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Reg. No.....

Name.....

M.Sc. DEGREE (C.S.S.) EXAMINATION, MAY 2017

Fourth Semester

Faculty of Science

Branch I (A)—Mathematics

MT 04E 13—ALGORITHMIC GRAPH THEORY

(2012 Admissions—Regular)

Time : Three Hours Maximum Weight : 30

Part A

Answer any **five** *questions*
Each question has weight 1.

1. Find two non isomorphic 3-regular graphs of order 6 and size 9.
2. Show that there exist a graph with more cut-vertices than bridges.
3. Define distance notion in digraphs. Describe with example.
4. Give an example of a unilateral digraph that does not contains a cycle.
5. Determine the connection number of $K_{m,n}$ and C_p.
6. If G is a 2-connected graph, then show that $G + K_1$ is 3-connected.
7. In $a(b, v, r, k, \lambda)$ design, show that $\lambda(v-1) = r(k-1)$.
8. Find k and λ in a BIBD with parameters $b = 6, v = 3$ and $r = 3$.

$(5 \times 1 = 5)$

Part B

Answer any **five** *questions.*
Each question has weight 2.

9. A graph G of order 7 and size 10 has six vertices of degree 'a' and one of degree 'b'. What is b ?
10. Show that every $u - v$ walk in a graph contains a $u - v$ path.
11. If T is a binary tree of height h and order p, then show that $h + 1 \leq p \leq 2^{h+1} - 1$.

Turn over

12. Prove that Kruskal's algorithm produces a minimum spanning tree in a nontrivial connected weighted graph.

13. In every network show that the value of a maximum flow equals the capacity of a minimum cut.

14. Show that $k(G) \leq \lambda(G) \leq \delta(G)$, for every graph G

15. Prove that a matching M in a graph G is a maximum matching if and only if there exists no augmenting path, with respect to M in G

16. Let G be a bipartite graph with partite sets V_1 and V_2. The set V_1 can be matched to a subset of V_2 if and only if V_1 is nondeficient.

(5 × 2 = 10)

Part C

Answer any **three** *questions.*
Each question has weight 5.

17. Prove that a nontrivial graph G is bipartite if and only if G has no odd cycles.

18. Explain binary search algorithm. What is the complexity of this algorithm?

19. Show that Prim's algorithm produces a minimum spanning tree in a nontrivial connected weighted graph.

20. Write Moore's Breadth-First Search algorithm. Describe it with example. Find the complexity of the algorithm.

21. Write Critical path algorithm. Determine the complexity and describe with example.

22. Write Kuhn-Munkres maximum weight Matching algorithm. Determine the complexity.

(3 × 5 = 15)