S. S. Jain Subodh College of Global Excellence, Jaipur
B.C.A. Part II Pre University Examination, 2023
(Faculty of Science)
(Three - Year Scheme of 10+2+3 Pattern)

DISCRETE MATHEMATICS

Time Allowed: Three Hours   Maximum Marks: 100

No supplementary answer-book will be given to any candidate. Hence the candidates should write their answers precisely in the main answer-book only.
All the parts of one question should be answered at one place in the answer-book. One complete question should not be answered at different places in the answer-book. Write your roll number on question paper before start writing answers of questions.
PART - I   (Very short answer) consists of 10 questions of 2 marks each. Maximum limit for each question is up to 40 words.
PART - II: (Short answer) consists of 5 questions of 4 marks each. Maximum limit for each question is up to 80 words.
PART -III: (Long answer) consists of 5 questions of 12 marks each with infernal choice.

Part-I

1. (i) Convert $(.6875)_{10}$ into binary form.
   (ii) Write the general term in the expansion of $(a + 2x)^n$.
   (iii) Expand $(2x - 3y)^4$
   (iv) If $A = \{1,2,3,4,5\}$ then cardinality of the set A will be?
   (v) Solve $x^2 - 3x + 2 = 0$
   (vi) If $f(x) = 2x - 7$ then find the value of the function on $x = 2,3 \& 4$.
   (vii) Write the truth table of $p \to q$.
   (viii) Define un-directed Graph.
   (ix) Draw a n-Regular Graph.
   (x) Write Euler Formula for Graph.

Part-II

2. a). If A, B. C and D are any four sets, then prove that $(A \times B) \cap (C \times D) = (A \cap C) \times (B \cap D)$

   b).Find the middle term in the expansion of $(x^2 + 3y)^5$

   c). Compute the sum (a) $(10111)_2 + (10011)_2$ (b) $(110101)_2 + (1010)_2$

   d). Solve $a_r = a_{r-1} + a_{r-2}$; $r \geq 2, a_0 = 0, a_1 = 1$

   e). If p and q are two statements then show that $p \Leftrightarrow q$ and $(p \wedge q) \vee (\sim p \wedge \sim q)$ are logically equivalent.
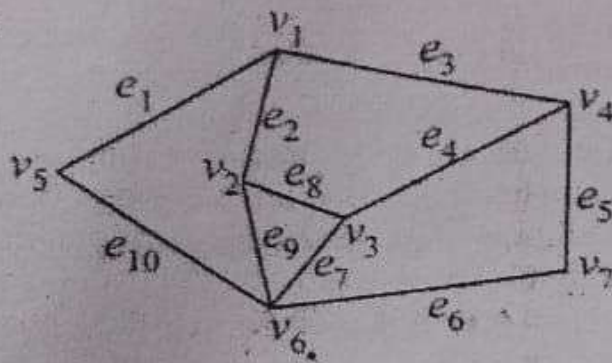
Part-III

3. a). Compute $(39)_{10} + (68)_{10} = (?)_2$

   b). Use Mathematical Induction to prove $1 + 2 + 3 + 4 + 5 .... + n = \frac{n(n+1)}{2}$

4. Find the coefficient of x^4 in the expansion of $(1 + 2x)^6 (1 - x)^7$

5. a). Prove $A \cap (A \cup B) = A$ and $A \cup (A \cap B) = A$

   b). Construct the truth table for $\sim p \to (q \to r)$

6. a). Multiply $(110111)_2$ by $(101)_2$. Hence convert the result in to the decimal number.

b). Write the converse, contraposition and inverse of the implication " If I am hungry then I will eat."

Or

7. a). Check whether the function $f(x) = 3x^3 + 5$, for all $x \in R$ is a bijection.
   b). Convert in binary numbers (i) $(236.245)_{10}$ (ii) $(35.3245)_{10}$ (iii) $(149)_{10}$

8. Find the incident matrix and adjacency matrix of the following graph And use the Euler formula to check whether it is a plannar.

B.C.A. (Pt.-II)   Disc. Math.

202/232
B.C.A. (Part-II) Examination, 2023   401941
(Faculty of Science)

(Three Year Scheme of 10+2+3 Pattern)

Discrete Mathematics

Paper : 202/232

Time Allowed : 3 Hours   **Maximum Marks : 100**

Answer of all the questions (Short answer as well as are to be given in the main answer-book only.

Answers of short answer type questions must be given in sequential order. Similarly all the parts of one question of descriptive part should be answered at one place in the answer-book. One complete question should not be answered at different places in the answer-book.

Write your roll number on question paper before you start writing answers of questions.

Question paper consists of **Three** parts.

All Three parts are Compulsory

PART-I : (Very short answer) consists of 10 questions of 2 marks each. Maximum limit for each question is up to 40 words.

PART-II : (Short answer) consists of 5 questions of 4 marks each, Maximum limit for each question is up to 80 words.

PART-III : (Long answer) consists of 5 questions of 12 marks each with one question from each unit with internal choices.
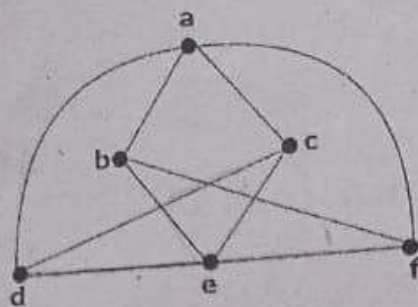
PART-I

1.   Attempt all the parts of the questions : $10 \times 2 = 20$

    (a)   Convert $(1101101.011)_2$ into $()_{10}$.

    (b)   Computer $(436)_{10} + (51)_{10} = ()_2$.

    (c)   If $A = \{2,3,4\}$ and $B = \{3,4,5,6\}$ then find the symmetric difference of the sets A and B.

    (d)   Define Reflexive relation with example.

    (e)   Show that $(p \wedge q) \Rightarrow p$ is a tautology.

    (f)   What is Universal Gate? Name the types of Universal Gates.

    (g)   What is Bipartite Graph? Give example.

(h) Find the chromatic number of the graph given below :

(i) Define Eccentricity of Vertex.

(j) What is binary Tree? Give example.

PART-II

2. Attempt all the parts : $4 \times 5 = 20$

(a) Find the terms independent of x in the expansion of $\left(3x^2 + \dfrac{1}{3x}\right)^9$.

(b) A and B are two sets and U the Universal set such that $n(U) = 700$, $n(A) = 200$, $n(B) = 300$ and $n(A \cap B) = 100$. Find $n(A' \cap B')$.

(c) Compute the truth table of the statement $(p \Rightarrow q) \Leftrightarrow (\sim q \Rightarrow \sim p)$.

(d) Explain Eular Graph? Find Eular line of the graph given below :
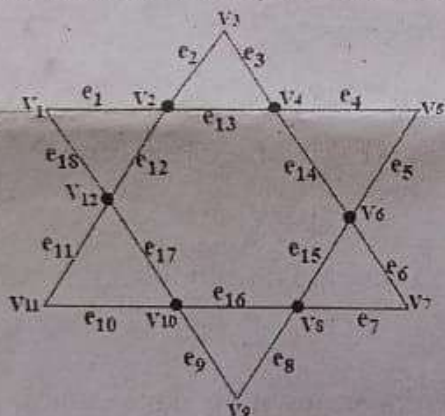
(e) Prove that the number of vertices in a binary tree is always odd.

PART-III

Attempt all the questions by taking Internal choice.

3. (a) Prove by Mathematical Induction method :   6

$$1^2 + 2^2 + 3^2 + 4^2 + \ldots\ldots\ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

(b) Find the coefficient of x^5 in the expansion of the product $(1 + 2x)^6 (1 - x)^7$.   6

Or

(a) Solve the recurrence relation :   6

$a_n = 6a_{n-1} - 8a_{n-2}$ where $a_0 = 4$, $a_1 = 10$

(b) Find the generating function of the Fibonacci Sequence (a_n) defined by   6

$a_n = a_{n-1} - a_{n-2}$ where $a_0 = 0$, $a_1 = 1$

2

4. (a) Prove that the relation R on the set Z of all integers defined by $(x, y) \in R \Rightarrow x - y$ is divisible by n is an equivalence relation on Z. 6

(b) Let $A = R - \{2\}$ and $B = R - \{1\}$ if $f : A \to B$ is a mapping defined by $f(x) = \dfrac{x-1}{x-2}$ show that f is bijective. 6

Or

(a) If $f : R \to R$ and $g : R \to R$ are defined by $f(x) = x + 2$ and $g(x) = 2x^2 + 5$, then show that $fog \neq gof$. Also $fog(-1)$ and $gof\left(\dfrac{1}{2}\right)$. 6

(b) Let * be a binary operation on the set Q of rotational number as $a^* b = a + b - ab$ check whether * is commutative and associative. 6

5. (a) Prove by using Boolean Algebra properties : 3+3

    (i) $[a + (a' + b']. [a + (b' + c]' = a$

    (ii) $(a + b).(a + b' + c') = a + b.c'$

(b) Prove that $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$.

Or

(a) Show by means of a truth table that $(p \Leftrightarrow q) \equiv (\sim p \vee q) \wedge (\sim q \vee p)$. 6

(b) (i) Express the following Boolean function in D.N.F.

      $[(x_1 + x_2') + (x_2 + x_3')']' + x_2. x_3$

    (ii) Draw the logic gate diagram of the following boolean function 4.2

      $[(x + y) + (x + z)]. x.y'$

6. (a) Find the Adjacency and incidence matrix of the following graph :
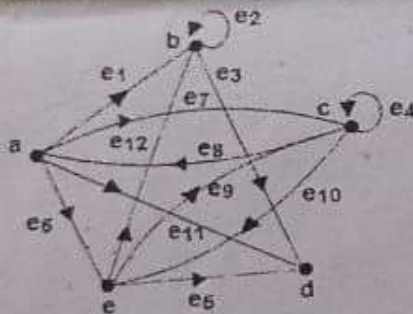
(b) Explain Planar and Non-Planar graph with suitable example. 3+3

Or

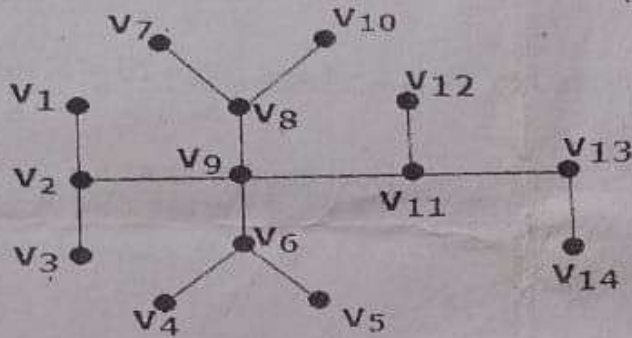(a) Find the Shortest path between the vertex a and f in the following graph by using Dijkstra's Algorithm :
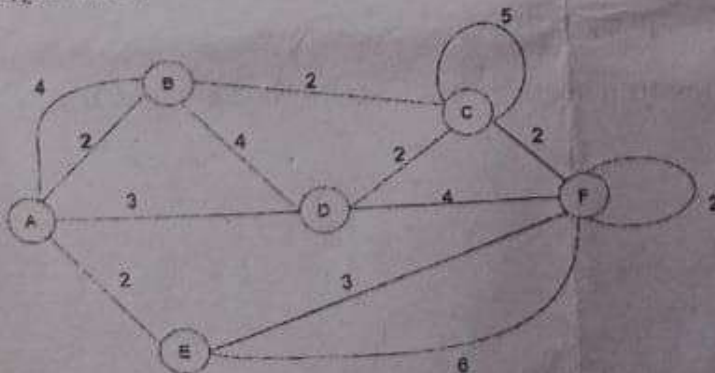
If G (V, E) be a loop free connected planar graph with $|V| = v$ vertices $|E| = e > 2$ edges and r region, then prove that
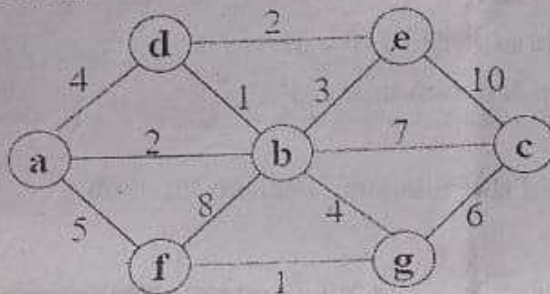
(i) $3r \leq 2e$ (ii) $e \leq 3V - 6$ 6

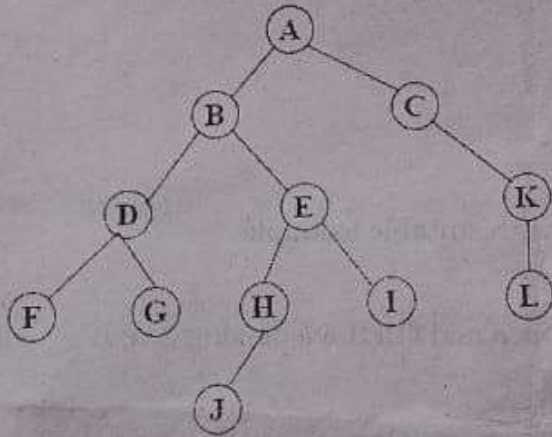7. (a) Find the eccentricity of all the vertices of the given tree below :

(b) Find a Minimal Spanning tree for a following weighted connected graph by using Prim's algorithm.

Or

(a) Write the Preorder, Inorder and Postorder traversal of the following graph.   6

(b) If T is binary tree of height h with n vertices, then prove that $h + 1 \leq n \leq 2^{h+1} - 1$.   6

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