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Question Paper Code : 20411

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Third Semester

Computer Science and Engineering

CS 8351 — DIGITAL PRINCIPLES AND SYSTEM DESIGN

(Common to : Electronics and telecommunication Engineering/ Information Technology)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Convert $(8723)_{10}$ to the corresponding BCD and excess-3 equivalents.

2. Consider the numbers represented in signed 2's complement form are P=11101101 and Q = 11100110. Find the value obtained in signed 2's complement form if Q is subtracted from P.

3. Give the MAXTERM notation of the following function $f = ab + a'bc' + a'c$.

4. Using only 2 * 1 MUX, draw a circuit that verifies the logic operation of a NAND gate.

5. Convert a T-FF to a D-FF.

6. Mention any two applications of Latch circuit.

7. What is race condition in an asynchronous sequential circuit. When it can be critical and non critical?

8. Define

   (a) Static '0' hazard

   (b) Essential hazard

9. How many 32K x 1 RAM chips are needed to provide a memory capacity of 256K bytes?

10. List any 4 FPGA Applications.

PART B — (5 × 13 = 65 marks)

11. (a) Simplify the Boolean function using K- map.

$f(V,W,X,Y,Z) = (0,2,4,6,9,11,13,15,21,23,25,27,29,31)$ (13)

Or

(b) Consider a four-input function that outputs a 1 whenever an odd number of its inputs are 1.

(i) Construct the Truth Table

(ii) Generate the K-map for the expression

(iii) Find minimal sum-of-product. Can you simplify it using K-map?

Can you provide a more economical solution given that only XOR gates are available is in your inventory? (13)

12. (a) Design the circuit to compare the magnitudes of two numbers and explain its operation under all possible cases. (13)

Or

(b) Design a code converter that converts a decimal digit from "8 4 -2 -1" code to BCD. (13)

13. (a) A sequential circuit with two D Flip-Flops, A and B; two inputs, x and y; and one output, z, is specified by the following next-state and output equations: (13)

$A(t+1) = x'y + xA$
$B(t+1) = x'B + xA$
$z = B$

(i) Draw the logic diagram of the circuit.

(ii) List the state table for the sequential circuit.

(iii) Draw the corresponding state diagram.

Or

(b) Using JK flip-flops, design a counter with the following repeated binary sequence:0,1 2,4,6 (13)

14. (a) Design a asynchronous sequential circuit with two inputs X and Y and with one output Z. Whenever Y is one, input X is transferred to Z. When Y is zero, the output does not change for any change in X. (13)

Or

(b) (i) Find the circuit that has no static hazards and implement the Boolean function $F(A,B,C,D) = \Sigma m(1,5,6,7)$. (5)

(ii) Discuss a method used for race free assignments with example. (8)

15. (a) (i) A 12-bit Hamming code word containing 8 bits of data and 4 parity bits is read from memory. What was the original 8-bit data word that was written into memory if the 12-bit word read out is as follows: (5)

(1) 000011101010

(2) 101110000110

(ii) Tabulate the truth table and draw the logic circuit for an 8 * 4 ROM that implements the Boolean functions $A(x,y,z) = (0,3,4,6)$ $B(x,y,z) = (0,1,4,7)$. (8)

Or

(b) List the PLA programming table for the 2 bit Binary/Parallel adder whose Boolean functions are simplified, and draw the PLA circuit. (15)

PART C — (1 × 15 = 15 marks)

16. (a) Design an asynchronous negative edge triggered T flip-flop. The circuit has two inputs, T (toggle) and C (clock) and output Q. the output state is complemented if T=1 and the clock C changes from 1 to 0 (negative edge triggering). Otherwise, under any other input condition, the output Q remains unchanged.

Or

(b) A binary number with 4-bits (w,x,y,z) appear at the input of a circuit. The output of the circuit is 1, if the values are 0,2,3,5 and 8. Obtain a sum-of products and product-of-sums expression for the circuit. Implement using NAND gates only. (you can use don't cares and any number of inputs for the NAND gates).

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