



Year and Program: 2018-19  
B. Tech. Computer Science  
& Engg.

School of Technology  
Department of Computer Science  
& Engg

SY B. Tech.  
Semester – III

Course Code : CST203

Course Title: Discrete Structures

Day and Date: 29-Nov-19 Thursday

End Semester Examination (ESE)

Max Marks: 100

Time: 2:30 PM 5:30 PM

Instructions: 1) All questions are compulsory

2) Figures to the right indicate full marks

3) Draw neat diagrams wherever necessary

Q.1

Marks	Bloom's Level	CO
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A Solve following

- i) Let A be the set of factors of 45 and  $\leq$  be the relation divides

03	3	CO2
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$$\leq = \{ \langle x, y \rangle \mid x \in A \wedge y \in A \wedge (x \text{ divides } y) \}$$

Draw Hasse diagram.

- ii) Consider the POSET  $A = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$  and  $\leq$  is divides relation. Find LUB & GLB for the sets  $\{6, 18\}$  and  $\{4, 6, 9\}$ .

04	4	CO2
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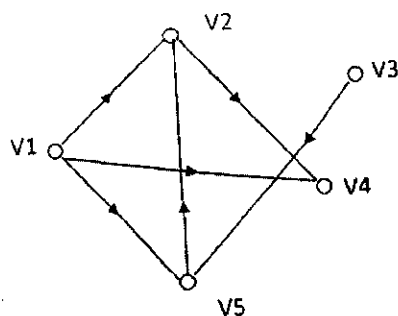
-----OR-----

- i) Explain the terms with example  
Covering of a set, Partition of a set

04	1	CO2
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- ii) Find adjacency matrix and  $A^T$  for following graph

03	2	CO2
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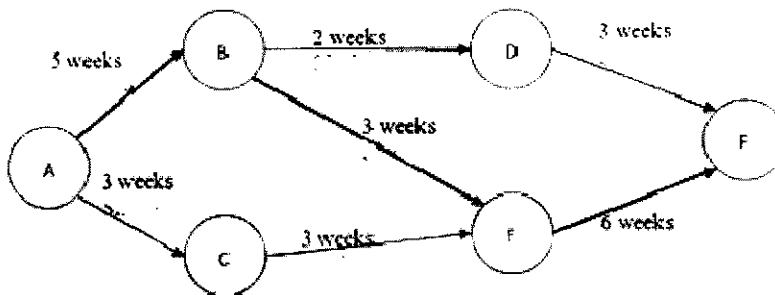
**B Solve following**

Compute earliest completion time and latest completion time, slack time for following PERT diagram

08

5

CO4



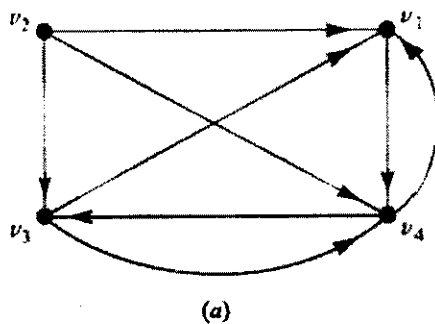
-----OR-----

Find adjacency matrix and path matrix of following graph

08

3

CO4



**Q.2**

**A Solve following**

i) Solve following without constructing truth table

04

3

CO1

$$(Q \rightarrow (P \wedge \neg P)) \rightarrow (R \rightarrow (P \wedge \neg P)) \Rightarrow (R \rightarrow Q)$$

ii) Obtain infix form of following

03

3

CO1

$$\rightarrow \neg P \vee Q \neg \neg R \neg S$$

-----OR-----

- i) Obtain PCNF and PDNF of following

$$(\neg P \rightarrow R) \wedge (Q \leftrightarrow P)$$

- ii) Show that

$$PV(\neg P \wedge Q) \Leftrightarrow PVQ$$

**B Solve following**

- i) Let  $\langle G, + \rangle$  is a abelian group and  $a, b \in G$ . Show that  $(a + b)^n = a^n + b^n$ .

- ii) Consider the set of positive integers  $N$ . Are  $(N, +)$  and  $(N, \times)$  monoids?

-----OR-----

Let  $G = \{1, -1, i, -i\}$  show that it is a group under multiplication operation  $\langle G, * \rangle$ .  $I = \text{Set of integers}$  and  $\langle I, + \rangle$  is an algebraic structure. Prove that the mapping  $f$  from  $I$  onto  $G$  such that  $f(x) = i^n$  for all  $n$  is a homomorphism.

**Q. 3 Solve any TWO**

- A Consider the following relations on the set  $A = \{1, 2, 3, 4\}$ :

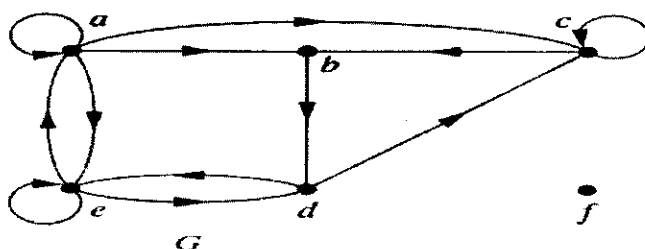
$$R1 = \{(1, 1), (1, 2), (2, 3), (1, 3), (4, 4)\}$$

$$R2 = \{(1, 1)(1, 2), (2, 1), (2, 2), (3, 3), (4, 4)\}$$

$R3 = \text{the empty relation}$

$R4 = A \times A$  Determine which of the relations are reflexive. Draw diagram of each relation

- B i) Find indegree and outdegree of each vertex in following graph  $G$



	ii) Define the terms – multigraph, simple graph	02	2	CO3
C	i) State and explain - i) Well formed formulas ii) Duality law	04	2	CO1
	ii) S : Stack is a data structure Q : Queue is a data structure A : stack can be implemented using an array L : queue can be implemented using a list	04	3	CO1
Construct sentences for the following formulae :				
	i) $S \wedge \neg Q$			
	ii) $S \rightarrow (Q \rightarrow L)$			
	iii) $\neg S \neq Q$			
	iv) $\neg(A \nabla Q)$			
D	i) Define the following w.r.t. semigroups. Isomorphism , Monomorphism	03	2	CO4
	ii) X is any given set and P(X) is its power set. Find the zeroes of the semigroups $(p(x), \cap)$ and $(p(x), \cup)$ . Are these monoids ? If so, give their identities.	05	3	CO4
<b>Q. 4 Attempt any TWO</b>				
A	Draw the POSET of P(A) (power set of set A) where $A = \{1,2,3\}$ under subset relation. Prove that it is a lattice.	09	2	CO1
B	i) Simplify following Boolean expression by using K-Map  $A'BC'D' + AB'C'D' + AB'CD' + ABC'D + ABCD'$	04	4	CO3
	ii) Draw the POSET of $A = \{1,2,3,5,6,10,15,30\}$ under divides relation. Prove that it is a lattice	05	4	CO3

C	i)	State Commutative laws, Distributive laws, Identity laws, Complement laws with respect to Boolean algebra.	04	2	CO3
	ii)	Find $L_1 \times L_1$ ( product of lattices) if $L_1=\{0,1\}$ and partial ordering is $\leq$ .	05	3	CO3
<b>Q. 5 Attempt any TWO</b>					
A	i)	In how many different ways can the letters of the word 'CORPORATION' be arranged so that the vowels always come together?	03	5	CO5
	ii)	In how many ways can a group of 5 men and 2 women be made out of a total of 7 men and 3 women?	03	5	CO5
	iii)	A bag contains 2 white balls, 3 black balls and 4 red balls. In how many ways can 3 balls be drawn from the bag, if at least one black ball is to be included in the draw?	03	5	CO5
B	i)	Balls numbered 1 through 20 are placed in a bag. Three balls are drawn out of the bag without replacement. What is the probability that all the balls have odd numbers on them?	04	5	CO5
	ii)	Describe algorithm to generate combination of 4 numbers out of $\{1,2,3,4,5,6\}$ .	05	2	CO5
C	i)	Explain the terms a priori probability, likelihood in regards to probability theory.	03	5	CO5
	ii)	Three machines M1, M2, and M3 were used for producing a large batch of similar manufactured items. Suppose that 20 percent of the items were produced by machine M1, 30 percent of the items were produced by machine M2, and 50 percent by machine M3. Suppose further that 1 percent of the items produced by machine M1 are defective, that 2 percent produced by machine M2 are defective, and 3 percent produced by	06	5	CO5

- machine M3 are defective. Finally, suppose that one item is selected at random from the entire batch, and it is found to be defective. Find the probability that this item was produced by machine M2.

**Q.6 Attempt any THREE**

A	Describe properties of lattice and Boolean algebra.	06	2	CO3
B	Prove that $S=\{1,2,3,6,12\}$ is a complemented lattice under divides relation	06	3	CO3
C	i) 25 buses are running between two places P and Q. In how many ways can a person go from P to Q and return by a different bus?	03	5	CO5
	ii) A box contains 4 red, 3 white and 2 blue balls. Three balls are drawn at random. Find out the number of ways of selecting the balls of different colors?	03	5	CO5
D	Write a note on information content and mutual information.	06	2	CO5

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