

Time: 3 Hours

Max. Marks: 75

**Note:** i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

**PART - A****(25 Marks)**

- 1.a) Give the truth table for the propositional formula  $(p \rightarrow q) \leftrightarrow (\neg p \vee q)$ . [2]
- b) Write the sentence "If  $2+3 = 4$  then sun rises in the east" in the symbolic form and also write its inverse and converse statement. [3]
- c) Define equivalence relation. [2]
- d) Differentiate between semi group and sub group. [3]
- e) How many words of three distinct letters can be formed from DUST? [2]
- f) Give the sequential rule for counting problem. [3]
- g) What is closed form expression of the sequence  $a_n = 4, n \geq 0$ ? [2]
- h) Find the coefficient of  $x^{32}$  in  $(1+x^5+x^9)^{10}$ . [3]
- i) State Euler's formula for a connected planar graph. [2]
- j) What are the advantages and disadvantages of breadth first search algorithm? [3]

**PART - B****(50 Marks)**

- 2.a) Show that the following proportions are contradiction.
  - i)  $(p \wedge q) \wedge \neg(p \vee q)$
  - ii)  $(\neg q \wedge p) \wedge q$
- b) Prove the following logical equivalence without using truth table
 
$$((\neg p \vee \neg q) \rightarrow (p \wedge q \wedge r)) \Leftrightarrow p \wedge q. \quad [5+5]$$

**OR**

3. Describe the rules of inference in predicate logic and verify the validity of the following inference.

If one person is more successful than another, then he has worked harder to deserve success. Naveen has not worked harder than Praveen. Therefore Naveen is not more successful than Praveen. [10]

- 4.a) Explain Warshall's algorithm with an example.
- b) Show that the inclusion relation  $\subseteq$  is a partial ordering on the power set of a set A. [5+5]

**OR**

- 5.a) If every element of a group G except the identity element is of order 2, then prove that the group G is abelian.
- b) What are the necessary and sufficient conditions for a homomorphism of a group? [5+5]



6.a) There are 20 boys and 15 girls in LKG while there are 12 boys and 23 girls in UKG. In how many ways can a team of 10 be chosen so that there are 5 girls and 3 UKG students in the team?

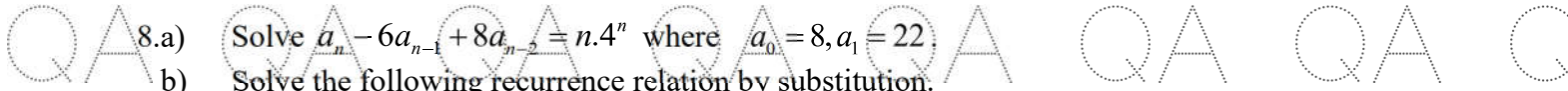
b) Enumerate the number of ways of placing 20 indistinguishable balls into 5 boxes where each box is non empty. [5+5]



OR

7.a) Find the middle term of  $\left(x - \frac{3}{y}\right)^9$ .

b) Find the number of integers between 1 and 1000 which are not divisible by 2, 3, 5 or 7. [5+5]



8.a) Solve  $a_n - 6a_{n-1} + 8a_{n-2} = n \cdot 4^n$  where  $a_0 = 8, a_1 = 22$ .

b) Solve the following recurrence relation by substitution.

$$a_n = a_{n-1} + n^3 \text{ Where } a_0 = 5$$

[5+5]

OR

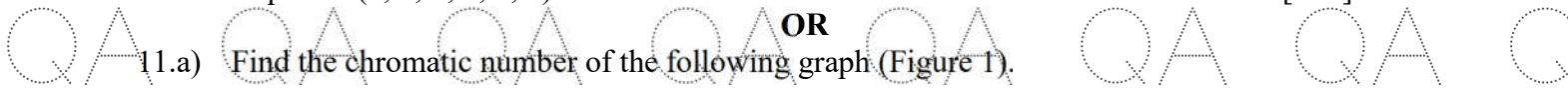
9.a) Solve  $a_n^2 - 2a_{n-1} = 1$  for  $n \geq 1$ , where  $a_0 = 2$ .

b) Find a general expression for  $a_n$  using generating functions.  $a_n - 4a_{n-1} + 3a_{n-2} = 0, n \geq 2, n \geq 2$ . [5+5]



10.a) Suppose that G is a non directed graph with 12 edges. Suppose that G has 6 vertices of degree 3 and the rest have degrees less than 3. Determine the minimum number of vertices G can have.

b) Give an example of 2 non isomorphism graphs of order 6 and size 6 with degree sequence (2, 2, 2, 2, 2, 2). [5+5]



OR

11.a) Find the chromatic number of the following graph (Figure 1).

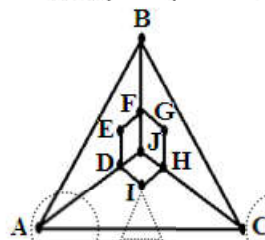


Figure 1

b) Show that the following figure 2 has no Hamiltonian cycle. But the graph has a Hamilton path (Figure 2). [5+5]

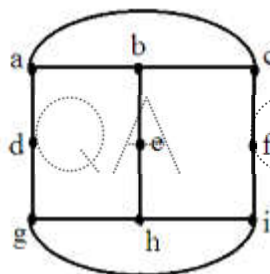


Figure 2

