Midterm Examination

ELEC8550 Computer Arithmetic, Fall 2020

October 20, 2020

ID	Name (print)	Signature
110031631	MOHIT SHARMA	Mohit Sharma

Read before start writing your solution

1. It is an open book examination. A calculator is allowed.
2. The exam time is 60 minutes (8:30am-9:30am) which includes the time it takes you to open the exam problem file from mailbox and answer the problems.
3. Write down ❶ your name, ❷ ID and ❸ page number/total number of pages at the top of each page of your answer sheets.
4. A 15-minute time span at 9:30am-9:45am will be available to you to scan your answer sheets, form one pdf file and upload the file to Resources/Online exams/Midterm at Blackboard course website.
5. In order to minimize the geometric distortion and unrecognizability caused by photo -taking, your answer sheets must be scanned (either using scanner or software based) and then formed into **one pdf file** as requested days before this exam. There will be 10% deduction for failing to do so.
6. The deadline that your submitted answer file will appear at Blackboard is 9:45am.
7. Submission later than 9:45am but before 9:55am will be deducted 10%. Submission after 9:55am will be assigned zero mark.
8. The use of external aid of any kind is not permitted. Certain measures will be taken if plagiarism is found. You are expected to take this final exam fairly.

Problem 1

Answer) $X = \pm 12.125$

$\Rightarrow X_I = 12, \quad X_F = 0.125$

	Quo.	Rem.
2	12	
2	6	0
2	3	0
2	1	1
	0	1

	Int.	Fraction
0.125×2	0	0.25
0.25×2	0	0.5
0.5×2	1	0

$\therefore (12.125)_{10} = (1100.001)_2$

$\Rightarrow +(12.125)_{10} = (1100.001)_2$ in 2's complement form

$-(12.125)_{10} = \overline{1100.001} + ulp$

$= 0011.110 + 0.001$

$= 0011.111$

$\Rightarrow -(12.125) = (0011.111)_2$ in 2's complement form

---

Problem 2

Answer) $X = \pm 108.75_{10}$

$+108.75 = 108.7 + 0.05$

$= 109 - 0.3 + 0.05$

$= 100 + 9 - 0.3 + 0.05$

$= 1(10^2) + 0(10) + 9(10^0) + 3(10^{-1}) + 5(10^{-2})$

$= (109.35)_{-10}$

$-108.75 = -108.8 + 0.05$

$= -108 - 0.8 + 0.05$

$= -110 + 2 - 0.8 + 0.05$

$= -100 + 10 + 2 - 0.8 + 0.05$

$= -1000 + 900 - 10 + 2 - 0.8 + 0.05$

$= 1(-10^3) + 9(10)^2 + 1(-10)^1 + 2(-10)^0 + 8(-10)^{-1} + 5(10)^{-2}$

$= (1912.85)_{-10}$

Problem 3

Answer)

(a) $X = \sum_{i=0}^{n-1} x_i 8^i$; $x_i \in \{\bar{a}, \ldots, \bar{1}, 0, 1 \ldots a\}$ and $a = 7$; $n = 4$

$\Rightarrow X = \sum_{i=0}^{4-1} x_i 8^i$

$= \sum_{i=0}^{3} x_i 8^i = x_3(8)^3 + x_2(8)^2 + x_1(8)^1 + x_0(8)^0$

Let minimum and maximum values be X_{max} and X_{min}

$\Rightarrow X_{max} = 7(8)^3 + 7(8)^2 + 7(8)^1 + 7(8)^0$

$= 3584 + 448 + 56 + 7$

$= (4095)_{10} = (7777)_{SD-8}$

$X_{min.} = \bar{7}(8)^3 + \bar{7}(8)^2 + \bar{7}(8)^1 + \bar{7}(8)^0$

$= -3584 - 448 - 56 - 7$

$= (-4095)_{10} = (\bar{7}\bar{7}\bar{7}\bar{7})_{SD-8}$

$\therefore$ Range of system is -4095_{10} to 4095_{10}

(b) $X = \sum_{i=0}^{n-1} x_i 8^i = (x_{n-1} x_{n-2} x_{n-3} \ldots x_3 x_2 x_1)$

$= x_{n-1} 8^{n-1} + x_{n-2} 8^{n-2} + \ldots + x_3 8^3 + x_2 8^2 + x_1 8^1 + x_0 8^0$

$= x_{n-1} \cdot 2^{3n-3} + x_{n-2} \cdot 2^{3n-6} + \ldots + 2^9 x_3 + 2^6 x_2 + 2^3 x^1 + x_0$

$= + 2^3(2^3 x_3 + 2^2 x_2 + 2^1 + x_0$

$+ (2^3 - 1)x_0$

Represent x_{n-1} as binary, x_{n-2}, $x_{n-3} \ldots x_3, x_2, x_1$ in binary SD form to get the binary SD representation

(c) $X = (3\ \bar{3}\ 5)_8 = (011\ 0\bar{1}\bar{1}\ 0101)_2$

Representing $3, \bar{3}, 5$ in binary SD

$\Rightarrow 3 = 011$

$\bar{3} = 0\bar{1}\bar{1}$

$5 = 101$

$\therefore X = (011\ 0\bar{1}\bar{1}\ 101)_{BSD}$

Problem 4)

Ans.) $A = 2\ \bar{5}\ 3\ 4_8$; $B = 3\ \bar{1}\ \bar{1}\ 3_8$

A =	2	$\bar{5}$	3	4
B =	3	$\bar{1}$	$\bar{1}$	3
c_i	0	0	0	1
u_i		5	$\bar{6}$	2	$\bar{1}$
s_i =	0	5	$\bar{6}$	3	$\bar{1})_8$

$\therefore Z = A + B = (05\bar{6}3\bar{1})_8$
