

PRN No.	Total No. of Questions: 09
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QP Code:

JSPM's
RajarshiShahu College of Engineering, Tathawade, Pune- 411033
(An autonomous institute affiliated to SavitribaiPhule Pune University)
End Semester Examinations (ESE) May/June23-24
Class: F. Y. B. Tech. (IT)
Semester: I Academic Year: 2023-24
Department: Engineering Sciences and Humanities

DE F.Y.B.Tech (IT)
23-24

Course Code: ES1204

Course Name and pattern: Discrete Mathematics (2023)

Duration: 2 Hours 30 Mins.

Max. Marks: 50 Marks

Instructions to the Candidates

1. Q.1, Q.2 and Q.3 are compulsory.
2. Solve Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.
3. Assume suitable data if necessary.
4. Use of non-programmable electronics pocket calculator is allowed.

Q.1 Solve any one

- a Obtain the principal conjunctive normal form (PCNF) and principal disjunctive normal form (PDNF) of the statement $p \rightarrow (p \rightarrow q) \wedge \sim (p \wedge q)$ by using the Truth table method. 4 BL3 CO1
- b Translate each of the statement into symbols, using quantifiers, variables and predicate symbols: 4 BL3 CO1
 - i) Every electrical engineering student must take an electronics course.
 - ii) There are some electrical engineering students who have not taken electronics courses.

Q.2 Solve any one

- a In a town of 10000 families it was found that 40% of families buy newspaper A, 20% family buy newspaper B, 10% family buy newspaper C, 5% family buy newspaper A and B, 3% family buy newspaper B and C and 4% family buy newspaper A and C. If 2% family buy all the newspaper. Find 4 BL3 CO2
 1. Number of families which buy none of A, B, C
 2. Number of families which buy newspaper A and B only

- b Let $A = \{1, 2, 3, 4, 5\}$ and R be relation defined on A whose M_R is

4 BL3 CO2

$$M_R = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

Draw Hasse diagram of relation R on A .

Q.3 Solve any one

- a Let $Z_n = \{0, 1, 2, \dots, n-1\}$. Let \oplus_n be a binary operation such that $a \oplus_n b =$ remainder of $a + b$ divided by n . Construct a table for $n = 5$. Is (Z_5, \oplus_5) an abelian group? 4 BL3 CO3

- b Given the generator matrix $G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 \end{bmatrix}$ corresponding to the encoding function $e: B^3 \rightarrow B^6$, find the corresponding parity check matrix. Use it to decode the following received words i) 000101 ii) 110001 and hence, find the original message. 4 BL3 CO3

- Q.4** a i) From a word containing 5 vowels and 12 consonants, how many 8 letter words can be formed by using 3 vowels and 5 consonants? 4 BL3 CO4
ii) In how many ways can the letters in the word 'MISSISSIPPI' be arranged so that 'S' are always together?
b Use mathematical induction to prove that $n^3 + 2n$ is divisible by 3 for all integers $n \geq 1$. 4 BL3 CO4
c Solve the recurrence relation $a_n - 12a_{n-1} + 36a_{n-2} = 39$, where $a_0 = 0$ and $a_1 = 2$. 4 BL3 CO4

OR

- Q.5** a In how many ways can 20 students out of a class of 32 be chosen to attend class on a Thursday afternoon if
i) Paul refuses to go to class?
ii) Michelle insists on going?
iii) Jim and Michelle insist on going? 4 BL3 CO4
b Find the generating functions of the sequence $a_n = 2(-3)^n + 3(5)^n$, where $n = 0, 1, 2, 3, \dots$ 4 BL3 CO4
c Solve the recurrence relation $a_n - 7a_{n-1} + 12a_{n-2} = 36$, where $a_0 = 1$ and $a_1 = 3$. 4 BL3 CO4

Q.6

a Suppose that a connected planar graph has eight vertices, each of degree three. Using Euler's formula, find how many regions are in that planar graph? Draw such a graph.

4

BL3 CO5

b Determine whether the graphs K_5 and $K_{2,3}$ are isomorphic or not. Justify your answer.

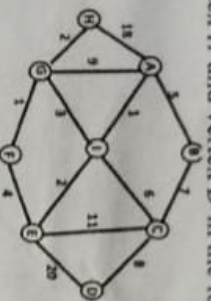
4

BL3 CO5

c Use Dijkstra's algorithm, to find the shortest path and its length between vertex H and vertex D in the following weighted graph.

5

BL3 CO5



Q.7

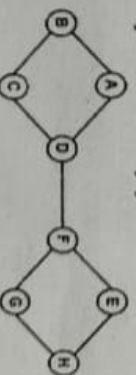
a Determine whether the following graph is

OR

4

BL3 CO5

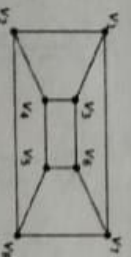
- Complete
- Bipartite. If yes, draw the graph
- Complete Bipartite. Justify your answer.



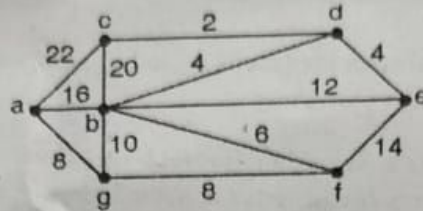
b Determine whether Eulerian path, Eulerian circuit, Hamiltonian path, Hamiltonian circuit, if it exists in the following graph. If it does not exist, explain why?

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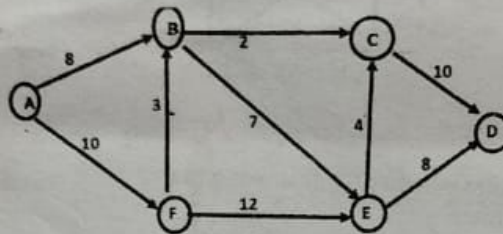
BL3 CO5



- Q.8 a Find the minimal spanning tree and its minimum weight using Kruskal's algorithm. 4 BL3 CO6



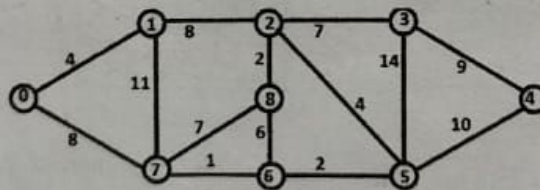
- b Find maximum flow in the transport network using labeling procedure. 4 BL3 CO6
Determine the corresponding minimum cut set.



- c A file contains the string "DATAMINNING". If Huffman Coding is used for data compression, determine the following: 5 BL3 CO6
i) Huffman Code for each character.
ii) Average code length.
iii) Length of Huffman encoded message (in bits).

OR

- Q.9 a Find the minimal spanning tree and its minimum weight using Prim's algorithm. 4 BL3 CO6



- b 19 lamps are to be connected to a single electrical outlet, using extension cords, each of which has 4 outlets. Find the number of extension cords needed and draw the corresponding tree. 4 BL3 CO6
- c A file contains the string "ENGINEERING". If Huffman Coding is used for data compression, determine the following: 5 BL3 CO6
i) Huffman Code for each character.
ii) Average code length.
iii) Length of Huffman encoded message (in bits).