BENNETT UNIVERSITY
TIMES OF INDIA GROUP

DO NOT WRITE ANYTHING ON QUESTION PAPER EXCEPT YOUR NAME, DEPARTMENT AND ENROLMENT No.

Name of Student ---------- Enrolment No. ----------

Department / School ----------

BENNETT UNIVERSITY, GREATER NOIDA

Supplementary / Make-Up Examination, January - 2020

COURSE CODE: **ECSE209L** MAX. DURATION: **2 Hours**

COURSE NAME: **Discrete Mathematical Structures** MAX. MARKS: **50**

Note: Attempt all the questions. All the questions are compulsory.

Q.1 State the negation of each of the following conjunctions: **(2 Marks)**

(a) Paris is in France and London is in England.

(b) $2 + 4 = 6$ and $7 < 12$

Q.2 Show that the following argument is invalid using truth table: **(2 Marks)**

If Siddharth solved this problem, then he obtained the answer 5.

Siddharth obtained the answer 5.

Therefore, Siddhartha solved this problem correctly.

Q.3 (a) Show that $\sum_{i=1}^{n}(2i - 1) = n^2$ using mathematical induction. **(3 Marks)**

(b) Describe Russell's Paradox. Justify your answer with the help of an example. **(2 Marks)**

Q.4 Show that $(X - Y) - Z = (X - Z) - (Y - Z)$ **(2 Marks)**

(Note: Consider X, Y and Z to be sets)

Q.5 (a) A computer company must hire 20 programmers to handle system programming jobs and 30 programmers for applications programming. Of those hired, 5 are expected to perform jobs of both types. Determine the total number of programmers that must be hired. **(2 Marks)**

(b) If R be a relation in the set of integers Z defined by: **(3 Marks)**

$R = \{(x, y): x \in Z, y \in Z \text{ and } x - y \text{ is divisible by } 3\}$

Determine whether R is a partial order relation. Justify your answer.

Q.6 If a mapping $f: A \to B$ is one-to-one and onto, then show that the inverse mapping $f^{-1}: B \to A$ is also one-to-one and onto. Also, support your answer with a suitable example. **(2 Marks)**

Q.7 Let $X = \{1, 2, 3, 4\}$ be a set and $A = \{(1,0.1), (2,1), (3,0.2), (4,0.5)\}$ be a fuzzy set. **(2 Marks)**

"Here, A is a normal fuzzy set". Justify this statement.

Also, compute the following for the fuzzy set A:

(a) Height

(b) Core

(c) Support

(d) Crossover Point

Q.8 Draw a graph corresponding to the map shown below and find a colouring that requires the least number of colours (vertex colouring). Calculate the chromatic number of the graph. **(3 Marks)**

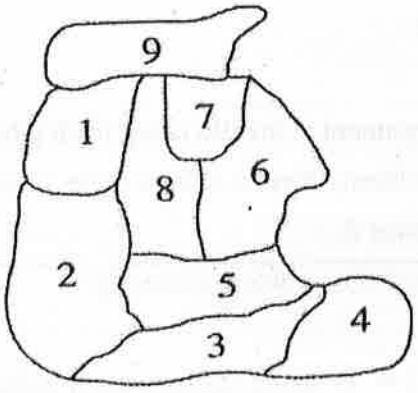

Fig. 1: A map representing important locations of a city

Q.9 (a) The set $L = \{1, 2, 3, 4, 6, 12\}$ of factors of 12 under divisibility forms a lattice. Prove by Hasse Diagram. **(3 Marks)**

(b) Determine whether the group $(G, +_6)$ is a cyclic group where $G = \{0, 1, 2, 3, 4, 5\}$. If yes, point out the generators. **(3 Marks)**

Q.10 Consider the statement: "A theorem in calculus states that every differentiable function is continuous." **(3+1 = 4 Marks)**

(a) State the derived implications of the given statement.

(b) Assuming that the given statement is TRUE, comment on the truth value of the derived implications.

Q.11 State whether the following are TRUE or FALSE: **(2 Marks)**

(a) If B is a tautology and A is a contradiction, then $(\neg A) \vee B$ is a tautology.

(b) If A and B are both contradictions, then $A \rightarrow B$ is a tautology.

Q.12 (a) Let $A = \{1,2,3,6\}$. If for $x, y \in A$. **(2 Marks)**

$$R = \{(x, y): x \leq y\}$$
$$S = \{x, y): x \; divides \; y\}$$

Write R and S as sets and Find $R \cap S$.

(b) Let P: We should be honest. Q: We should be dedicated. R: We should be overconfident. Then 'We should be honest or dedicated but not overconfident.' is best represented by: **(2 Marks)**

(i)$\sim P \vee \sim Q \vee R$
(ii) $P \wedge \sim Q \wedge R$
(iii)$P \vee Q \wedge R$
(iv) $P \vee Q \wedge \sim R$

Q.13 Show that the given pair of graphs are isomorphic: **(3 Marks)**

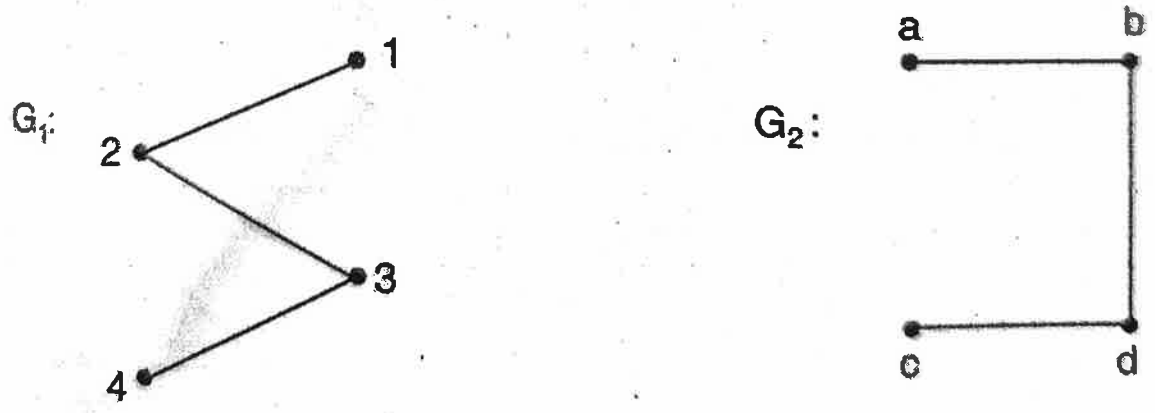

Fig. 2: A pair of graphs G_1 and G_2

Q.14 A bag has some pens. If these pens were equally distributed to:
(i) four students, then three pens left in the bag.
(ii) five students, then two pens left in the bag.
(iii) seven students, then four pens left in the bag.
Find the minimum number of pens in the bag. **(3 Marks)**

Q.15 (a) Compute the minimal spanning tree for the following graph G using Kruskal's algorithm: **(3 Marks)**

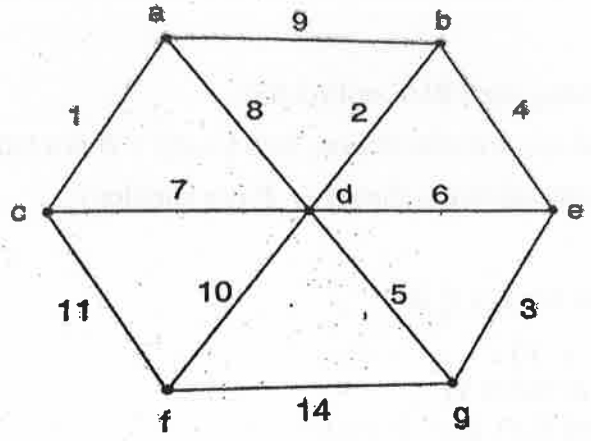

Fig. 3: A weighted graph G with 7 vertices

(b) Given the preorder and inorder traversal of a binary tree, draw the unique tree: **(2 Marks)**

Preorder: A B D E C F G H I

Inorder: D B E A F C H G
