Roll Number:_____

Note: Attempt all questions with proper justification.
Assume missing data, if any, suitably.

Q.1(a)   Determine the validity of the following argument: (3)

     If 7 is less than 4, then 7 is not a prime number.
     7 is not less than 4.
     Conclusion: 7 is a prime number.

Q1(b)   Express the statement "someone in this class knows French" as a logical (4) statement using quantifier. Write down the negation of the statement. Express the negation in English sentence.

Q1(c)   Express the following statement into symbolic form: (3)

     If either Jerry takes Calculus or Ken takes Sociology, then Larry will take English.

Q2(a)   Using the truth table, check whether the proposition $(p \wedge \sim q) \vee \sim (p \wedge q)$ (4) is a tautology or not.

Q2(b)   Consider the following statement: I come to class if there is going to be a (6) quiz. State the Inverse, Converse and Contrapositive of the statement.

Q3(a)   Let K_n represent the complete graph with n vertices. Develop a (5) recurrence relation for the number of edges of K_n. Solve this recurrence relation and derive the explicit formula for the same.

Q3(b)   Insert the keys 28, 5, 19, 15, 33, 12, 17, 77, 20 into a hash table with 9 slots (5) in the given order and resolve the collision by linear probing. Let the hash function be $h(k) = k \bmod 9$.

Q4

     Let M denote the set of all 2×2 matrices of the form $\begin{bmatrix} a+ib & c+id \\ -c+id & a-ib \end{bmatrix}$ (10)

     where a, b, c, d are real numbers. Is $(M, +, *)$ a field? Justify your answer.

Q5(a)   Let $U = \{1, 2, 3, 4, 5, 6\}$ be a universal set and let $A = \{1, 2, 3, 4\}$ and (5) $B = \{3, 4, 5, 6\}$

     i)   Find the bit string representation for the Set A and B.
     ii)   Using bit string, determine the complement of Set A.

iii) Find $A \cup B$ and $A \cap B$ using bit string method.

Q5(b)   Let $A = \{3.a, 2.b, 2.c, 3.d\}$ and $B = \{2.a, 3.b, 2.c, 3.e\}$. Determine   (4)
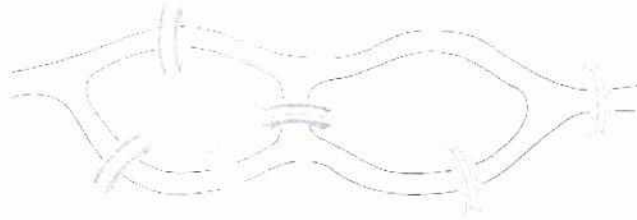   i) $A \cup B$
   ii) $A \cap B$
   iii) $A - B$
   iv) $A + B$

Q6(a)   Can someone cross all the bridges shown in this map exactly once and   (4)
        return to the starting point? Write down the Euler circuit, if it exists?

(Fig.1)

Q6(b)   Draw Hasse diagram for set $A = \{1, 2, 3, 6, 12, 24\}$ on divisibility relation.   (6)
        Determine maximal, minimal, least and greatest element.

Q7(a)   Prove that the fourth roots of unity $1, -1, i, -i$ form an abelian   (6)
        multiplicative group.

Q7(b)   Consider the positive integers N. Are (N, +) and (N, ×) are monoid? Explain   (4)
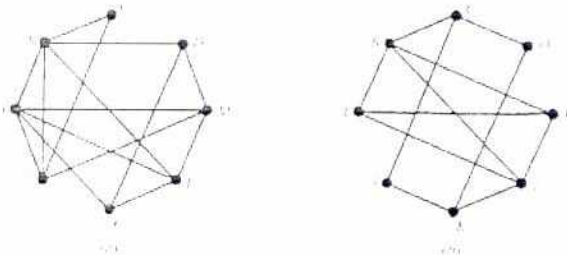   your answer.

Q8(a)   Convert the propositional formula into CNF and DNF form.   (5)
$$((p \rightarrow q) \wedge q \rightarrow p) \wedge (\sim q \vee r)$$
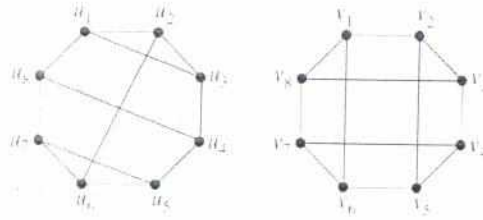   Assume $\wedge$ has higher precedence than $\rightarrow$.

Q8(b)   If G be a connected planar graph with e edges, v vertices and r regions,   (5)
        Using mathematical induction, prove that v-e+r=2

Q9(a)   Find the Chromatic number of the graphs given in Fig. 2.   (6)

(Fig.2)

Q9(b)   Check whether the graphs given in Fig. 3 are isomorphic or not. Justify   (5)
        your answer.

(Fig.3)

Q10   Determine the Theta notation of the following functions. Assume no error   (6)
in the given pseudo code.

    i) $i := n;$

       while $i \geq 1$ do

         begin

           $x := x + 1;$

           $i := i / 2;$

         end

    ii) $k = 1;$

       for i=k to n do

         for j=k to k do

           sum=sum+ i;

Q10(b)   Consider the recurrence relation   (4)

      $a_n = 2a_{n-1} + 3a_{n-2}$ with $a_0 = 1; a_1 = 2$

      Solve the recurrence relation.

***********End of Paper***************

Note for Students:

1. Students can go through their marks out of 55 on Web kiosk. If any discrepancy please inform your respective instructor by **17/12/2016 (Before 2 P.M.).**
2. Students can go through their evaluated answer sheet on **21/12/2016** as per following schedule:

Group	Time
COE1-4	9 to 10:00 A.M.
COE 5-8	10:00 to 11:00 A.M.
COE 9-10	11:15 to 12 P.M
CML	12 to 12: 30 P.M.
CAG	12:30 to 1:00 P.M.
SEM	1: 00 to 1: 30 P.M.