045

The Open University of Sri Lanka

B. Sc. Degree program – Level 04

Final Examination 2007

CSU 2178: Digital Computer Fundamentals

Duration: Two and half hours (2 $^{1}/_{2}$)

Date: 20.06.2007 Time: 1.30 pm- 4.00 pm

Answer **FOUR** Questions ONLY.

Q1.

a. Briefly describe the following
   i. Master control block
   ii. Direct memory access
   iii. Magnetic tapes

b. Discuss the advantages and disadvantages of using cache memory.

c. Using D type flip -flop and suitable logic gates, show how to construct a RAM cell with read write and select facilities.

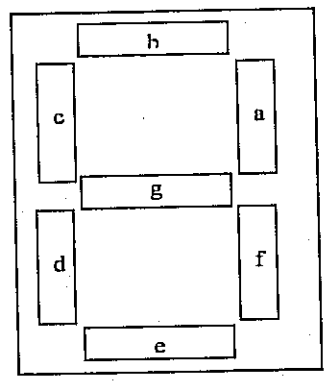
d. Create four-word by eight bit RAM by using two four-word by four-bit RAMs.

Q2.

a. Following table shows truth table of the BCD-to-7 Segment decoder.

   i. Complete the following truth table.

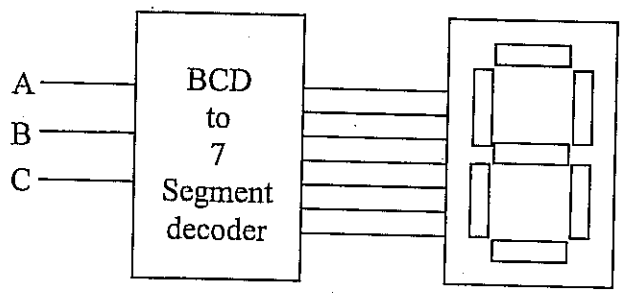
value			7-segment display						
A	B	C	a	b	c	d	e	f	g
0	0	0	1	1	1	1	1	1	0
0	0	1	1	0	0	0	0	1	0
0	1	0							
0	1	1							
1	0	0							
1	0	1							
1	1	0							
1	1	1							



   ii. Design a circuit for any three values of BCD-to-7 Segment decoder.

b. International Cricket Council (ICC) wants to develop special type of score board to display scores in the forthcoming World Cup cricket matches. A batsman can score 0 – 7 for a single ball. Assume that you have seven segments Display, BCD to 7-segment decoder and seven switches.
   i. Create a truth table for a circuit diagram to implement this.
   ii. Design the circuit diagram.

It will clear if the block diagram includes the circuit to be designed and the seven switches.



Q3.

a. Using truth tables show that
   i. A+B+C = (A+B) + C
   ii. $A + \overline{A} = 1$
   iii. A.1 = A
   iv. $\overline{A}.\overline{B} = \overline{(A+B)}$

b. Using Boolean algebra and show that
   i. $\overline{A}.\overline{B}.\overline{C}.\overline{D} + \overline{C}.\overline{A}.D + \overline{C}.\overline{A}.B = \overline{A}.\overline{C}$
   ii. $A.B.C.D + \overline{C}.D.B + \overline{A}.B.D = B.D$

c. A Nuclear power controlling system contains four sensors to monitor temperature (A), pressure (B), Density (C) and Boron plates (D).Each A,B,C and D values represent high as '1' and low as '0'. Function of the controlling system as follows.

$F = \overline{A}.\overline{B}.\overline{C}.\overline{D} + \overline{C}.D + A.B.C.D + \overline{A}.B$

   i. Using Boolean algebra and K-Map show that, $F = \overline{A}.\overline{C} + B.D + \overline{C}.D + \overline{A}.B$.
   ii. Implement above circuit using basic gates.

Q4.

a. Briefly describe the following
   i. Radix Number System
   ii. The EBCDIC character set
   iii. Unicode character set

b. Convert following binary numbers into octal and hexadecimal
   i. 101011001010_2
   ii. 1000100.011_2

c. Use Two's complement addition to perform the following calculation
   i. $12_{10} + 33_{10}$
   ii. $20_{10} - 27_{10}$

d. Design a truth table for full adder.

e. Implement Full Adder using basic logic gates.

Q5.

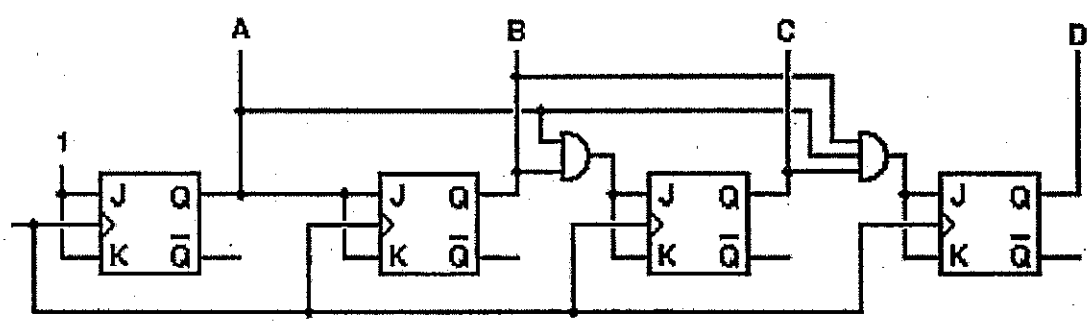
a. Briefly describe the following using suitable truth tables and Circuit diagrams
   i. S-R Flip-flop
   ii. J-K Flip-flop

b. Develop a four-bit register using J-K flip flops

c. What are the differences between synchronous and asynchronous counters

d. Draw 4 bit up counter and a down counter.

e. Explain the counter circuit given bellow.



Q6.

a. Briefly describe the following using suitable truth tables and circuit diagrams
   i. 4-to-1 Multiplexer
   ii. Decoders

b. Design 8-to-1 Multiplexer using two 4-to-1 Multiplexers

c. Implement AND gate, an OR gate and a XOR gate using NAND gates.

d. Find the minimal logic expression for the following truth table using the K-MAP method. Design a circuit to implement this truth table using 3-input NAND gates only.

A	B	C	D	F
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	X
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1