2002 SCHEME

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CS33

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Logic Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Define Boolean algebra. State and prove absorption law. **(06 Marks)**

b. Describe the Shannon's reduction theorem. Simplify the following expression using Shannon's reduction theorem

$f(w, x, y, z) = x + \overline{\overline{w}x}(y + wx) + \bar{x}y + \overline{wz}$. **(06 Marks)**

c. Perform the following operations on the Boolean expression

$x\bar{y} + wx(\bar{y} + w\bar{x}) + wxz$

i) Expand into the from

$(x + g_1(w, y, z))(\bar{x} + g_2(x, y, z))$

ii) Convert into the minterm canonical form. **(08 Marks)**

2 a. Simplify the following Boolean functions, using algebraic manipulation

i) $f(x,y,z) = \overline{x}\,\overline{y}\,\bar{z} + \overline{x}\,y + xyz$

ii) $f(w,x,y,z) = \overline{w}\,\bar{y}\,\bar{z} + wz + \bar{y}\,z + xyz$ **(08 Marks)**

b. Realize the following function, using (no simplification)

i) NAND gates only

ii) NOR gates only

$f(x, y, z) = x\bar{z} + x\bar{y}z + \overline{x + y}$. **(08 Marks)**

c. Show the steps in the graphical procedure for the realization of Boolean function, using NAND gates only. **(04 Marks)**

3 a. Define the prime implicate and the irredundant conjunctive normal form. **(04 Marks)**

b. Using K–map obtain the minimal sum of products for the following Boolean function show the essential prime implicates on the map

$f(w, x, y, z) = \Sigma m(0, 2, 6, 7, 8, 10, 12) + dc(3, 15)$. **(08 Marks)**

c. Draw the K–map and simplify the following expression using z as the map–entered variable and x and y as map variables.

$f(x,y,z) = \overline{x}\,\overline{y} + \bar{x}\,y\,\bar{z} + x\,\bar{y}\,z$. **(08 Marks)**

4 a. Explain the operation of a two input TTL NAND-gate with totem-pole with a neat circuit diagram. **(08 Marks)**

b. Discuss how a resistor can be constructed using MOSFET. **(06 Marks)**

c. With the help of a circuit diagram, explain the operation of a two input NMOS nor gate. **(06 Marks)**

5 a. Explain a 4-bit parallel adder with carry lookhead scheme. **(10 Marks)**

b. Explain how the binary number A and B can be compared using a 1-bit comparator network. **(10 Marks)**

6 a. A combinational network is defined by the following three Boolean functions:

$f_1(x, y, z) = \bar{x}\bar{y} + x y \bar{z}$

$f_2(x, y, z) = \bar{x} + y$

$f_3(x, y, z) = xy + \bar{x}\bar{y}$

Design the network using a decoder and external gates. **(06 Marks)**

b. Implement the following Boolean function using a 8-to-1 multiplexer:

$f(A, B, C, D) = \Sigma m(0, 1, 3, 4, 8, 9, 15)$ **(06 Marks)**

c. Explain the different types of flipflops along with their truth table. Also explain the race-around condition in a flipflop. **(08 Marks)**

7 a. Design a synchronous Mod-6 counter, using clocked JK flip-flops. **(10 Marks)**

b. Obtain a minimal state table for a clocked synchronous sequential network having a single input line x, in which the symbols 0 and 1 are applied and a single output line z. An output of 1 is to be produced coincident with each third multiple of the input symbol 1. At all other times, the network is to produce 0 outputs. An example of input/output sequences that satisfy the conditions of the network specifications is

x = 0 1 1 0 1 0 1 1 1 1 0 0 0 1 1 1 0

y = 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0 1 0 0 **(10 Marks)**

8 Write explanatory notes on :

a. Algorithm for generating prime implicants using Quine-McCluskey method.

b. High speed addition using Carry look ahead adders.

c. Serial-in, serial-out & parallel-in, serial-out Shift registers.

d. Binary ripple counter. **(20 Marks)**

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