EC-121 Digital Logic Design
Quiz # 1 — Section B
(Solution)

Q - 1 You have to design a display system for a thermometer. The minimum temperature that your display will have to output is 0 degrees and the maximum is 99 degrees.

a) What is the min. number of bits that is required to represent the temperature in binary?

Sol:

2	99
2	49 - 1
2	24 - 1
2	12 - 0
2	6 - 0
2	3 - 0
	1 - 1

Minimum 7 bits are required to present humidity.

$(99)_{10} = (1100011)_2$

b) Convert 95 degrees in decimal to binary, octal, and hexadecimal.

Sol:

2	95
2	47 - 1
2	23 - 1
2	11 - 1
2	5 - 1
	2 - 1
	1 - 0

$(95)_{10} = (1011111)_2$

8	95
8	11 - 7
	1 - 3

$(95)_{10} = (137)_8$

16	95
	5 - F

$(95)_{10} = (5F)_{16}$

c) Convert 95 degrees in decimal to BCD representation.

Sol: $(95)_{10} = (1001\ 0101)_{BCD}$

d) If you were required to represent both positive and negative temperatures in the range from -99 degree to 99 degree, how many bits do you need to represent the temperature in binary.

Sol: For signed binary numbers, an extra bit is required to represent sign of a number.

So,
+99 in 2's complement form represented as 01100011
-99 in 2's complement form will be 10011101

Therefore, total **8 bits are required** to represent temperatures +99 and -99.