TB256900I

Reg. No :...............................

Name :..................................

BACHELOR'S DEGREE (C.B.C.S) EXAMINATION, MARCH 2025

2018, 2019, 2020, 2021 ADMISSIONS SUPPLEMENTARY

SEMESTER VI - CORE COURSE (MATHEMATICS)

MT6B11B18 - Graph Theory and Fuzzy Mathematics

Time : 3 Hours **Maximum Marks : 80**

Part A

I. Answer any Ten questions. Each question carries 2 marks **(10x2=20)**

1. When do we say that two subgraphs G_1 and G_2 of a graph G is disjoint? Illustrate with example.
2. Show that it is impossible to have a group of nine people at a party such that each one knows exactly five of the others in the group.
3. Prove that there is no simple graph with seven vertices of which one vertex has degree 2, two vertices have degree 3, three vertices have degree 4, one vertex has degree 5.
4. Define a tree. Draw a tree with 3 vertices.
5. Let G be an acyclic graph with 20 vertices and 3 connected components. Determine the number of edges in the graph.
6. If G is a disconnected graph, find $\kappa(G)$.
7. Calculate the number of different spanning trees of K_5.
8. Define the support and core of a fuzzy set.
9. Deduce the Absorption law of fuzzy set operations
10. Prove that the law of contradiction is violated for fuzzy sets.
11. For each $a \in [0, 1]$ prove that $d_a = c(a)$ if the fuzzy complement is involutive, where d_a is the dual point of 'a' with respect to c.
12. Define a dual triple and give an example of a dual triple.

Part B

II. Answer any Six questions. Each question carries 5 marks **(6x5=30)**

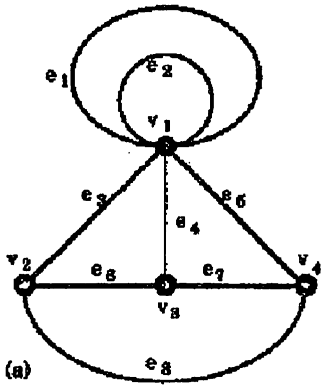
13. Given any two vertices u and v of a graph G, prove that every u - v walk contains a u - v path.
14. Let G be a graph with n vertices, t of which have degree k and others have degree k+1. Show that t=(k+1)n-2e, where e is the number of edgesin G.
15. Let v be a vertex of a connected graph G. Then show that v is a cut vertex of G if and only if there are two vertices u and w of G, both different from v, such that v is on every u-w path in G.
16. Explain Chinese Postman Problem.
17. Show that if u and v are distinct vertices of a tree T, then there is precisely one path from u to v.
18. Prove or disprove: The standard fuzzy union is a cut-worthy property when applied to a finite family of fuzzy sets.
19. State and prove De Morgan' s law of fuzzy set operations
20. Prove that the function $u : [0, 1] X [0, 1] \rightarrow [0, 1]$ defined by u(a, b) = min {1, a + b } is a t-conorm.
21. Show that the threshold-type fuzzy complements satisfy only the axiomatic skeleton of fuzzy complements.

Part C

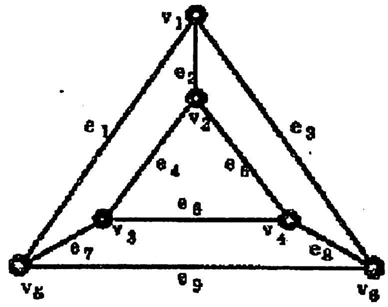
III. Answer any Two questions. Each question carries 15 marks **(2x15=30)**

22. a. Find the adjacency and incidence matrix of the Peterson graph.

b. Write the incidence and adjacency matrix in each of the following graphs.

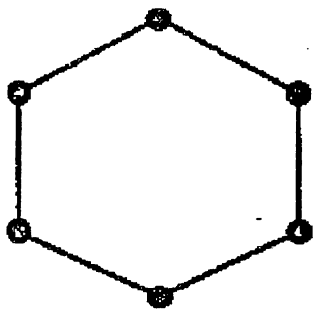


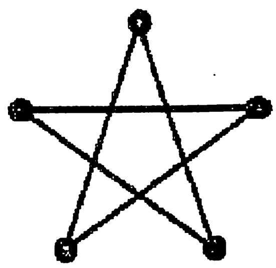
(a)

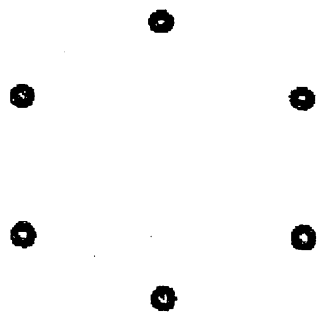


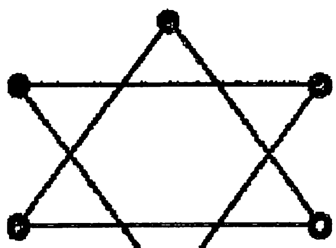
(b)

c. Find the complements of the following four graphs.









G

(i) (ii) (iii)

(iv)

23. A connected graph is Euler if and only if the degree of every vertex is even.

24. Deduce a necessary and sufficient condition for convexity of fuzzy sets defined on the set of real numbers.

25. Let u_w denote the class of Yager t-conorms. Then prove that $max\{a, b\} \leq u_w(a, b) \leq u_{max}(a, b)$