PRESIDENCY UNIVERSITY
BENGALURU
SCHOOL OF ENGINEERING

MAKEUP EXAMINATION – JAN 2023

Course Code: CSE225

Course Name: Introduction to Combinatorics and

Graph Theory

Program : B.Tech

Date: 28-JAN-2023

Time: 01:00 PM- 04:00 PM

Max Marks: 100

Weightage: 50%

Instructions:

(i) Read the questions properly and answer accordingly.

(ii) Question paper consists of 3 parts.

(iii) Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

**Answer all the questions. Each question carries THREE marks. (6Q x 3M = 18M)**

1. There are exactly three types of students in a school: the geeks, the wannabees, and the athletes. The total number of students in the school is 1000. The total number of geeks is 310, wannabees is 650, athletes is 440, both geeks and wannabees are 170, both geeks and athletes are 150 and both wannabees and athletes is 180. What is the total number of students who fit into all 3 categories?

(C.O.No.1) [Knowledge]

2. Define pseudo graph. Give an example. (C.O.No.2) [Knowledge]

3. Can there be a graph consisting of the vertices A, B, C and D with deg(A) = 2, deg (B) = 3, deg(C) = 3 and deg(D) = 3 ? (C.O.No.2) [Knowledge]

4. Draw a cubic graph and $K_{1,6}$ graph. (C.O.No.3) [Knowledge]

5. Define Hamiltonian graph with an example. (C.O.No.3) [Knowledge]

6. Define binary tree with an example. (C.O.No.4) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the questions. Each question carries TEN marks. (5Q x 10M = 50M)

7. Five teachers T_1, T_2, T_3, T_4, T_5 are to be made class teachers for five classes, C_1, C_2, C_3, C_4 and C_5, one teacher for each class. T_1 and T_2 do not wish to become the class teachers for C_1 or C_2, T_3 and T_4 for C_4 or C_5, and T_5 for C_3 or C_4 or C_5. In how many ways can the teachers be assigned the work?

(C.O.No.1) [Comprehension]

8. Find the adjacency matrix and incidence matrix of the following graph.
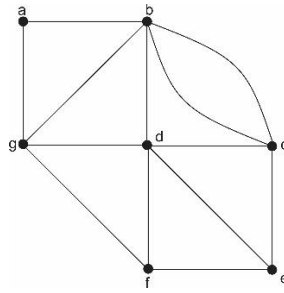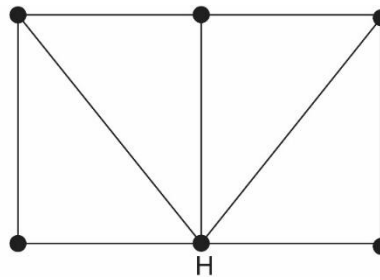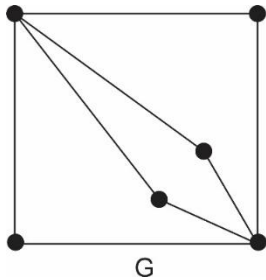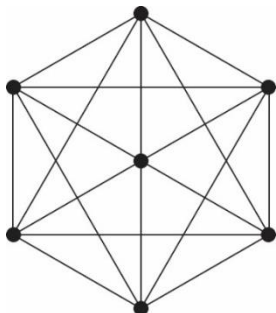
9. (a) Check if the following graphs are isomorphic.
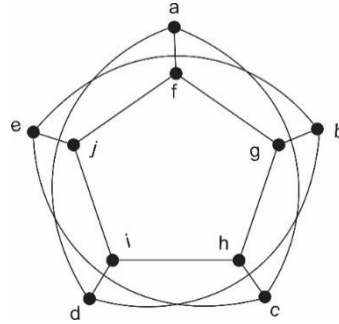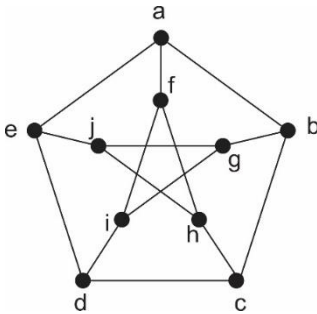
(b) Check if the following graphs G and H are Euler graph as well as Hamiltonian graph.

10. (a) Prove that the complete bipartite graph $K_{3,3}$ is a non-planar graph.

(b) Assign colors and find the chromatic number of the following graph.

11. (a) Define binary search tree with an example. Form the binary search tree for the following word's: banana, peach, apple, pear, coconut, mango and papaya using the alphabetical order.

(b) Suppose that a tree T has 3 vertices of degree 2, 4 vertices of degree 3 and 2 vertices of degree 4. Find the number of pendant vertices in T.

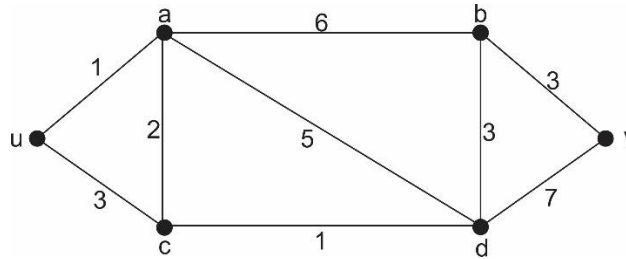(C.O.No.4) [Comprehension]

Part C [Problem Solving Questions]
Answer all the questions. Each question carries 16 marks.   (2Q x 16M = 32M)

12. Find the number of integer solution of the equation $x_1 + x_2 + x_3 = 20$ subject to $2 \le x_1 \le 5, \ 4 \le x_2 \le 7$ and $-2 \le x_3 \le 9$.   (C.O.No.1) [Comprehension]

13. (a) Explain the Kruskal's algorithm.   (C.O.No.5) [Comprehension]

(b) Apply Dijkstra's algorithm to the following graph to find the shortest path from u to v.

(C.O.No.5) [Application]