

Duration: 3hrs

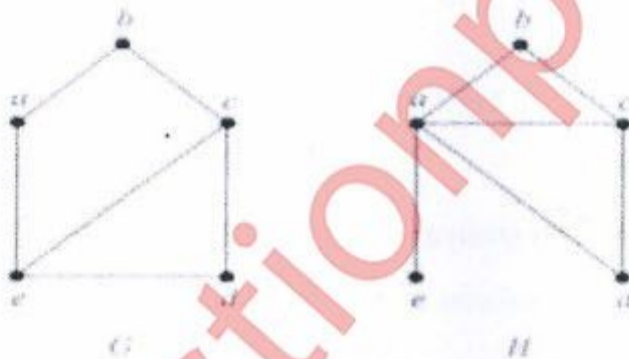
[Total Marks: 80]

- 1) Question no.1 is compulsory.
- 2) Solve any three questions out of remaining five questions.
- 3) All questions carry equal marks as indicated by figures to the right.
- 4) Assume appropriate data whenever required. State all assumptions clearly.

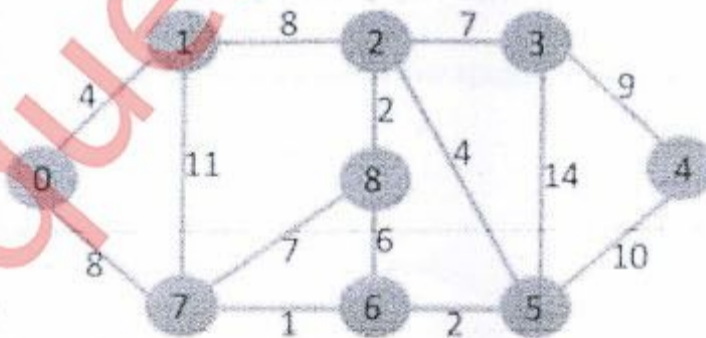
- Q.1 a) Prove by induction that n^2+n is an even number, for every natural number n . (05M)
- b) Find the generating function for the following finite sequences (05M)
- i) 2,2,2,2,2,2 ii) 1,1,1,1,1,1
- c) Let $A=\{a,b,c,d,e\}$ and $R=\{(a,a),(a,b),(b,c),(c,e),(c,d),(d,e)\}$ (05M)
 Compute R^2 and R^∞
- d) Define Lattice. Check if the following diagram is a lattice or not. (05M)



- Q.2 a) Define Isomorphism of graphs. Find if the following two graphs are isomorphic. If yes, find the one-to-one correspondence between the vertices. If not justify your answer. (08M)



- b) Find Minimum spanning tree for the following graph using Kruskal's Algorithm. (08M)



- c) Prove $(p \vee q) \wedge (p \wedge \neg q) \vee q \leftrightarrow p \vee q$

Q. 3 a) Prove that set $G = \{0,1,2,3,4,5\}$ is a finite abelian group of order 6 with respect to addition modulo 6. (08M)

b) Let $A=\{1,2,3,4\}$, let $R=\{(1,2),(2,3),(3,4),(2,1)\}$ Find Transitive closure of R using Warshall's Algorithm. (08M)

c) Test whether the following function is one-to-one, onto or both. (04M)

$$f: \mathbb{Z} \rightarrow \mathbb{Z}, f(x)=x^2+x+1$$

Q.4 a) Show that the (2,6) encoding function $e: B^2 \rightarrow B^6$ defined by (08M)

$$e(00)=000000$$

$$e(01)=011110$$

$$e(10)=101010$$

$$e(11)=111000 \text{ is a group code.}$$

Find Minimum distance. How many errors will it detect and correct?

b) Let $H = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

Be a parity check matrix. Decode the following words relative to a maximum likelihood decoding function associated with e_H . 1) 01111 2) 01110 3) 11001 (08M)

c) How many friends must you have to guarantee that at least five of them will have birthdays in the same month? (04M)

Q.5 a) Let G be a set of rational numbers other than 1. Let $*$ be an operation on G defined by $a*b=a+b-ab$ for all $a,b \in G$. Prove that $(G, *)$ is a group.

b) Solve the recurrence relation $a_r - a_{r-1} - 6a_{r-2} = -30$ given $a_0=20, a_1=-5$ (08M)

c) Let $A=\{a,b,c,d,e,f,g,h\}$. Consider the following subsets of A (04M)

$$A1=\{a,b,c,d\}$$

$$A2=\{a,c,e,g,h\}$$

$$A3=\{a,c,e,g\}$$

$$A4=\{b,d\}$$

$$A5=\{f,h\}$$

Determine whether following is partition of A or not. Justify your answer.

i) $\{A1, A2\}$ ii) $\{A3, A4, A5\}$

Q.6 a) Draw the Hasse Diagram of the following sets under the partial order relation divides and indicate which are chains. Justify your answers. (08M)

I. $A=\{2,4,12,24\}$

II. $A=\{1,3,5,15,30\}$

b) Let the functions f,g, and h defined as follows: (08M)

$$f: \mathbb{R} \rightarrow \mathbb{R}, f(x)=2x+3$$

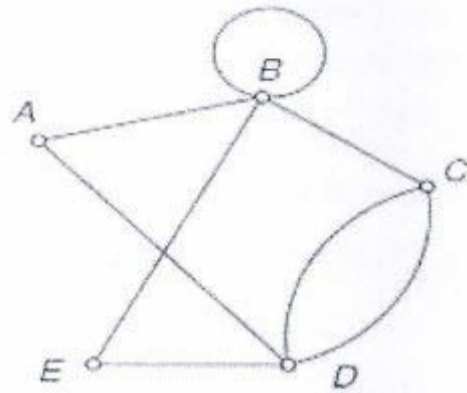
$$g: \mathbb{R} \rightarrow \mathbb{R}, g(x)=3x+4$$

$$h: \mathbb{R} \rightarrow \mathbb{R}, h(x)=4x$$

Find gof, fog, foh, , gofoh

c) Determine Euler Cycle and path in graph shown below

(04M)



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