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 : 17/12/2015 **COMPUTER SCIENCE [Gen]**

Time : 11 am – 1 pm **Paper :** I Full Marks : 50

[Use a separate Answer Book for each group]

Group – A

Answer **any one** question :

1. a) What do you mean by self-complementary code? Explain with example. [2·5]
   b) Convert $(FACE)_{16} = (?)_2 = (?)_8$ [2·5]

2. Explain the following terms with examples : [2×2·5]
   a) Parity bit
   b) De-morgan's theorem

Answer **any two** questions :

3. a) What are the unused bit combinations for excess-3 code? Give reasons. [2]
   b) Determine the base of the numbers in the following operations :
   (i) 14/2 = 5; (ii) 132 – 25 = 104 [1·5+1·5]
   c) Find the value of $25_{10} - 35_{10}$ using 1's complement and 2's complement method. [2]
   d) The state of a 12-bit register is 100010010111. What is its content if it represents
      i) three decimal digits in BCD?
      ii) three decimal digits in 84 – 2 – 1 code? [1·5+1·5]

4. a) Without using truth table, prove that $\overline{(a+b)} = \bar{a} \cdot \bar{b}$. [2·5]
   b) Explain Floating Point notation with an example. [3]
   c) Show that a positive logic NAND gate is a negative logic NOR gate. [2]
   d) To get the output value as same as the value of expression $\bar{a}bc + a\bar{b}c + ab\bar{c} + abc$ from a circuit for three inputs a, b, c, find the minimum number of different basic gates which you consider to form the circuit in minimum cost. Give reasons. [2·5]

5. a) Draw the circuit using only NOR gates for the following expression $(A+B)(C+D)E$. [3]
   b) Simplify the following Boolean function by first finding the essential prime implicants : $F(A,B,C,D) = \sum(1,3,4,5,10,11,12,13,14,15)$. [5]
   c) What do you mean by odd function, explain with an example. [2]

6. a) For transmission of 6-bit message [1+2]
      i) How many minimum number of parity bits be needed for only single bit error detection?
      ii) How many parity bits be needed for single bit error detection and correction?
   b) Describe the necessary steps to convert a 4-bit gray code to its binary equivalent with an example. [2·5]
   c) Define Hamming Code and explain its use with example. [4·5]

Group – B

Answer **any one** question :

7. a) Write down the working principle of priority encoder. [2]
   b) Convert a D Flip-flop into a JK Flip-Flop. [3]

8. a) How can a D flip flop be operated in toggle mode? [2]
   b) Derive the characteristic equation for J-K flip flop. [3]

Answer **any two** questions :

9. a) Design a 2-bit magnitude comparator. [3·5]
   b) 'A full adder is a combination of two half adders and one OR gate' — Justify. [2·5]
   c) Implement a BINARY to GRAY code converter. [4]

10. a) Convert the following to other canonical form : $F(A, B, C, D) = \sum(0, 2, 6, 11, 13, 14)$. [3]
   b) Implement a 4-to-16 decoder using two 3-to-8 decoders. [4]
   c) Prove that, NOR gate is universal. [3]

11. a) Simplify the expression $f = \Pi(1, 3, 5, 8, 9, 11, 15)$ using K-map. [6]
   b) Differentiate between asynchronous and synchronous counter. [2]
   c) 'A flip flop is a 1-bit memory element' —Justify. [2]

12. a) Design a 2-bit asynchronous up-down counter using T flip flop and explain its operation. [3+3]
   b) Differentiate between sequential and combinational logic circuit. [2]
   c) What is the difference between register and counter? [2]

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