BENNETT UNIVERSITY
TIMES OF INDIA GROUP

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

POSSESSION OF MOBILE IN EXAMINATION IS A UFM PRACTICE

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

Department -----------------------------

BENNETT UNIVERSITY, GREATER NOIDA

Supplementary Examination, FALL SEMESTER 2018-19

COURSE CODE: **ECSE209L / ECSE203L** MAX. DURATION: **2 Hours**

COURSE NAME: **Discrete Mathematical Structures**

COURSE CREDIT: **04** MAX. MARKS: **100**

Note

- All the questions are compulsory.
- Please write precisely and neatly. Please make clear diagram wherever required.

Q1) Prove the theorem "If n is a positive integer, then n is odd if and only if n^2 is odd". **(5 marks)**

Q2) For each of the following sets, determine whether 2 is an element of that set. **(5 marks)**

(a) {x € R | x is an integer greater than 1}
(b) {x € R | x is the square of an integer}
(c) {2, {2}}
(d) {{2}, {{2}}}
(e) {{2}, {2, {2}}}

Q3) If $A = \{1, 2, 3\}, B = \{4,5\}, C = \{1, 2, 3, 4, 5\}$, Find **(5 marks)**

(a) $A \times B$
(b) $C \times B$
(c) $B \times B$

Hence, prove that $(C \times B) - (A \times B) = (B \times B)$

Q4) Consider the relation R defined on A as follows: **(5 marks)**
$R = \{(a, b), (b, c), (d, c), (d, a), (a, d), (d, d)\}$ on $A = \{a, b, c, d\}$
Find the transitive and symmetric closure of R.

Q5) State whether each of the following relations represent a function or not: **(4 marks)**

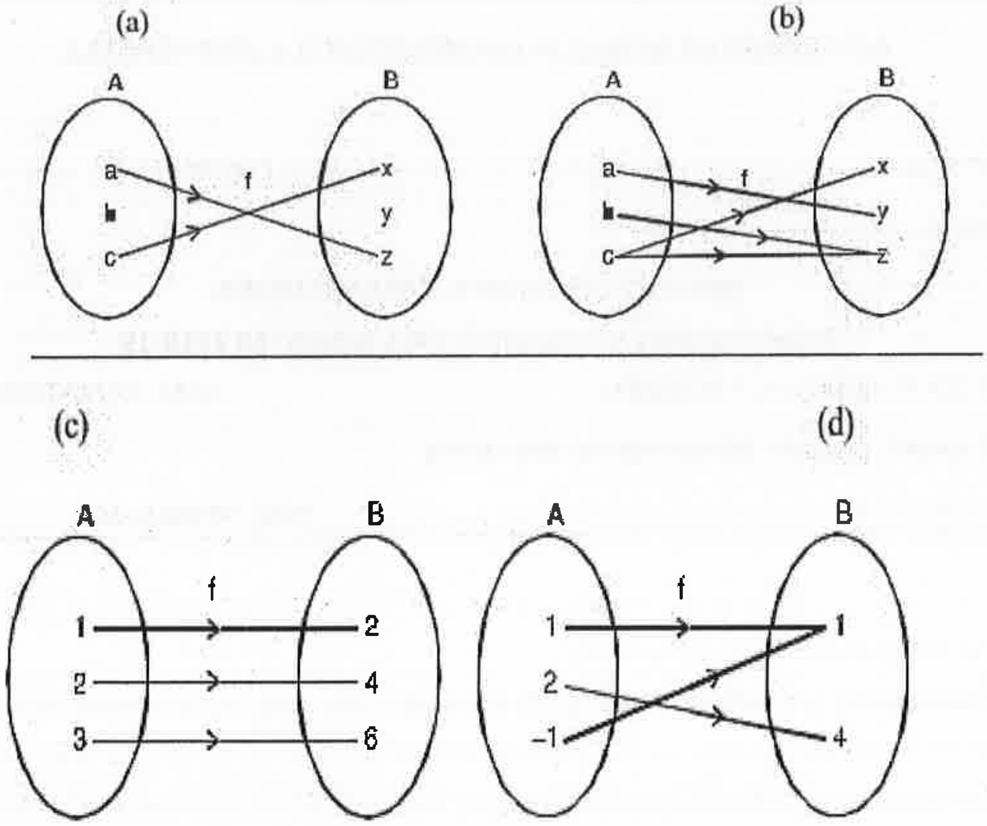


Fig 1: (a), (b), (c) and (d) represent the relation between two sets

Q6) Let f and g be the function from the set of integers to itself, defined by f(x) = 2x + 1 and g(x) = 3x + 4. Then the composition of f and g is ___________ **(1 mark)**

(a) 6x + 9
(b) 6x + 7
(c) 6x + 6
(d) 6x + 8

Q7) Determine whether the following pairs represent logically equivalent statements: **(2.5 + 2.5 = 5 marks)**

(a) $(P \wedge Q)'$ and $\neg P \vee \neg Q$
(b) $(P \rightarrow Q) \vee P$ and $(P \vee \neg Q) \wedge Q$

Q8) Each statement is either true or false. Identify which case is correct, and then provide justification for your answer. **(2.5 + 2.5 = 5 marks)**

(a) The statements $\neg(P \vee Q)$ and $(\neg P) \vee (\neg Q)$ have the same truth values for all possible values of P and Q.
(b) The compound proposition $P \vee Q \vee R$ can be interpreted as either $P \vee (Q \vee R)$ or as $(P \vee Q) \vee R$

Q9) Compute the secret message produced from the message "MEET YOU IN THE PARK" using the Caesar cipher. **(5 marks)**

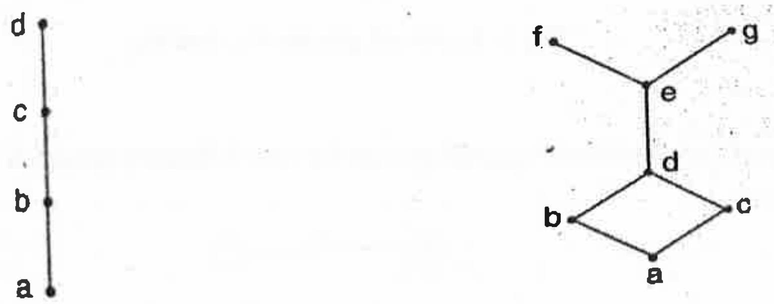
Q10) (a) A drawer contains 10 black and 10 white socks. Determine the least number of socks one must pull out to be sure to get a matched pair **(Tick the right answer)**: **(1 mark)**

(i) 2
(ii) 3
(iii) 4

(b) Compute the coefficient of x^2y^4 in $(x+y)^6$ **(Tick the right answer)**: **(1 mark)**

(i) 8
(ii) 12
(iii) 15

Q11) (a) Determine whether the following posets are lattices. Justify your answer: **(2.5 + 2.5 = 5 marks)**



(i) **(ii)**

Fig 2: (i) and (ii) represent the Hasse Diagram of Posets

(b) Suppose a bag contains 4 red balls and 5 black balls. Compute the number of ways in which 5 balls can be chosen so that at least 2 balls are red? **(5 marks)**

Q12) (a) If $X = \{4,2,3\}$, Find the number of elements in power set of X. **(3 marks)**

(b) In how many ways can we draw an Ace or a Heart from a pack of cards? **(5 marks)**

Q13) (a) Use mathematical induction to prove that $2^n < n!$ for every positive integer n with $n \geq 4$. **(Note that this inequality is false for $n = 1, 2$ *and* 3).** **(5 marks)**

(b) 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. **(5 marks)**

Q14) (a) Consider the traveling salesman problem. State whether the solution to this problem lies in finding the Hamiltonian path, Euler path, Euler circuit or Hamiltonian circuit. Justify your answer with one complete example. **(5 + 5 = 10 marks)**

(b) Show that the given pair of graphs are isomorphic: **(5 marks)**

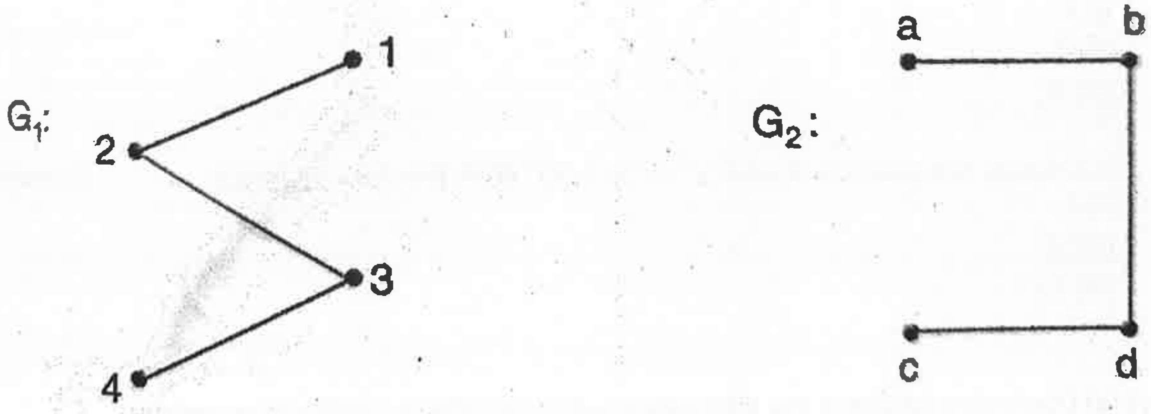


Fig 3: A pair of graphs G_1 and G_2

Q15) (a) Compute the minimal spanning tree for the following graph G using Kruskal's and Prims's algorithm: **(5 + 5 = 10 marks)**

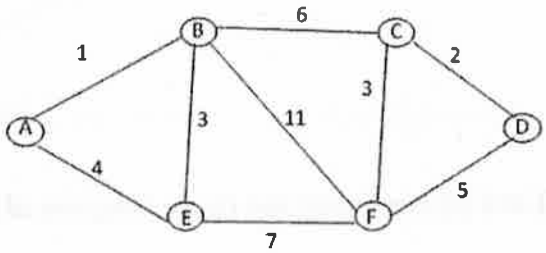


Fig 4: A weighted graph G with 6 vertices

(b) Given the preorder and inorder traversal of a binary tree, draw the unique tree: **(5 marks)**

Preorder: A B D E C F G H I
Inorder: D B E A F C H G I