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Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Digital System Design

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Design a combinational circuit to output the 2's complement of a 4-bit binary number. (07 Marks)
- b. Identify all prime implicants and essential prime implicants of following function using K-map:
 $f(a, b, c, d) = \sum m(6, 7, 9, 10, 13) + dc(1, 4, 5, 11, 15)$. Draw the diagram using NAND gates. (07 Marks)
- c. Expand the following in to canonical form and represent in decimal form:
 - i) $f_1 = a + bc + ac'd$ in to min-terms
 - ii) $f_2 = a(b+c)(a+c+d)$ into max terms. (06 Marks)

OR

- 2 a. Find the minimal sum of the following Boolean function using Quine-McClusky method:
 $f(a, b, c, d) = \sum m(7, 9, 12, 13, 14, 15) + dc(4, 11)$. (07 Marks)
- b. Using K-map determine minimal product of sum expressions and implement the simplified equation using only NOR gates:
 $f(w, x, y, z) = \pi(1, 2, 3, 4, 9, 10) + d(0, 14, 15)$. (07 Marks)
- c. Explain briefly K-map, Incompletely specified functions, essential prime implicants and Gray code. (06 Marks)

Module-2

- 3 a. Implement the following using 3 to 8 decoder with active low enable and active HIGH outputs:
 - i) $f_1(a, b, c, d) = \sum m(0, 1, 5, 6, 7, 9, 10, 15)$
 - ii) $f_2(a, b, c) = \pi(1, 3, 6, 7)$ (06 Marks)
- b. Explain 4-bit carry look-ahead adder with necessary diagram and relevant expressions. (08 Marks)
- c. Design 4 line to 2 line priority encoder which gives MSB the highest priority and LSB least priority. (06 Marks)

OR

- 4 a. Implement $f(a, b, c, d) = \sum(0, 4, 8, 10, 14, 15)$ using
 - i) 8:1 MUX with a, b, c as select lines
 - ii) 4:1 MUX with a, b as select lines. (06 Marks)
- b. Design a two bit magnitude comparator and draw the neat diagram. (08 Marks)
- c. Explain the structure of programmable logic arrays (PLA) with an example. (06 Marks)

Module-3

- 5 a. Explain clocked SR flip flop using NAND gates with necessary truth table and waveform. (06 Marks)
- b. Explain with a neat diagram and truth table, a 4-bit SIPO shift register to store binary number 1011. (07 Marks)
- c. What is race around condition? Explain JK master slave flip flop with a diagram, function table and timing diagram. (07 Marks)

OR

- 6 a. Explain with an excitation table, the conversion of SR flip flop in to JK and D flip flop. (06 Marks)
- b. Explain the working of 4-bit Twisted Ring counter using necessary diagram and waveform. (07 Marks)
- c. Explain the working of 3-bit Asynchronous up-down counter with necessary waveform and truth table. (07 Marks)

Module-4

- 7 a. Design a self correcting synchronous counter using positive edge triggered JK flip flop to count 0, 1, 2, 4, 5, 6, 0, 1, 2.... Use the state table and state diagram. (10 Marks)
- b. Design a clocked sequential circuit which operates according to the state diagram shown in Fig.Q.7(b). Implement the circuit using negative edge triggered JK flip-flop. (10 Marks)

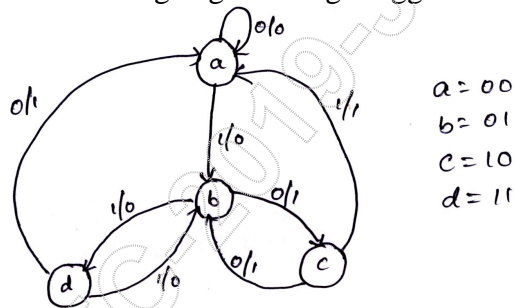


Fig.Q.7(b)

OR

- 8 a. Construct the excitation table, transition table, state table and state diagram for the sequential circuit shown in Fig.Q.8(a). (10 Marks)

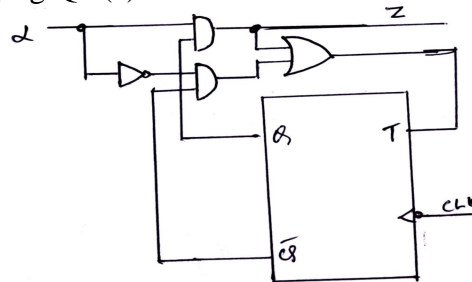


Fig.Q.8(a)

- b. Realize synchronous decade counter using T-flip-flop and draw the neat diagram. (10 Marks)

Module-5

- 9 a. Design a Melay type sequence detector to detect the sequence of 101 in the given sequence of 001101100101011. (10 Marks)
- b. With necessary diagram, explain the concept of serial adder with accumulators. (10 Marks)

OR

- 10 a. Design a sequential circuit to convert BCD to Excess-3 code with state table, state graph and transition table. (10 Marks)
- b. Explain the design of sequential circuit using CPLDs and give CPLD implementation of a shift register and parallel adder with accumulator. (10 Marks)

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