

Code No: 113BN

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, November - 2015

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

(Common to CSE, IT)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Verify whether the following inference is valid or not.

Statement 1 : If today is 2<sup>nd</sup> October then today is Gandhi's birthday.

Statement 2 : Today is not 2<sup>nd</sup> October

Inference : Today is not Gandhi's birthday

[2M]

b) Express  $P \leftrightarrow Q$  in terms:

[3M]

i) Implication and AND

ii) In terms of AND, OR, NOT

iii) In terms of EX-OR.

c) Define group.

[2M]

d) Let  $X = \{1, 2, 3, 4\}$  and a partition of  $X$  is given as  $\{\{1,2\}, \{3, 4\}\}$ . Find the corresponding equivalence relation for given partition.

[3M]

e) List the 3-combinations of  $\{3a, 2b, 4c\}$

[2M]

f) Enumerate the number of binary numbers with seven 1's and five 0's.

[3M]

g) Find the general solution for the recurrence.

$a_n = a_{n-1} + f(n), n \geq 0$  and  $a_0$  is given initial condition

[2M]

h) Find the co-efficient of  $X^9$  in  $(1+x^3+x^8)^{10}$ .

[3M]

i) Find the cut vertices and cut edges in the following graph (figure 1).

[2M]

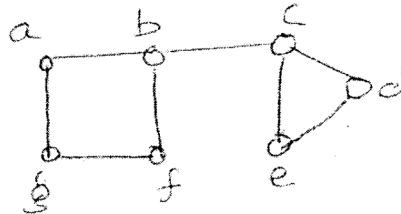


Figure: 1

j) How many regions will be there in a tree with 'n' vertices? Give explanation in one or two lines.

[3M]

**PART-B**

**(50 Marks)**

- 2.a) Obtain PCNF and PDNF by using truth table for the formula.  
 $(P \rightarrow Q) \vee (Q \vee R)$
- b) Using automatic theorem proving, show that  $(P \rightarrow Q), \sim Q$  logically implies  $\sim P$ . [5+5]

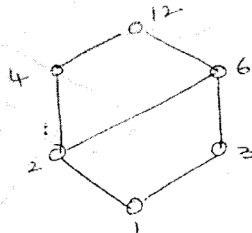
**OR**

- 3.a) Show that  $\sim (P \rightarrow Q) \rightarrow \sim (R \vee S), ((Q \rightarrow P) \vee \sim R), R$  logically implies  $P \leftrightarrow Q$ .
- b) Show that the set of following premises are inconsistent. [5+5]
- Premise 1 : If today is 1<sup>st</sup> April then today is fool's day  
Premise 2 : If today is 1<sup>st</sup> April then  $2+2 \neq 8$   
Premise 3 : If today is fool's day then  $2+2 = 8$   
Premise 4 : Today is 1<sup>st</sup> April.

- 4.a) Let  $X = \{\text{ball, bed, dog, let, egg}\}$  and  $R$  is a relation defined on  $X$  as  $R = \{(x, y) \mid x \text{ and } y \text{ contains some common letter}\}$ . Show that  $R$  is compatibility relation and also find maximum compatibility blocks for  $R$ .
- b) Draw the Hasse diagram for the relation  $R = \{(x, y) \mid x \text{ divides } y\}$  on  $X = \{2, 3, 6, 12, 24, 36\}$ . [5+5]

**OR**

- 5.a) Consider the following Hasse diagram shown in figure 2 for the relation "divides" and find the upper bounds and lower bounds for: i)  $\{2, 3\}$  ii)  $\{3, 4, 6\}$ .



**Figure: 2**

- b) Verify the following system is group or not  $G = \{1, 2, 3, 4, 5\}$  and the operation  $+_6$ . Where  $+_6$  represents additive module 6. [5+5]
- 6.a) In how many ways can the letters of English alphabet be arranged so that there are exactly 6 letters between the letters b and c.
- b) How many different outcomes are possible by tossing 15 similar coins? [5+5]
- OR**
- 7.a) Enumerate the number of non-negative integral solutions to the inequality  $X_1 + X_2 + \dots + X_5 \leq 12$ .
- b) Find the co-efficient  $X^5 Y^5 Z^{10}$  in the expansion  $(2X + 5Y - 3Z)^{20}$ . [5+5]
8. Solve the recurrence relation  
 $a_n - 5a_{n-1} + 8a_{n-2} - 4a_{n-3} = 0$ , where  $n \geq 3$  and  $a_0 = 1, a_1 = 1, a_2 = 2$ . [10]

**OR**

- 9.a) Solve the recurrence relation  $a_n = a_{n-1} + 1/n(n+1)$  where  $a_0 = 2$ .  
 b) Write the generating function for the following sequence  $B = \{b_r\}_{r=0}^{\infty}$  where

[5+5]

$$b_r = \begin{cases} 1 & \text{if } 0 \leq r \leq 4 \\ 2 & \text{if } r = 5 \\ 0 & \text{if } r \geq 6 \end{cases}$$

10. Consider the following Graph (Figure 3).

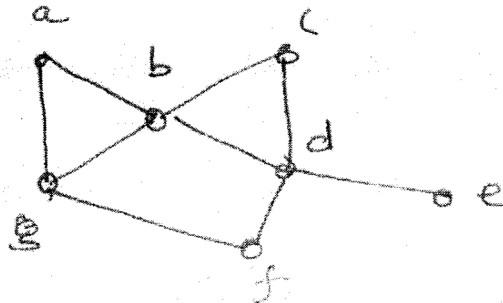


Figure: 3

With respect to the above graph decide whether the each of the following paths are simple, closed, circuit and cycle.

- a-b-c-d-b-g-a
- a-b-c-e-f
- g-b-d-f-g
- a-b-d-e
- a-b-d-e-d-b-a.

[2+2+2+2+2]

OR

- 11.a) Verify whether the following graph (Figure 4) contains Hamiltonian cycle or not.

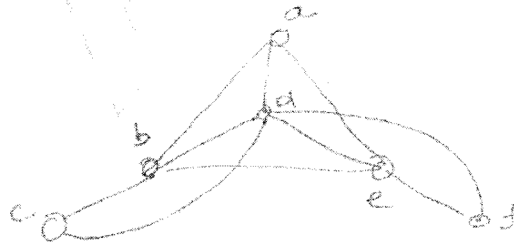


Figure: 4

- b) Show that the complete graph  $K_n$  is planar if  $n \leq 5$ .

[5+5]

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