

**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE PILANI**  
**K K BIRLA GOA CAMPUS**

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FIRST SEMESTER 2019-2020, Mid-Term Examination (Closed Book)

Course no.: MATH F213

Day: Saturday

Date: September 28, 2019

**Course title: Discrete Mathematics**

**Time: 90 minutes**

**Max Marks: 60**

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**INSTRUCTIONS:** 1. All questions are compulsory. 2. Begin answering a new question on a fresh page. 3. Explain all steps clearly to get full credit. 4. Incomplete/No index costs 2 marks.

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1. Translate the following into symbolic form and test the validity of the argument without using truth table .  
If 6 is even then 2 does not divide 7. Either 5 is not prime or 2 divides 7. But 5 is prime, therefore, 6 is odd. [5]
2. Prove by principle of mathematical induction that for all integers  $n \geq 4$ ,  $3^n > n^3$ . [7]
3. Let  $A = \{1, 2, \dots, 15\}$  and the equivalence relation  $R$  on  $A \times A$  defined by  $(a, b)R(c, d)$  if  $ad = bc$ . Find the equivalence class of  $(3, 2)$ . [5]
4. Let  $A = \{1, 2, 3, 4\}$  and let  $R$  be the relation on  $A$ , where  $R = \{(1, 2), (2, 3), (3, 4), (2, 1)\}$ . Find the transitive closure of  $R$  using Warshall's algorithm. [8]
5. Prove that for a bounded distributive lattice  $L$ , the complements are unique if they exist. [5]
6. Consider the lattice  $D_{60} = \{1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60\}$ 
  - (a) Find all join irreducible elements. [3]
  - (b) Draw the Hasse diagram. [4]
  - (c) Find all atoms. [2]
  - (d) Find complements of 10, if exist. [1]
7. (a) Write the circuit diagram (or gate diagram) of  $f(x_1, x_2, x_3) = (x_1 \cdot x_2 + x_3) \cdot ((x_2 + x_3) + x_3)$ . [4]  
(b) Simplify the function in part-(a) by using basic Boolean algebra laws. [3]  
(c) Write the circuit (gate) diagram of the result obtained in part-(b). [3]
8. (a) Use a K-map to find a minimal sum-of-products form for  $E = xy' + xyz + x'y'z' + x'yz't'$ . [5]  
(b) Find all prime implicants of  $E = xy + y't + x'yz' + xy'zt'$  using consensus method. [5]

\*\*\*\*\*Best of Luck\*\*\*\*\*