RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FIRST SEMESTER EXAMINATION, DECEMBER 2015

FIRST YEAR [BATCH 2015-18]

Date : 14/12/2015 **COMPUTER SCIENCE [Hons]**

Time : 11 am – 3 pm **Paper :** I Full Marks : 75

[Use a separate Answer Book for each Group]

Group - A

Answer **any one** question : [1×5]

1. Draw a flowchart or give an algorithm to output twin primes within the range 1 to 100. Twin primes are two prime numbers that differs by 2. [5]

2. a) Prove that, the function $F(A,B,C) = \bar{A}BC + A\bar{B} + \bar{B}\bar{C}$ is functionally complete. [2]

   b) Build a Binary Decision Diagram (BDD) for the function $f(a,b,c,d) = abc + \bar{b}d + \bar{c}d$ with variable ordering $b \le c \le d \le a$. [3]

Answer **any two** questions : [2×10]

3. a) Obtain Disjunctive Normal Form (DNF) of the following : $P \Rightarrow ((p \Rightarrow q) \wedge \sim(\sim q \vee \sim p))$. [3]

   b) Prove the transposition theorem of boolean algebra using boolean laws and axioms. [3]

   c) Establish the following relationship : $2^r \ge d + r + 1$, where r is the number of redundant bits and d is the number of data bits in Hamming code. [3]

   d) What is the advantage of Quine-McCluskey method over K-map method? [1]

4. a) Discuss the validity of the following argument :
   "All graduates are educated. Ram is a graduate. Therefore, Ram is educated." [4]

   b) Find the value of N in the following expression. $(345)_6 + (632)_7 + (487)_9 = (N)_5$. [3]

   c) Find all possible solutions of the following equation $(43)_x = (y3)_8$, where x and y are unknown. [3]

5. a) What do you mean by well-formed formula (WFF)? When a WFF is said to be valid? [2+1]

   b) Show that the WFF's

      i) $p \to q$ (p implies q)

      and ii) $\sim p \vee q$ are equivalent. [3]

   c) Find the minimal SOP (Sum of Product) expression for $\sum m(6,7,8,9) + d(10,11,12,13,14,15)$ using binary designations of minterms in Quine-McCluskey method. [4]

6. a) Perform the following subtraction in 8421 BCD code using 10's complement method. $206{\cdot}4 - 507{\cdot}6$. [3]

   b) Obtain canonical Product of Sum (POS) form of the following boolean function : $F = (p + r)(\bar{q} + p)(\bar{p} + q)$. [3]

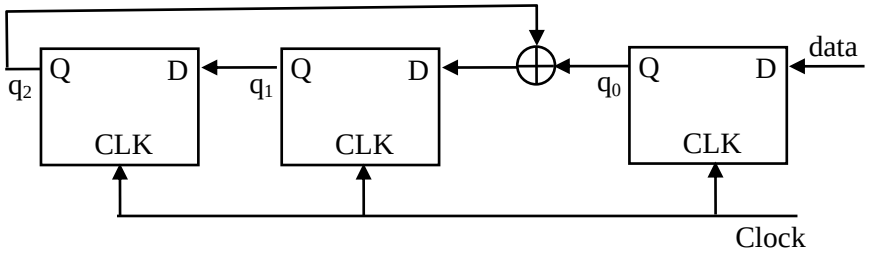
   c) Show that the dual of Exlusive – OR is equal to its complement. [2]

   d) 'Hamming Code is single bit error correction scheme' —Justify. [2]

Group - B

Answer **any five** questions [5×10]

7. a) Consider the following circuit where ⊕ represents Exclusive OR. The D flip-flops are initialized to zeros.
The following data 100110000 is supplied to the data terminal in nine clock cycles. What will be the values of $q_2q_1q_0$ after nine clock cycles? [4]



b) Design a full adder using 4×1 MUX keeping the MSB fixed. [6]

8. a) Design a combinational circuit for 2 4 2 1 to BCD conversion. [8]
b) What is the advantage of Carry-Lookahead adder? [2]

9. a) Explain the operation of a 3 bit PISO Shift Left register with proper diagram. [3+3]
b) Compare Control Flow and Data Flow architecture. [4]

10. a) Compare Static and Dynamic RAM. [4]
b) Draw the USB topology diagram and explain USB system overview. [4]
c) Differentiate between counter and register. [2]

11. a) Explain Indexed addressing and Immediate addressing with proper example. [4]
b) Explain the role of various address registers. [3]
c) Why are multiplexers called functionally complete block? [3]

12. a) Design a mod-6 asynchronous counter using D flip flop. [4]
b) Draw and explain a single bus datapath of control unit and show the sequence of control signals for the instruction Move (R1), R2. [6]

13. a) Explain asynchronous inputs of flip-flop in brief. [2]
b) Draw the logic diagram of a Master-Slave JK flip flop using only NAND gates with asynchronous inputs. [3]
c) Suppose physical addresses are 32 bit long. Cache contains 256K words of data and each block contains 4 words. Specify how the 32 bit address would be partitioned for each of the following configurations : (i) Direct mapped (ii) Associative [5]

14. a) Draw and explain the basic components of a microprogrammed control unit. [5]
b) Explain different types of cache miss techniques. [5]

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