Ex/Comp.Sc/S/1/14/2017

BACHELOR OF SCIENCE EXAMINATION, 2017

(1st Year, 1st Semester)

COMPUTER SCIENCE

Unit - I

(Computer System and Organization)

Full Marks : 50 Time : Two Hours

The figures in the margin indicate full marks.

(Symbols have their usual meanings, if not mentioned otherwise)

1. Answer any *two* questions : 8×2=16

(a) Given the function

$$T = \Sigma(0, 1, 2, 3, 4, 6, 7, 8, 9, 11, 15)$$

(i) Show the map.

(ii) Find all prime implicants and indicate which are essential.

(iii) Find a minimal expression for T. Is it unique ?

[*Turn over*]

(b) (i) Find the values of the two-valued variables A, B, C and D by solving the equations

$$A' + AB = 0 \qquad AB = AC$$

$$AB + AC' + CD = C'D.$$

(ii) What is universal operation in the switching algebra ? Show that $f(A, B, C) = A'BC + AB' + B'C'$ is a universal operation. 4+4=8

(c) Define (i) *irredundant expression* and (ii) *prime implicant* of a switching function. Prove that every irredundant sum-of-products of a switching function f is a union of prime implicants of f. 4+4=8

2. Answer any *two* questions : 7×2=14

(a) Give the truth table for the full-adder. Design the logic diagram for the full-adder. 3+4=7

(b) Draw the logic diagram of a 5 by 32 decoder constructed with four 3 by 8 decoder (with enable line) and one 2 by 4 decoder. Use the block diagram for the supplied decoders.

[*Turn over*]

(c) Draw the logic diagram of a 16 by 1 multiplexer constructed with five 4 by 1 multiplexers. Use the block diagram for the supplied multiplexers.

3. Answer any *two* questions : 10×2=20

(a) Write the procedure for 2's complement substraction of two n-bit binary numbers M and N as minuend and subtrahend respectively. Prove the correctness. 5+5=10

(b) How do you detect the overflow after the addition of two binary numbers each stored in signed-2's complement representation ? Detect the overflow in the arithmetic operations (+70)+(+80), (+70)+(–80), (–70)+(+80) and (–70)+(–80). Assume that each number is accomodated in an 8-bit register with signed-2's complement representation. 4+6=10

(c) (i) Represent the decimal number $(+46.5)_{10}$ as a floating-point binary number in 24 bits having 16 bits for the normalized fraction mantissa and 8 bits for the exponent with signed-magnitude integer representation.

(ii) Represent $(8620)_{10}$ in (a) BCD; (b) excess-3 code; (c) as a binary number. 5+5=10

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