## **COE 200, Term 042**

## **Fundamentals of Computer Engineering**

## HW# 9

- Q.1. Show how to build a 16x1 multiplexer using the minimum number of 4x1 multiplexers.
- Q.2. Four computers are to connect to 4 distant printers using a single 4x1 mux and a single 1-to-4 Demux. To save in cabling only one wire connects the 4 computers to the 4 distant printers. Draw the block diagram of such system and explain how a given computer would send data to a particular printer. Can more than one computer send data to the printers at the same time?
- **Q.3.** Four computers are to connect to only one printer through a single wire.
  - a. Without using multiplexers, show how to use tri-state buffers and decoders to ensure that only one computer is connected to the printer at any given time.
  - b. Assume that if a computer wants to use the printer, it will enable a request pin,  $REQ_i$ . Assume that computers can request to use the printer simultaneously and in such a case priority will be given to computer 1, 2, 3, 4. Design a priority encoder and show how it can be used with the design you obtained in a.
- **Q.4.** Implement the following functions using an 8x1 MUX where w, x and y connect to the select lines S2, S1 and S0 respectively:
  - c.  $F(w, x, y, z) = \sum (2, 5, 6, 7, 9, 12, 13, 15)$
  - d.  $F(w, x, y, z) = \sum (1, 2, 4, 5, 8, 10, 11, 15)$
  - e.  $F(w, x, y, z) = \sum (0, 4, 6, 8, 9, 11, 13, 14)$
- **Q.5.** Repeat problem 4 using a 16x1 MUX.
- **Q.6.** Given a 4 bit signed 2's-complement number design a circuit that gives the absolute value of this number using only MSI parts.
- **Q.7.** Design a *signed-magnitude adder*. The inputs to this adder are two 5-bit signed numbers (A & B) each having a 4-bit magnitude and a sign bit. The adder output **S** is a 6-bit signed result (5-bit magnitude and a sign bit). The adder works as follows:

$$\underline{\textbf{IF}} \ \text{Sign}(A) = \text{Sign}(B) \ \underline{\textbf{THEN}} \ |S| = |A| + |B| \ \textit{and} \ \text{Sign}(S) = \text{Sign}(A) = \text{Sign}(B)$$
 
$$\underline{\textbf{ELSE}} \ \underline{\textbf{IF}} \ A > B \ \underline{\textbf{THEN}} \ |S| = |A| - |B| \ \textit{and} \ \text{Sign}(S) = \text{Sign}(A)$$
 
$$\underline{\textbf{ELSE}} \ |S| = |B| - |A| \ \textit{and} \ \text{Sign}(S) = \text{Sign}(B)$$

You may assume the availability of a 4-bit binary parallel <u>adder/subtractor</u> which has a mode-control input signal m such that if m=0 the circuit works as an ADDER but if m=1 it works as a SUBTRACTOR. Design this Signed-Magnitude adder using mostly MSI parts