

Q. P. Code: 19835

(2 ½ Hours)

[Total Marks: 75]

- N.B. 1) All questions are compulsory.
 2) Figures to the right indicate marks.
 3) Illustrations, in-depth answers and diagrams will be appreciated.
 4) Mixing of sub-questions is not allowed.

Q. 1 Attempt All (Each of 5Marks) (15M)**(a) Select correct answer from the following:**

- The product of two consecutive natural number is always divisible by _____.
 (a) 3 (b) 2 (c) 6 (d) 10
- String is the _____ of characters or symbols
 (a) Series (b) sequence (c) line (d) arrangement
- A vertex with degree one is called _____.
 (a) Pendant (b) isolated (c) incident (d) none of the above
- A graph with no parallel edges and no loops is called a _____ graph.
 (a) simple (b) pseudo (c) multiple (d) none of the above
- Augmenting path is used to _____ the value of a network flow.
 (a) increase (b) decrease (c) equal (d) none of the above

(b) Fill in the blanks

(Pascal triangle, n, trail, equal, one)

- The _____ is used to find the coefficients in binomial expansion.
- ${}^n C_0 =$ _____
- The walk in which no edges is repeated more than one is called _____
- Chromatic number of complete graph with n vertices is _____.
- In network the amount of leaving the source is _____ to the amount arriving at the sink.

(c) Short Answers

- Combination
- Binomial theorem
- Regular graph
- Planar graph
- Augmenting path

Q. 2 Attempt the following (Any THREE) (15M)**(a)** For the binary strings of length 10, how many of them

- Begins with 1
- Begins with 1 and ends with 0

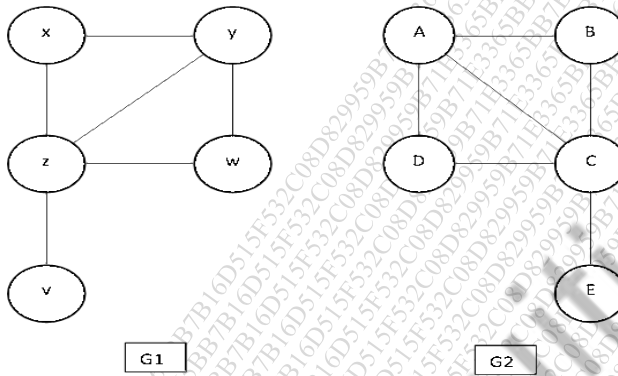
(b) Determine the coefficient of $x^2 y^2 z^2$ in the expansion of $(x + y + z)^6$.

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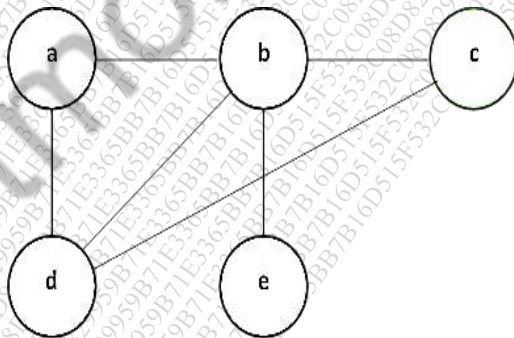
- (c) For any positive integer n , the sum of the first n positive integers is $\frac{n(n+1)}{2}$. Prove by first principle of mathematical induction.
- (d) How many integer-valued solutions are there for the equation $x_1 + x_2 + x_3 + x_4 + x_5 = 72$, all $x_i \geq 0$
- (e) How Combinatorics is useful in graph theory?
- (f) For each $n > 0$, prove that $\binom{n}{0} - \binom{n}{1} + \binom{n}{2} - \dots + (-1)^{n-1} \binom{n}{n-1} + (-1)^n \binom{n}{n} = 0$

Q. 3 Attempt the following (Any THREE) (15M)

- (a) Show that following graphs are isomorphic.



- (b) Draw a tree whose prufer(T) = 6643143 with vertex set {1, 2, 3, 4, 5, 6, 7, 8, 9}
- (c) Explain the colouring of vertices in a graph.
- (d) State pigeon hole principle and Show that if any five numbers from the set {1, 2, 3, 4, 5, 6, 7, 8} are chosen, then two of them will add up to 9.
- (e) Define adjacency matrix in a graph also find the adjacency matrix of the following graph.



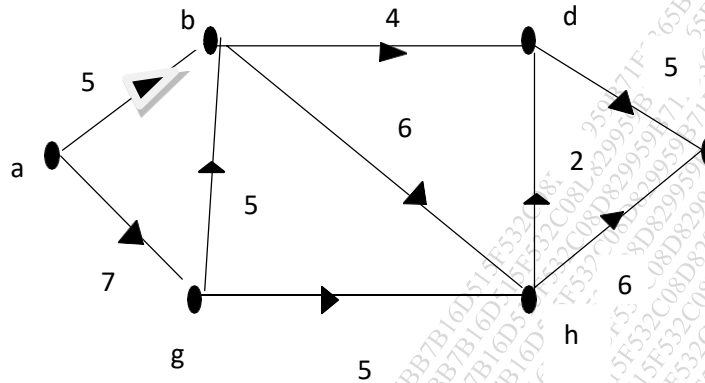
- (f) Give an example of graph which is both Eulerian and Hamiltonian and justify it.

Q. 4 Attempt the following (Any THREE) (15)

- (a) Explain Matching in Bipartite graphs.

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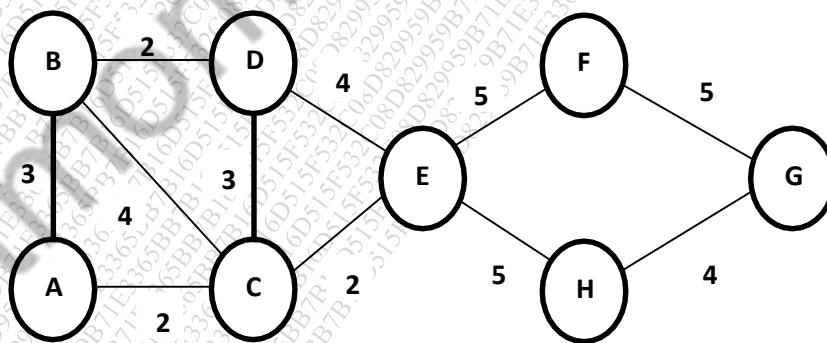
- (b) Explain Ford- Fulkerson’s labelling algorithm.
- (c) Find maximum flow of the following network.



- (d) Suppose we are colouring the vertices of the square using black and white. Draw all the possible pattern of colouring also find the different transformations for fixed colouring.
- (e) Write permutations shown below in cycle notation of π_1 and π_2 also compute $\pi_1\pi_2$ (product of two permutations)
 $\pi_1 = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 2 & 5 & 6 & 3 & 1 \end{pmatrix}, \pi_2 = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 5 & 6 & 1 & 3 & 4 & 2 \end{pmatrix}$
- (f) State Burnside’s theorem.

Q. 5 Attempt the following (Any THREE) (15)

- (a) In how many ways can we arrange the letters in TALLAHASSEE? How many of these arrangements have no adjacent A’s?
- (b) Define Chromatic number with example.
- (c) Explain flows and cuts.
- (d) Find the minimum spanning tree using Kruskal’s algorithm for the given graph.



- (e) State first principle and second principle of mathematical induction
