6 persons A,B,C,D,E,F in such a way that the total numbers of apples given to A and B together does not exceed 4.
   b) Illustrate binomial & multinomial theorem. Find the coefficient of $x^9y^3$ in the expansion of $(2x-3y)^{12}$

4. Use generating function to determine the number of four element subsets of S={1, 2, 3, …15} that contain no consecutive integers.

5. Find the BFS and DFS spanning trees for the graph shown below:




6. a) Show that the following graph is Hamiltonian but not Eulerian.



   b) What is chromatic number? What are the applications of graph coloring?

7. a) Given that $a_0 = 0$ , $a_1 = 1$, $a_2 = 4$ and $a_3 = 12$ satisfy the recurrence relation
   i) $a_r + C_1 a_{r-1} + C_2 a_{r-2} = 0$. Determine $a_r$.
   b) Show that $n^3 + 2n$ is divisible by 3 for all $n \geq 1$ by induction.

8. a) Let ( A, +, •) be a ring such that a • a = a for all a in A.
   i) Show that a+a =0 for all a, where 0 is the additive identity.
   ii) Show that the operation • is commutative.
   b) Let (A, ∗) be a commutative semigroup. Show that if a ∗a = a and b ∗b = b, then (a ∗ b)∗ (a ∗ b) =( a ∗ b).

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