Question Paper Code : X 20409

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020

Seventh/Eighth Semester

Computer Science and Engineering

CS 6702 – GRAPH THEORY AND APPLICATIONS

(Common to Information Technology)

(Regulations 2013)

Time : Three Hours   Maximum : 100 Marks

Answer ALL questions

PART – A   (10×2=20 Marks)

1. Define Isomorphism.

2. Define Hamiltonian circuits and paths.

3. Distinguish between Planar and non-planar graphs.

4. Define max-flow and min-cut theorem (equation).

5. List the properties of chromatic numbers (observations).

6. Define directed graph.

7. What is fundamental principle of counting ?

8. Find the number of derangements of 1, 2, 3, 4.

9. If there is an unlimited number (or at least 24 of each color) of red, green, white and black jelly beans, in how many ways can Douglas select 24 of these candies so that he has an even number of white beans and at least six black ones ?

10. Define Exponential generating function.

PART – B   (5×13=65 Marks)

11. a) Problem : We are given four cubes. The six faces of every cube are variously colored blue, green, red or white. Is it possible to stack the cubes one on top of another to form a column such that no color appears twice on any of the four sides of this column ? (Clearly, a trial-and-error method is unsatisfactory, because we may have to try all 41,472 $(-3 \times 24 \times 24 \times 24)$ possibilities.)

(OR)

b) Prove the number of vertices of odd degree in a graph is always even and prove if a graph (connected or disconnected) has exactly two vertices of odd degree, there must be a path joining these two vertices.

12. a) Write Algorithm for shortest spanning tree using prims and Kruskal's with an example.

(OR)

b) Prove the theorem for the ring sum of any two cut-sets in a graph is either a third cut-set or an edge disjoint union of cut-sets.

13. a) Explain the four colour problem with a neat diagram.

(OR)

b) i) Prove the theorem for every tree with two or more vertices is 2-chromatic. **(7)**

   ii) Prove the theorem for a graph with at least one edge is 2-chromatic if and only if it has no circuits of odd length. **(6)**

14. a) i) If the letters of the word MASTER are permuted in all possible ways and the words thus formed are arranged in the dictionary order, then find the rank of the word "REMAST". **(7)**

   ii) If the letters of the EAMCET are permuted in all possible ways and if the words thus formed are arranged in the dictionary order. **(6)**

(OR)

b) What is Principle of Inclusion and Exclusion and prove it.

15. a) Explain the first order and second order recurrence relation.

(OR)

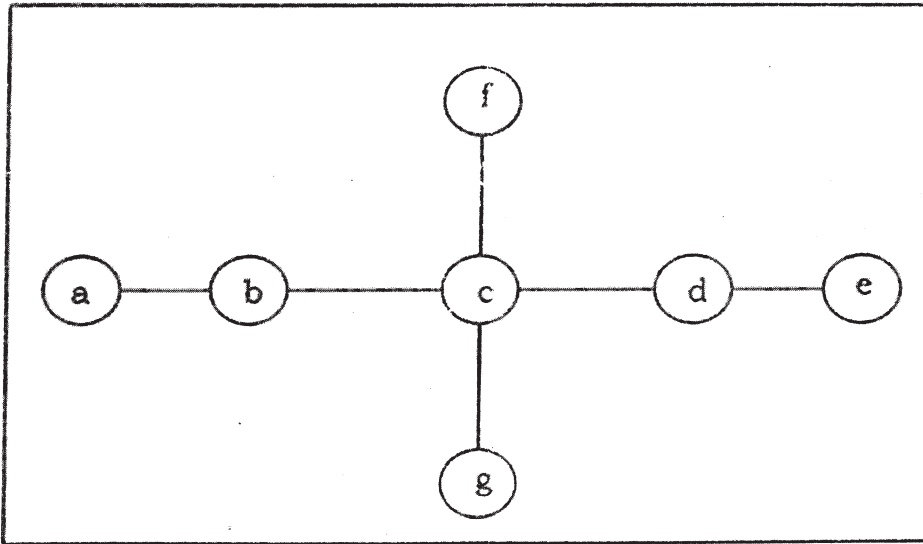b) Prove the non-homogeneous recurrence relations.

PART – C   (1×15=15 Marks)

16. a) Expand using Binomial Theorem $\left(1+\dfrac{x}{2}-\dfrac{2}{x}\right)^4$, $x \neq 0$.

(OR)

b) Define rooted tree. Write an Algorithm to find centers and bi-centers of a tree and solve the problem given below.

Problem 1.

Problem 2.