Registration Number:

Date & Session

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU -27

III SEMESTER

SEMESTER EXAMINATION: OCTOBER 2022

(Examination conducted in December 2022)

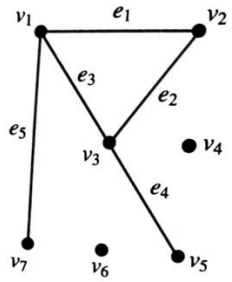
MTOE 6 – Graphs and their real life applications

Time: 2 Hours **Max Marks: 60**

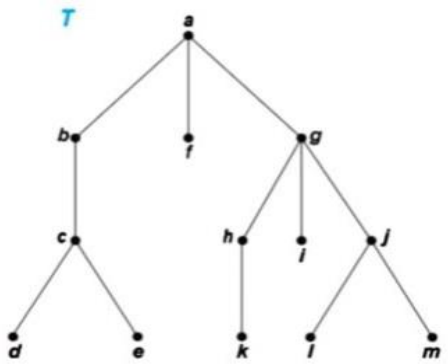
This paper contains 3 printed pages and 2 parts.

I. Answer any SIX of the following questions. (6X2=12)

1. Define a simple graph with an example.
2. State the First theorem on digraphs.
3. Find all the isolated vertices and pendant vertices of the graph shown in the figure.



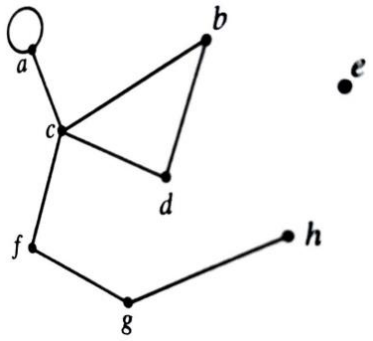
4. Define Euler circuit and Euler path.
5. State Dirac's theorem
6. Define planar graphs and give an example.
7. What is a complete binary tree? Give an example.
8. The figure given below is a rooted tree T with the root **'a'**
   (i) Find all the internal vertices.
   (ii) Draw the sub tree rooted at the vertex **'g'**.



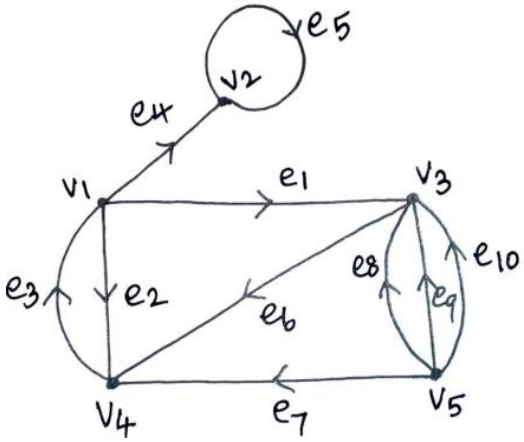
9. State the *n*-Queens problem.

II. Answer any EIGHT of the following questions. (8X6=48)

10. For the graph shown in figure, indicate the degree of each vertex and verify the hand shaking property.

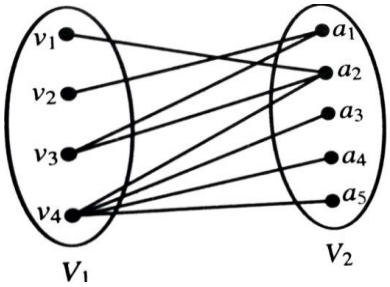


11. Define indegree and outdegree of vertices in a digraph. Write the indegree and outdegree of all the vertices in the graph given below.

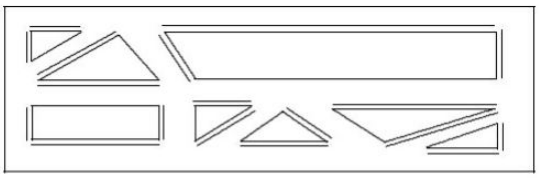


12. Determine the order $|V|$ of the graph $G = (V, E)$ in the case if G has 10 edges with 2 vertices of degree 4 and all other vertices of degree 3.

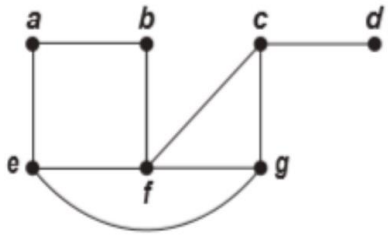
13. State Hall's theorem and hence prove that the bipartite graph shown in the figure does not have a complete matching from V_1 to V_2.



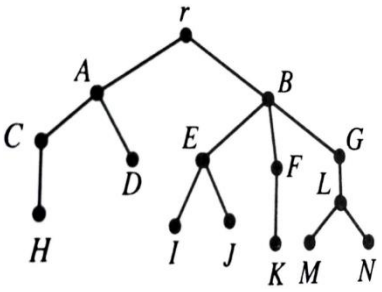
14. State Kuratowski's theorem. Show that $K_{3,3}$ is nonplanar.
15. Explain the applications of graph coloring in the scheduling problem.
16. The figure below shows the layout of a housing development in a community, where mailboxes are placed along one side of each street (indicated by double lines in the diagram). Can a letter carrier make a round trip through the development and pass by each mailbox but exactly once?



17. State the four color theorem. Explain the map coloring problem in graph theory.
18. Define a spanning tree. Find all the spanning trees of the given graph G.



19. The figure shown below is a rooted tree. Identify the following:



(i) The root vertex
(ii) All ancestors of the vertex L
(iii) All descendants of the vertex A
(iv) The children of the vertex B
(v) The parent of the vertex C
(vi) The siblings of the vertex C

20. Explain the backtracking algorithm. How can backtracking be used to decide whether a graph can be colored using *n* colors?
21. Explain the steps in Kruskal's algorithm. Use Kruskal's algorithm to find a minimum spanning tree in the weighted graph shown below.