

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FIRST SEMESTER EXAMINATION, DECEMBER 2016

FIRST YEAR (BATCH 2016-19)

COMPUTER SCIENCE (Honours)

Date : 12/12/2016

Time : 11 am – 3 pm

Paper : I

Full Marks : 75

(Use a separate Answer Book for each Group)

Group – A

Answer **any one** question of the following:

(1 × 5)

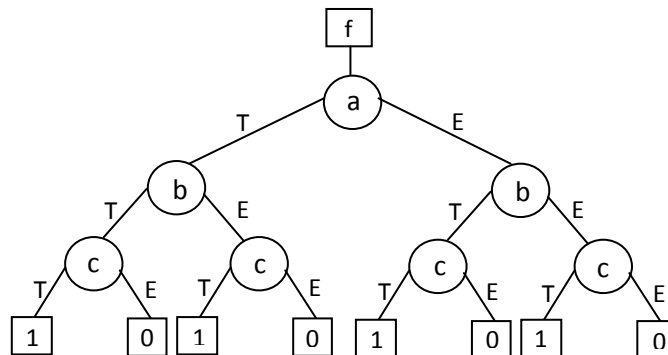
1. Differentiate between Essential Prime Implicant (EPI) and Selective Prime Implicant (SPI) with proper examples.
2. Draw a flow chart to print all the prime numbers less than 100.

Answer **any two** questions of the following:

(2 × 10)

3. a) Reduce the following Binary Decision Diagram (BDD) :

(3)



- b) Design an XOR gate using the functionalities of NOR gate only.

(4)

- c) Prove the following Boolean identity :

(3)

$$A \oplus B \oplus A \cdot B = A + B$$

4. a) What is the next number to $(3034)_5$?

(1)

- b) Show that $f(x_1, x_2) = x_1 | x_2 = (x_1 x_2)'$ is functionally complete.

(3)

- c) Find the Disjunctive Normal Form of the following :

(3)

$$p \rightarrow ((p \rightarrow q) \wedge \sim (\sim q \vee \sim p))$$

- d) The solutions to the quadratic equation $x^2 - 11x + 21 = 0$ are $x = 3$ and $x = 5$. What is the base of the number system on which the above solutions have been obtained?

(3)

5. a) Using 16's complement method, subtract $(507D)_{16}$ from $(4AB)_{16}$.

(3)

- b) Find the contrapositive for the following proposition :

(2)

p : It rains q : The crops will grow

- c) 'Gray code is a unit distance reflective code' – Justify the statement with proper examples.

(3)

- d) What is the canonical form of a Boolean expression?

(2)

6. a) Using a Karnaugh Map, find the minimal expression for : $\prod M(2, 3, 8, 12, 13) \cdot d(10, 14)$.

(6)

- b) Determine the Hamming code for the following binary pattern : $(1100)_2$ using even parity.

(4)

Group – B

Answer **any five** questions of the following:

(5 × 10)

7. a) Draw and explain the structure of an SRAM cell.
- b) Differentiate between memory-mapped I/O operation and I/O mapped I/O operation.
- c) Implement the following Boolean function using a suitable multiplexer :
 $F(A, B, C, D) = \sum m(0, 2, 3, 9, 11, 15)$

(4)

(2)

(4)

8. a) Differentiate between a RISC architecture with a CISC one. (3)
- b) Design a 3-bit binary to Excess – 3 code converter. (4)
- c) What is the race around condition in a flip-flop? (3)
9. a) Design a T flip-flop with a J-K flip-flop. (4)
- b) What is the advantage of using auto increment addressing mode? (2)
- c) A combinational circuit is defined by the following functions : (4)

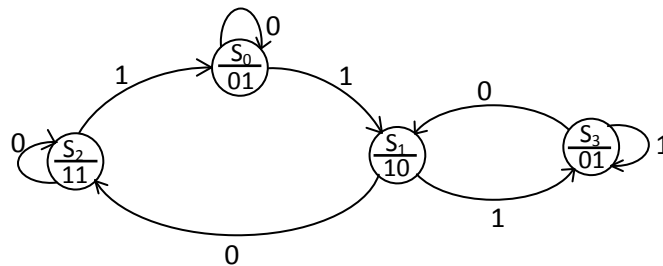
$$F_1 = x'y' + xyz'$$

$$F_2 = x' + y$$

$$F_3 = xy + x'y'$$

Design the circuit with proper decoder and external gates, if required.

10. a) What is the advantage of using associative memory? (2)
- b) Explain the different cache write policies. (4)
- c) Multiply -7_{10} and -3_{10} using Booth's algorithm by generating partial products. (4)
11. a) Represent -14.25_{10} in IEEE-754 double precision floating point representation. (3)
- b) Design a 4-bit adder-subtractor circuit with necessary logic gates. (4)
- c) Explain the usefulness of locality of reference. (3)
12. a) What is miss penalty? (2)
- b) A computer system has a main memory consisting of 1M 16-bit words. It also has a 4K word cache organized in 4 way set associative manner and 64 words per block. Calculate the number of bits in each of TAG, SET and WORD fields of main memory address format. (4)
- c) Find out the state table for the following state graph. Find out the output sequences for the input $X = 011001$. Assume that the circuit is initially at state S_0 . (2 + 2)



13. a) What is a Johnson's counter? (3)
- b) Explain the generation of the control signals by a hardwired control unit. (3)
- c) Design a 3-bit synchronous down counter using JK flip flops and basic gates. (4)

_____ × _____