INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR
Computer Science and Engineering

Switching Circuits and Logic Design (CS21002)
Assignment – 1 (Spring)

Group: _____   *Marks:* 30

Answer ALL the questions using xournal or similar software to edit the PDF

Q1: Given that $(16)_{10} = (100)_b$, determine the value of b.   4

$$16 = 0 * b^0 + 0 * b^1 + 1 * b^2$$

$$16 = b^2 \implies b = 4$$

Q2: The n-bit fixed-point representation of an unsigned real number X uses f bits for the fraction part. What is the range of decimal values for X in this representation?

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For unsigned real number the minimum value is 0, when all bits are turned off. The maximum value occurs when all bits are turned on, i.e.,

$$X = 2^{n-f-1} + \ldots + 2^1 + 2^0 + 2^{-1} + \ldots + 2^{-f}$$

$$X = \frac{2^{n-f-1}(1 - (\frac{1}{2})^n)}{1 - \frac{1}{2}}$$

$$X = \frac{2^n - 1}{2^f}$$

Therefore, we have,

$$0 \leq X \leq \frac{2^n - 1}{2^f}$$

Q3: Encode each of the ten decimal digits 0, 1, . . . , 9 by means of the weighted binary code 7 3 2 -1.   5

	7	3	2	-1
0	0	0	0	0
1	0	0	1	1
2	0	0	1	0
3	0	1	0	0
4	0	1	1	1
5	0	1	1	0
6	1	0	0	1
7	1	0	0	0
8	1	0	1	1
9	1	1	0	1

Q4: Design a circuit which converts a four bit input binary number to a five bit output representing the radix-12 representation of the input number and a carry-out bit. You may use a 4-bit binary adder block and basic logic gates. 8

Q5: Prove that the Hamming distance satisfies the triangle inequality. That is, show that $HD(x,y)+HD(y,z) \geq H(x,z)$. 8