INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Computer Science and Engineering

Switching Circuits and Logic Design (CS21002)

Class Test – I (Spring)

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Date: Wed, Jan 20, 2021 *Marks:* 35 *Time:* 8:10-9am (FN)

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

Q1: Your roll number is of the form $nnDDx_2nnx_1x_0$. Consider the decimal number $x_2x_1x_0 =$ 139. Let B be its binary equivalent. Run the *double dabble* (also called *add-3 and shift*) algorithm to convert the binary number B to BCD showing each step clearly. The operations should be either `L Sft` for left shift or `Add 3`. The entries for D2, D1 and D0 should be their values after application of the indicated operation. 25

Operation	B2	B1	B0	$x_2x_1x_0 =$ 139
Initial	0000	0000	0000	$B =$ 10001011
L Sft	0000	0000	0001	10001011
L Sft	0000	0000	0010	10001011
L Sft	0000	0000	0100	10001011
LSft	0000	0000	1000	10001011
Add 3	0000	0000	1011	10001011
LSft	0000	0001	0111	10001011
Add 3	0000	0001	1010	10001011
LSft	0000	0011	0100	10001011
LSft	0000	0110	1001	10001011
Add 3	0000	1001	1100	10001011
LSft	0001	0011	1001	10001011
Finish	$x_2 =$ 1	$x_1 =$ 3	$x_0 =$ 9	

Q2: Your roll number is of the form $nnDDnnnx_1x_0$. Consider the decimal number x_1x_0 = 39.

Represent 49 and -x_1x_0 in 8-bit signed 2's complement representation; then perform the following operations on your representations, showing each step clearly:

(a) 49+(-x_1x_0) 5

Item	Binary representation
x_1x_0 =	00100111
-x_1x_0 (2's complement)	11011001
49	00110001
+ (-x_1x_0)	11011001
Result 266	100001010

= 10 (mod 2^8 = 256)

(b) (-x_1x_0)+(-49) 5

Item	Binary representation
49	00110001
-49 (2's complement)	11001111
-x_1x_0	11011001
+ (-49)	11001111
Result 424	110101000

= -88 (mod 2^8 = 256)