Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Computer Science and Technology
End Semester Examination – August/September 2014

CST 131-2 Microcomputer Architecture and Logic Design

Number of questions: Four (04)
Answer all questions
Time allocation: Two (02) hours
Total mark: 100

1.

a. Express the base 5 number $(4310)_5$ in decimal. (3 mark)

b. What is the largest binary number that can be expressed with 14 bits? What are the equivalent decimal and hexadecimal numbers? (3 mark)

c. Given the two binary numbers **X=1010100** and **Y=1000011**, perform the subtraction **X-Y** and **Y-X** by using 2's complement and using 1's complement. (8 mark)

d. Formulate a weighted binary code for the decimal digits, using the weight code 6,3,1,1. (5 mark)

e. Draw basic three logic gates and their truth tables. (6 mark)

2.

a. Simplify the following Boolean expressions to a minimum number of literals. (4x2 = 8 mark)

i. $\overline{(x+y)}(\bar{x}+\bar{y})$

ii. $\bar{x}yz + xz$

b. Draw logic diagrams of the circuits that implement the original and simplified expressions in the above problem **(2.a).** (3.5 x2 = 7 mark)

c. Simplify the following Boolean functions, using Karnaugh maps. (5x2 = 10 mark)

i. $F(x,y,z) = \sum(0,2,6,7)$

ii. $F(w, x, y, z) = \sum (0, 1, 2, 4, 5, 6, 8, 9, 12, 13, 14)$

3.

a. Consider the combinational circuit as shown in Figure 1.

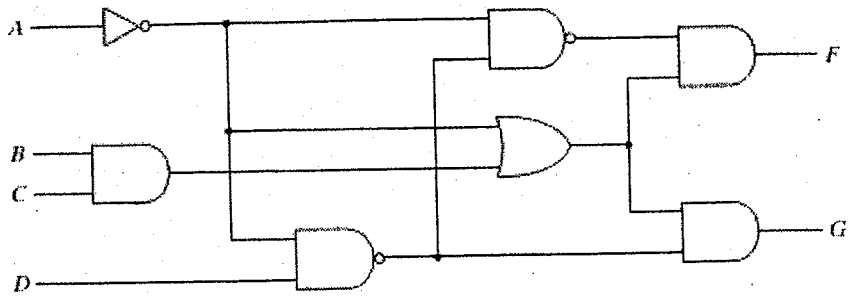

Figure 1. Combinational Circuit

i. Derive the Boolean expressions for F and G. (4 mark)

ii. Draw the truth table for the logic circuit shown in Figure 1. (4 mark)

iii. Draw the K-maps for the truth table obtained in (ii) and derive the Boolean Expressions. (4 mark)

b. Design a combinational circuit with three inputs, x, y, and z, and three outputs, A, B, and C. When the binary input is 0, 1, 2, or 3, the binary output is two greater than the input. When the binary input is 4, 5, 6, or 7, the binary output is three less than the input. Provide the truth table, simplified Boolean expressions and the circuit diagrams. (8 mark)

c. Construct 4x16 decoder with two 3x8 decoders. (You can use 3x8 decoder block diagrams). (5 mark)

4.

a. Consider the circuit shown in Figure 2.

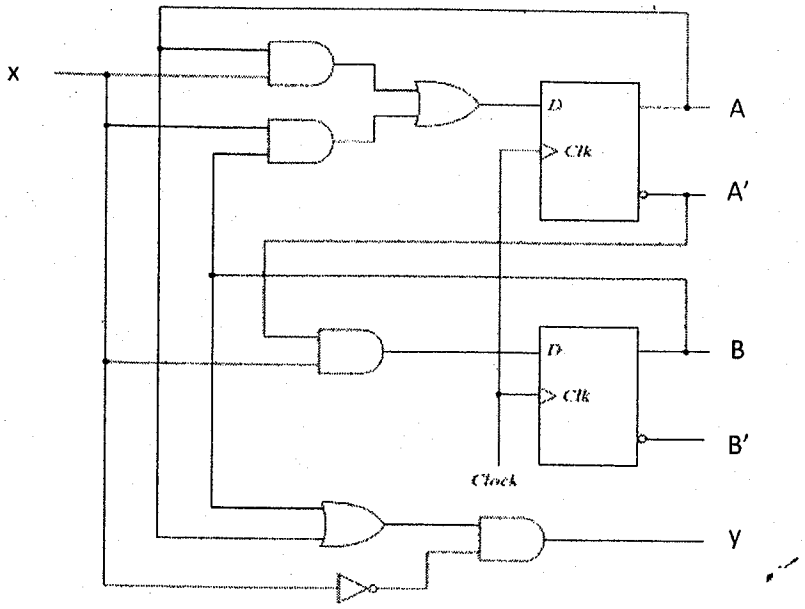

Figure 2. Sequential Circuit

i. Write all the state equations for A,B and y. (4 mark)

ii. Derive the state table for the above circuit. (4 mark)

iii. Draw the state diagram of the above circuit. (4 mark)

b. Design a circuit that detects a sequence of three or more consecutive 1's in a string of bits coming through an input line using D flip flops. State diagram, state table, state equations and circuit diagram should be included. (13 mark)