I Semester B.C.A. Degree Examination, May 2022

(NEP – 2021-2022 and Onwards)

COMPUTER SCIENCE

Paper – 1.1 : Discrete Structures

Time : 2½ Hours

Max. Marks : 60

*Instruction : Answer **any four** questions from **each** Section.*

SECTION – A

I. Answer **any four** questions. **Each** question carries **2** marks. $(4×2=8)$

1) Find the intersection $A \cap B$ and set difference $A - B$ if

   $A = \{1, 3, 5, 7, 9\}$ and $B = \{2, 3, 4, 5, 6, 8\}$.

2) Prove that $(p \rightarrow q) \leftrightarrow (7q \rightarrow 7p)$ is a tautology.

3) Find the values of i) $4P_3$ ii) $6C_3$.

4) Find A^{-1} if $A = \begin{bmatrix} 6 & 3 \\ 2 & 4 \end{bmatrix}$.

5) Define the terms :

   i) Graph ii) Adjacency Matrix.

6) What is a minimum cost spanning tree ?

SECTION – B

II. Answer **any four** questions. **Each** question carries **5** marks. $(4×5=20)$

7) Prove that for any three propositions p, q and r show that

   $p \rightarrow (q \wedge r) \equiv [(p \rightarrow q) \wedge (p \rightarrow r)]$.

8) Consider the functions f & g : $R \rightarrow R$ defined by $f(x) = x^2 + 5$ and $g(x) = 5x - 2$
   Find the composite functions.

   i) fog ii) gof iii) fof

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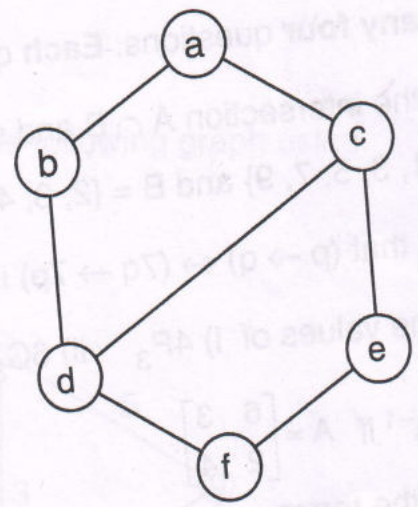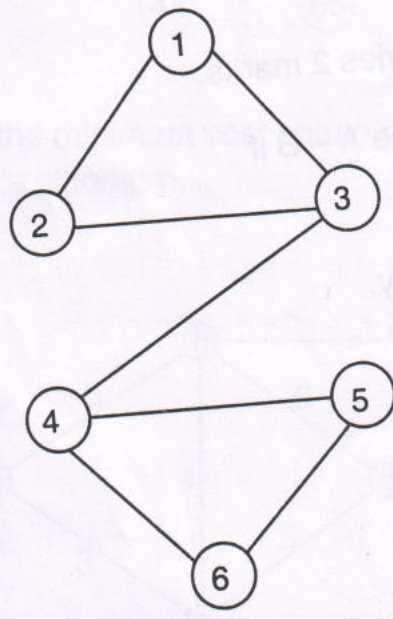
9) How many ways are there to form a committee, if the committee consists of 3 women and 4 men if there are 6 women and 7 men ?

10) Define rank and nullity of a matrix. Find the rank of the following matrix

$$A = \begin{bmatrix} 3 & -1 & 4 \\ 6 & 1 & -1 \\ 1 & 5 & 8 \end{bmatrix}.$$

11) Define isomorphism of graphs. Verify that the two graphs shown below are isomorphic or not.

12) What is a Hamiltonian circuit ? Check whether the following graph contains Hamiltonian circuit. Justify your answer.
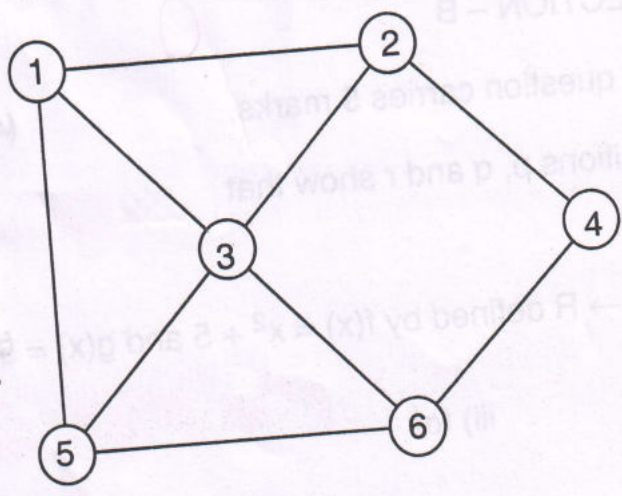
SECTION – C

III. Answer **any four** questions. **Each** question carries **8** marks.   (4×8=32)

13) Let A and B non-empty sets. Define :

    i) One-to-one function

    ii) Onto function

    iii) Bijective function

    iv) if $|A| = 4$ and $|B| = 7$ find the number of functions from A to B.

14) Using Mathematical induction prove that $1^3 + 2^3 + 3^3 + ... + n^3 = \dfrac{n^2(n+1)^2}{4}$ where n is a natural number ?

15) a) In how many ways can the letters of the word 'LEADING' be arranged in such a way that the vowels always come together ?   4

    b) A box contains 2 white balls, 3 black balls and 4 red balls. In how many ways can 3 balls be drawn from the box, if atleast one black ball is to be included in the draw ?   4

16) Solve the following system of linear equations using Cramer's rule.

    $x + y + z = 6$

    $2x + 3y - z = 5$

    $6x - 2y - 3z = -7$

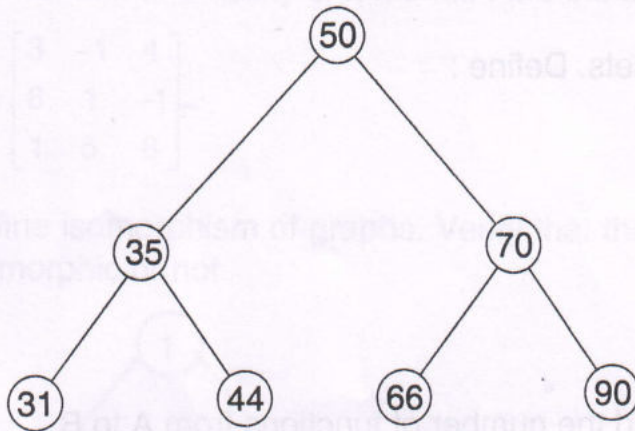17) a) If $2A + B = \begin{bmatrix} 4 & 4 & 7 \\ 7 & 3 & 4 \end{bmatrix}$

    $A - 2B = \begin{bmatrix} -3 & 2 & 1 \\ 1 & -1 & 2 \end{bmatrix}$ then find A and B.   4

b) Find the in order, preorder and post order traversal of the following tree.

4

18) Obtain the minimum cost spanning tree for the following graph using Kruskal's algorithm.

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