

Computer Organisation

Mid-Semester Examination, Semester IV

20 February, 2006

The paper is set for 140 marks, it suffices to answer any 100

1. What is the 2's complement representation of -17 using 8 bits? What is its representation if we are allowed 16 bits? What is its 1's complement representation using 8 bits. (10 marks)
2. Recall the behavior of a 2 bit multiplexor. It has inputs a, b , a selector input s and an output c which is a if $s = 0$ and b otherwise. Show that a 2 bit multiplexor along with the constants 0 and 1 is functionally complete. (10 marks)
3. Use the Karnaugh Map method to simplify the following function with the four variables (w, x, y, z) given in the sum of products form.

$$\bar{w}\cdot\bar{x}\cdot\bar{y}\cdot\bar{z} + \bar{w}\cdot\bar{x}\cdot\bar{y}\cdot z + \bar{w}\cdot\bar{x}\cdot y\cdot\bar{z} + \bar{w}\cdot\bar{x}\cdot y\cdot z + \bar{w}\cdot x\cdot\bar{y}\cdot\bar{z} + \bar{w}\cdot x\cdot\bar{y}\cdot z + \bar{w}\cdot x\cdot y\cdot\bar{z} + \bar{w}\cdot x\cdot y\cdot z$$

(10 marks)

4. Design a *magnitude comparator* for two 4-bit numbers. It takes two 4-bit numbers X and Y as input and has three output lines l_0, l_1, l_2 . The output is determined as follows:
 $l_0 = 1$ iff $X < Y$, $l_1 = 1$ iff $X=Y$, $l_2 = 1$ iff $X > Y$.
(10 marks)
5. Design a boolean circuit to convert a given BCD(binary coded decimal, that is , a 4 bit number in the range 0000 – 1001 representing the digits 0...9) to its 9's complement representation (where 9's complement of a digit is obtained by subtracting it from 9) (15 marks)
6. Draw the circuit diagram of an $S - R$ latch and describe its behavior. Explain why it cannot be used in this form as a part of a sequential circuit. Draw the circuit diagram of a master-slave D flipflop, describe its behavior, and explain how it overcomes disadvantages of the $S - R$ latch. (15 marks)
7. The logic diagram of a sequential circuit with two flipflops is given below. Analyse this circuit and write out its state transition table and state transition diagram (15 marks)

