

Indian Institute of Information Technology SriCity  
Discrete Mathematics and Probability Theory

Midsem exam Monsoon 2018

Full marks 50

Group A: Discrete Mathematics

Answer all questions; each having equal weightage

Full marks 25

1. Write down the mathematical form of the following statements and check the validity of the argument: All kids are beautiful. Some kids are naughty. Naughty kids make noises. Here is no noise. Here are some kids. Conclusion: All the kids here are beautiful but not naughty.
2. Simplify the following expression and check whether it is a tautology or not:  $\neg[(p \vee q) \leftrightarrow (\neg p \wedge q)]$ .
3. Derive the PDNF form of the following expression:  $(\neg p \vee q) \leftrightarrow (p \vee \neg q)$ .
4. Prove the following:
  - a. Consider the linear equation  $y = ax + b$ , where  $x$  and  $y$  are real variables,  $a$  and  $b$  are real constants, where  $a \neq 0$ . Prove that,  $\forall x$ , there exist a unique  $y$  satisfying the equation.
  - b. Find out the mistake in the following proof method:  
Prove that, for all real number  $x$ , the real number  $x^2$  is positive  
There are two cases:  
Case 1:  $x$  is positive  
Case 2:  $x$  is negative  
In case 1,  $x^2$  is positive  
In case 2,  $x^2$  is positive.  
Hence, for all  $x$ ,  $x^2$  is positive.

5. In an island, there are two groups of people. The members of same group are friends and of different groups are enemies. You have found 6 persons from the island and observed the following

- A and B are friends
- B and C are enemies
- D and E are enemies
- A and F are friends
- C and D are friends

What is the relationship between E and F?

IITS  
DMPT Midterm  
Section -B (Probability Theory)

Total:25Marks

Instructions:

- Closed book exam
- Scientific calculators are allowed
- Question paper needs to be attached with answer sheet

I. Answer all questions

✓ 1. From a city population, the probability of selecting

- A male or a smoker is  $7/10$
- A male smoker is  $2/5$
- A male if a smoker is already selected is  $2/3$

[10M]

Find the probability of selecting

- (a) A non smoker  $2/5$  ✓
- (b) A male  $4/5$
- (c) A smoker if the male is selected first  $4/5$

✓ 2. The probability that at least one of the events A, B occurs is 0.6. If A, B occurs simultaneously with probability 0.2. Then find  $P(A^c) + P(B^c)$ . [5M]

✓ 3. (a) A box contains 15 blue, 20 red, 25 green, 15 yellow and 18 white balls.

How many balls must we choose to ensure that we have 12 balls of the same color. Explain your solution.

(b) How many strings with seven or more characters can be formed from the letters in EVERGREEN. [2+3M]

4. A box of chocolates contains 8 milk chocolates and 4 plain chocolates. A person eats 3 chocolates. Use Tree diagram to show the possible outcomes and their probabilities of occurrence. Calculate the probability that the person eats exactly one plain chocolate. [5M]

## INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, SriCity

Monsoon 2018: Mid Sem. Exam

Duration: 1:45 minutes

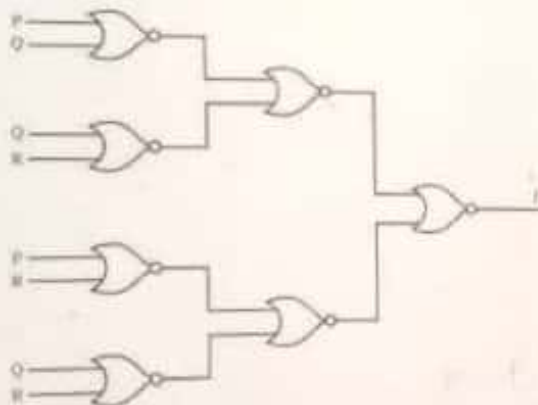
Subject: Digital Design

Max marks:30

- Instructions:**
- 1) Answer all the questions.
  - 2) Attach question paper with answer sheet
  - 3) This is a closed book exam. Basic calculators are allowed
  - 4) Any assumptions must be explicitly stated

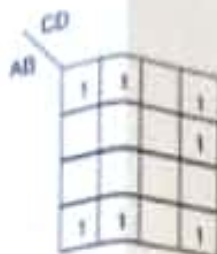
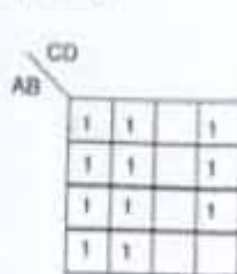
Long Answer questions (Each question=5 marks)

- 1a) Minimize the logic function  $F(A,B,C,D) = \prod(1,2,3,8,9,11,14)$   $d(0,7,15)$ . Use K-map, write POS expression, draw the logic circuit using 2 or 3 input NOR gate only.
  - b) Minimize the logic function  $F(A,B,C,D) = \sum(0,2,3,4,6,7,8,11,15)$ . Use K-map, write SOP expression, draw the logic circuit using 2 or 3 input NAND gate only.
- 2) For the given circuit, prove that  $F = (Q+R)'$  by applying Boolean algebra.



- 3) Write the binary numbers for decimal equivalent of 0-15 in a sequence. Adjacent to binary number write the corresponding gray code. Draw the circuit diagram for converting binary to gray.
- 4) Prove  $(A+C+D)(A+C+D')(A+C'+D)(A+B') = A+B'CD$  using boolean algebra rules.
- 5)
  - a) Implement  $f(A,B,C,D) = \sum(0,1,3,4,5,9,10,11,12,14,15)$  using 4:1 Mux

b) For the following K-map, write the SOP expression. Your Boolean expression should be as minimum as possible



1) In the same k-maps, assuming zeros are present in the empty cells, group zeros and write POS expression.

6) Complete the min term list for the given 2:1 Mux circuit,  $(A, B, C, D) = \Sigma$

