

- Instructions:**
- 1) All questions are compulsory.
 - 2) Figures to right Indicate full mark :.
 - 3) Illustrations, in-depth answers and diagram will be appreciated.
 - 4) Mixing of all questions is not allowed.

Q.1. Attempt All (Each of marks)

(15)

a) Select correct answer from the following.

1) _____ matrix is symmetric.

- i) Adjacency ii) Incidence iii) Path iv) Scalar

2) If terminal vertices are same in walk then it is called _____

- i) open walk ii) close walk iii) path iv) trail

3) A vertex with degree one is called _____

- i) Isolated ii) pendent iii) adjacent iv) incident

4) For all positive integers $n, n^3 + (n+1)^3 + (n+2)^3$ is divisible by _____

- i) 7 ii) 9 iii) 8 iv) 11

5) The ford Fulkerson labeling algorithm is used for finding _____ flow in a network.

- i) maximum ii) minimum iii) negative iv) zero

b) Fill in the blanks.

(Intermediate, $\binom{n}{L}$, Sequence, isomorphic, odd vertices)

1) Any two paths with the same number of vertices are _____

2) If X is set of numbers then the string are called _____

3) _____ give coefficient of $x^i y^{n-1}$ in expansion of $(x + y)^n$.

4) An Undirected graph has even number of _____

5) V_1 and V_n are called terminal vertices and remaining are called _____ vertices.

c) Short answers.

- 1) Connected graph
- 2) Permutation
- 3) Pascal's Identity
- 4) Hamilton circuit
- 5) Augmenting path

Q.2. Attempt the following (Any three)

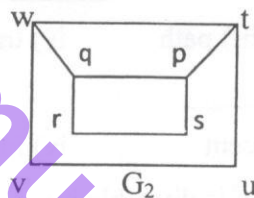
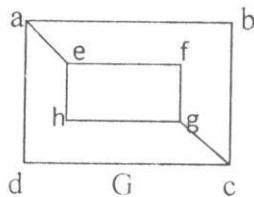
(15)

- Give combinatorial arrangement it proves that $k \binom{n}{k} = n \binom{n-1}{k-1}$
- find the coefficient of $x^2 y^2 z$ in the expansion of $(2x - 3y + 4z)^5$ also find no. of terms and sum of all coefficient.
- Find all non-negative integer solution to the equation $x_1 + x_2 + x_3 + x_4 + x_5 \leq 40$.
- Show that for all positive integers n , $3^{2n} - 1$ is divisible by 8.
- How many integers solutions are there for a equation $x_1 + x_2 + x_3 + x_4 = 32$ all $x_i > 0$ and $x_2 \leq 13$
- Let a_n be the recursive relation defined by $a_n = 2a_{n-1} + a_{n-2}$, $n \geq 2$ with initial condition $a_0 = 1$, $a_1 = 2$ prove that $a_n \leq \binom{5}{2}^n$

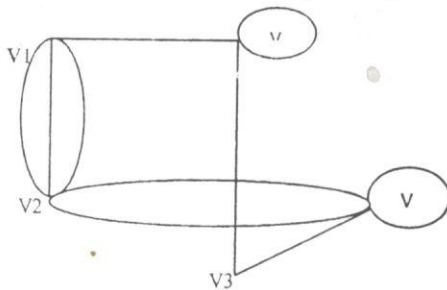
Q.3. Attempt the following (Any three)

(15)

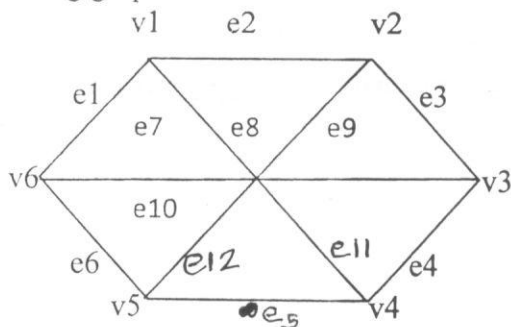
- Determine if the following graphs are isomorphic



- Draw a tree whose prifer (T) = 23134
- Write incidence and adjacency matrix of the following graph.



- Define spanning subgraph. Draw any two non-isomorphic spanning sub graph of the following graph.

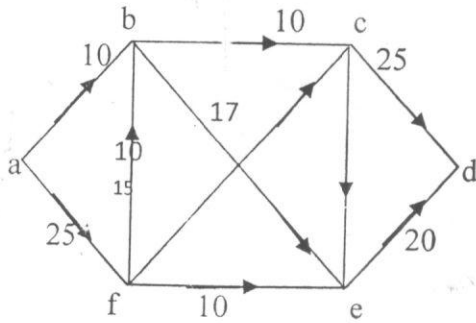


- A connected planar simple graph has 20 vertices each of degree 3. How many regions thus planar representation of this planar graph split the plan.
- If G is complete graph on 10 vertices then find the number of cycle in G .

Q.4. Attempt the following (Any three)

(15)

a) Find maximum flow of below network.



b) Explain matching in bipartite graphs.

c) Write Permutation shown below in cycle notation compute $\Pi_1 \Pi_2$ (product) of two permutation and inverse of $\Pi_1 \Pi_1 = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ 3 & 1 & 5 & 8 & 2 & 6 & 4 & 7 \end{pmatrix} \Pi_2 = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ 3 & 7 & 1 & 6 & 8 & 4 & 2 & 5 \end{pmatrix}$

d) Explain flows and cuts.

e) What is complete matching? Explain with an example?

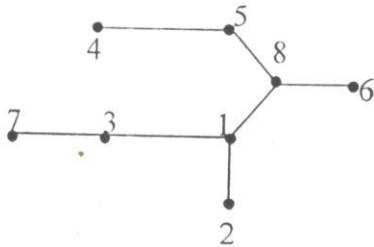
f) Explain Augmenting path with examples.

Q.5. Attempt the following (Any three)

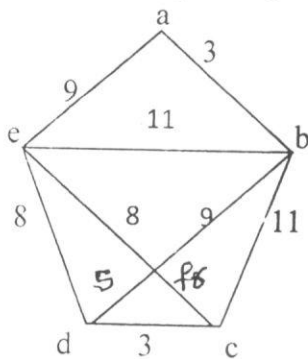
(15)

a) In how many ways we can arrange the letters in WORD TELECOMMUNICATION? How many of these arrangements have no adjacent E'S?

b) Find priffer (T) of the following tree.



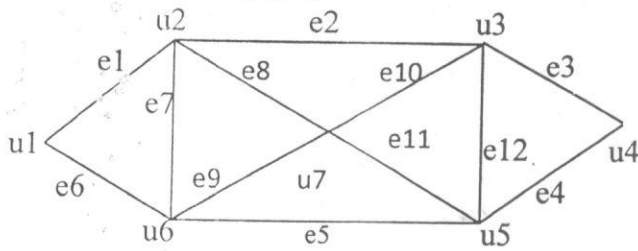
c) Using kruskal's Algorithm, find shortest spanning tree of the following graph, also find weight of the shortest spanning tree.



d) What is a combination? Prove that.

$$\binom{2n}{2} = 2\binom{n}{2} + n^2$$

e) For the following graph find.



1. Any two path from u_1 to u_5
2. Any two walk from u_1 to u_5
3. Any two cycles containing u_3
4. Path of length 6 from u_1 to u_4
5. Vertex of distance 3 from u_4 .

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