## COE 200, Term 042

## Fundamentals of Computer Engineering

## HW\# 9

Q.1. Show how to build a $16 \times 1$ multiplexer using the minimum number of $4 \times 1$ multiplexers.
Q.2. Four computers are to connect to 4 distant printers using a single $4 x 1$ 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, $R E Q_{i}$. 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 8 x 1 MUX where $\mathrm{w}, \mathrm{x}$ and y connect to the select lines $\mathrm{S} 2, \mathrm{~S} 1$ and S 0 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 $16 \times 1$ 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 $\mathbf{S}$ is a 6 -bit signed result (5-bit magnitude and a sign bit). The adder works as follows:

IF $\operatorname{Sign}(\mathrm{A})=\operatorname{Sign}(\mathrm{B})$ THEN $|\mathrm{S}|=|\mathrm{A}|+|\mathrm{B}|$ and $\operatorname{Sign}(\mathrm{S})=\operatorname{Sign}(\mathrm{A})=\operatorname{Sign}(\mathrm{B})$
ELSE IF $\mathrm{A}>\mathrm{B}$ THEN $|\mathrm{S}|=|\mathrm{A}|-|\mathrm{B}|$ and $\operatorname{Sign}(\mathrm{S})=\operatorname{Sign}(\mathrm{A})$
ELSE $|\mathrm{S}|=|\mathrm{B}|-|\mathrm{A}|$ and $\operatorname{Sign}(\mathrm{S})=\operatorname{Sign}(\mathrm{B})$
You may assume the availability of a 4-bit binary parallel adder/subtractor which has a modecontrol 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

