Total No. of printed pages = 4

BCA 171504 E 3

Roll No. of candidate | | | | | | | | | | |

10/12/22 **2021**

B.C.A. 5th Semester End-Term Examination

GRAPH THEORY

(New Regulation)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest

1. Select The correct Options: (10 × 1 = 10)

(i) Length of the walk of a graph is

(a) The number of vertices in walk W

(b) Total number of edges in a graph

(c) The number of edges in walk W

(d) Total number of edges and vertices in walk W.

(ii) What is the number of edges present in a complete graph having n vertices?

(a) (n*(n+1))/2 (b) (n*(n-1))/2

(c) n (d) n-1

(iii) What is the maximum number of edges in a bipartite graph having 10 vertices?

(a) 24 (b) 21

(c) 25 (d) 16

(iv) A graph with n vertices having equal degree is known as a _____

(a) Multi Graph (b) Regular Graph

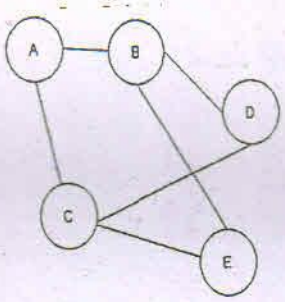
(c) Simple Graph (d) Complete Graph

[Turn over

(v) The number of circuits that can be created by adding an edge between any two vertices in a tree is?

(a) One
(b) Two
(c) Three
(d) At least Two

(vi) For the given graph (G), which of the following statements is true?



(a) G is a complete graph
(b) G is not a connected graph
(c) The edge connectivity of the graph is 1
(d) The vertex connectivity of the graph is 2

(vii) A connected planar graph having 6 vertices, 7 edges contains _____ regions.

(a) 15
(b) 11
(c) 3
(d) 4

(viii) Let G be a simple graph with 20 vertices and 8 components. If we delete a vertex in G, then number of components in G should lie between _____

(a) 7 and 19
(b) 8 and 19
(c) 7 and 20
(d) 8 and 20

(ix) What is the chromatic number of an n-vertex simple connected graph which does not contain any odd length cycle? Assume n > =2.

(a) 2
(b) 3
(c) n
(d) n-1

(x) Which of the following properties does a simple graph not hold?

(a) Must be connected

(b) Must have no loops or multiple edges

(c) Must be unweighted

(d) All of the mentioned

2. (a) Define followings: $(3 \times 2 = 6)$

(i) Bipartite Graph

(ii) Walk and Cycle

(iii) Spanning tree

(b) State and prove Hand Shaking Theorem? $(1 + 3 = 4)$

(c) Prove that total number of odd vertices in a graph is always even (5)

3. (a) "Two graphs equal number of vertices and equal number of edges may not be isomorphic" Justify your answer. (4)

(b) If a connected graph has exactly two vertices of odd degree there must be a path joining these two vertices. (3)

(c) Prove that a graph G is disconnected if and only if its vertex set can be partitioned into two non empty, disjoint subsets V1 and V2 such that there exist no edge in G whose one vertex is in subset V1 and the other in subset V2. (4)

(d) If G is a simple graph having n vertices and e edges with minimum degree δ and maximum degree Δ ,then prove that $\delta \leq 2e/n \leq \Delta$. (4)

4. (a) "Complete graph is a regular graph". Justify your answer. (3)

(b) State and explain Konigbergs Bridge problem. (5)

(c) Prove that, a simple graph with n vertices and k components has at most $(n-k)(n-k+1)/2$ edges. (7)

5. (a) Define a tree. (2)

(b) Prove that, a graph is tree if and only if it is minimally connected. (4)

(c) Prove that a tree with n vertices has exactly n-1 edges. (5)

(d) Show that the number of pendent vertices in a tree of n vertices is (n+1)/2. (4)

6. (a) What is the maximum possible number of vertices in a k-level tree? (3)

(b) Derive an expression for calculating maximum height of a binary tree. (4)

(c) Write the different steps for checking planarity of a graph. (4)

(d) Prove that both the Kuratowskis graphs are non planer. (4)

7. (a) State the differences between Kruskal's and Pin's Algorithms. (3)

(b) What are the different kinds of information can be obtained from an adjacency matrix? (3)

(c) Prove that every complete tournament has a directed Hamiltonian path (4)

(d) State and established the five colour theorem. (5)