2002 SCHEME

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CS33

Third Semester B.E. Degree Examination, June 2012
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

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

c. Perform the following operations on the Boolean expression

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

i) Expand into the from

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

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

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

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

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

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

i) NAND gates only

ii) NOR gates only

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

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

4 a. Use Quine – McCluskey method to obtain the prime implicants for the following function. Identify the essential prime implicants, if any. Also obtain the minimal sum of products.

$f(w, x, y, z) = \Sigma m(1, 3, 4, 6, 7, 9, 11, 13, 15)$. **(10 Marks)**

b. Briefly discuss the row and column reduction technique used for the simplification of Boolean functions. **(04 Marks)**

c. Using decimal method obtain the minimal product of sums for the following function

$f(x, y, z) = \pi m(0, 1, 4, 6)$. **(06 Marks)**

5 a. Discuss the following performance parameters of logic gates.

i) Noise margin

ii) Propagation delay

iii) Power dissipation. **(06 Marks)**

b. With the help of the circuit diagram, explain the working of a two input TTL NAND gate. **(10 Marks)**

c. Write short note on Schottky TTL. **(04 Marks)**

6 a. Realize the following function, using 4 to 1 MUX and external gates if w and x are applied to the select lines.
$f(w, x, y, z) = \Sigma m(0, 1, 3, 5, 7, 8, 10, 14) + dc(4, 6, 12)$. **(10 Marks)**

b. Illustrate how PLA can be used to realize the following functions, using $3 \times 4 \times 2$ PLA
$f_1(x, y, z) = \Sigma m(0, 1, 6, 7)$
$f_2(x, y, z) = \Sigma m(0, 3, 4, 6, 7)$. **(10 Marks)**

7 a. Show the circuit diagram, for a J–K flip–flop using NAND gates and explain its working. Also derive the expression for the Q output. **(10 Marks)**

b. Design a mod – 6 synchronous counter, using SR flip–flops. **(10 Marks)**

8 a. Differentiate between Moore model and mealy model of clocked synchronous sequential network. **(08 Marks)**

b. For the clocked synchronous sequential circuit whose excitation equations for T–flip–flop are $T_1 = \bar{x}\ Q_2$ and $T_2 = \bar{x}\, Q_2 \overline{Q_1} + x\, \overline{Q_1}\ \overline{Q_2}$
And output equation
$Z = Q_1 Q_2$
Prepare the excitation table, transition table, state table and state diagram where x is 1 the external input to the circuit. **(12 Marks)**

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