BRAINWARE UNIVERSITY

Term End Examination 2018 - 19

Programme – Bachelor of Technology in Computer Science & Engineering

Course Name - Discrete Mathematics

Course Code - M201

(Semester – 2)

Time allotted: 3 Hours **Full Marks : 70**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group –A

(Multiple Choice Type Questions) 10 x 1 = 10

1. ***Choose the correct alternative from the following***

(i) If A is a nth order square matrix, then det(5A)=

a. $5[\det(A)]^n$ b. $5[\det(A)]$

c. $5^n[\det(A)]^n$ d. $5^n[\det(A)]$

(ii) If A and B are non-singular square matrices, then $(AB)^{-1}$=

a. $A^{-1} B^{-1}$ b. AB^{-1}

c. $A^{-1} B$ d. $B^{-1} A^{-1}$

(iii) The inverse of the matrix $\begin{pmatrix} 2 & 1 \\ 4 & 2 \end{pmatrix}$ is

a. $\begin{pmatrix} 2 & -1 \\ -4 & 2 \end{pmatrix}$ b. $\begin{pmatrix} 2 & -4 \\ -1 & 2 \end{pmatrix}$

c. Does not exit d. $\begin{pmatrix} -2 & 4 \\ -3 & 6 \end{pmatrix}$

(iv) Trace of a square null matrix is

a. 1 b. 0

c. ∞ d. None of these

(v) Let N be the set of natural numbers and R be the relation in N defined as $R = \{(a, b) : a = b - 2, b > 6\}$. Then

a. $(2, 4) \in R$ b. $(8, 7) \in R$

c. $(3, 8) \in R$ d. $(6, 8) \in R$

(vi) The truth value of the statement $x^2 = x$ holds for all real values of x is

a. T
b. F
c. Neither T nor F
d. None of these

(vii) Contrapositive of "$\sim p \rightarrow q$" is

a. $p \rightarrow q$
b. $\sim q \rightarrow \sim p$
c. $\sim q \rightarrow p$
d. $q \rightarrow \sim p$

(viii) The Fibonacci sequence is

a. 0,1,2,3,5,8…….
b. 0,1,2,3,4,5,…..
c. 1,1,2,3,5,8,…….
d. 0,-1,3,-6,10,…….

(ix) The solution of the recurrence relation $a_n=2a_{n-1}+1$, with $a_0=1$

a. 2^n
b. 2^n-2
c. 2^n+1
d. 2^n-1

(x) The root of a binary tree is the vertex having degree

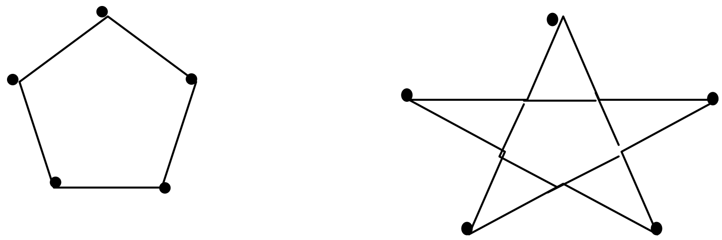
a. 1
b. 2
c. 3
d. 4

Group – B

(Short Answer Type Questions) 3 x 5 = 15

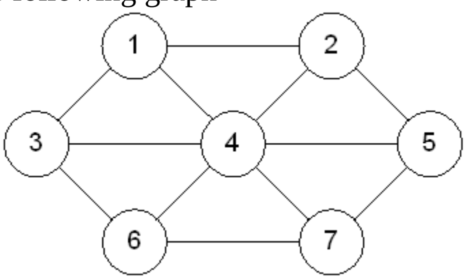
Answer any *three* from the following :

2. Write a short note on "Konigsberg Bridge Problem". [5]
3. Define Isomorphism in graph. Examine whether the following graphs are isomorphic or not. [2+3]



4. Show that $(p \rightarrow (q \rightarrow r)) \rightarrow ((p \rightarrow q) \rightarrow (p \rightarrow r))$ is a contradiction. [5]

5. Solve the following recurrence relation by using iterative method: $a_n=4(a_{n-1}-a_{n-2})$, given $a_0=a_1=1$ [5]
6. Define adjacency matrix for a non-directed graph. Hence find the adjacency matrix for the following graph [5]



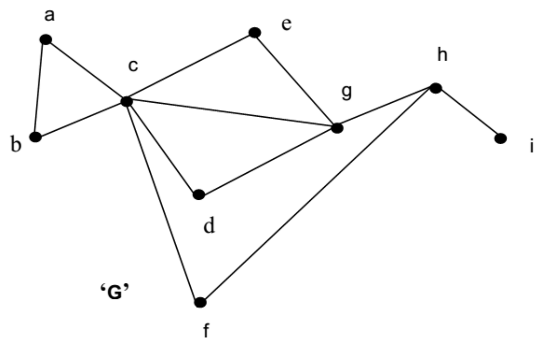
Group – C

(Long Answer Type Questions) 3 x 15 = 45

Answer any *three* from the following :

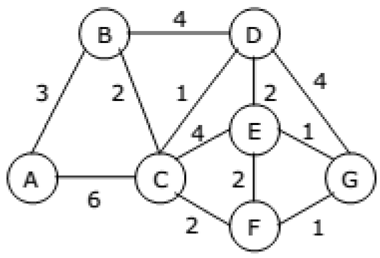
7. (a) Prove that a complete graph with n number of vertices has exactly $\frac{n(n-1)}{2}$ edges. [5]

(b) Construct a spanning tree of the following graph G by BFS and DFS: [5]



(c) Show that $(p \wedge q) \vee (q \wedge r) \vee (p \wedge r)$ is a contingency. [5]

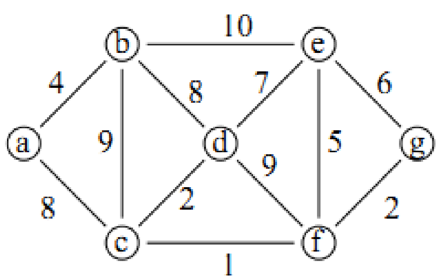
8. (a) Apply Kruskal's algorithm to find a shortest spanning tree of the following graph: [6]



(b) Show that the statement formula A logically implies statement formula B: [5]
$A:(q \rightarrow (p \wedge \sim p)) \rightarrow (r \rightarrow (p \wedge \sim p))$, $B:(r \rightarrow q)$

(c) Show that a graph with at least one edge is 2- chromatic if it has no circuit of odd length. [4]

9. (a) Find by Prim's algorithm a minimal spanning tree from the following graph: [6]



(b) Find the CNF(Conjunctive normal form) of the following statement [4]
$\sim (p \vee q) \leftrightarrow (p \wedge q)$

(c) Show that a graph G has a spanning tree if and only if G is connected [5]

10. (a) Find the inverse of the matrix $A = \begin{pmatrix} 2 & -3 & 4 \\ 1 & 0 & 1 \\ 0 & -1 & 4 \end{pmatrix}$ [5]

(b) Solve, by characteristic root method, the recurrence relation [6]
$a_n = 3a_{n-1} + 4a_{n-2}, a_0 = 0, a_1 = 5$ .Hence find a_8.

(c) Prove that the number of vertices in the binary tree is always odd. [4]

11. (a) Prove that, a simple graph with n number of vertices and k number of components can have maximum $\frac{(n-k)(n-k+1)}{2}$ number of edges. [6]

(b) Show by truth table that the following statement formula is a tautology: [5]
$\{(p \wedge \sim q) \rightarrow r\} \rightarrow \{p \rightarrow (q \vee r)\}$

(c) Using generating function solve the recurrence relation [4]
$a_n = a_{n-1} + n, \ with \ a_0 = 1$
