EE 2720, Spring 2012

Homework# 1 solution

EE 2729 HW #1 solution

Problem 1: $11010101.011_2 =$

$1\times2^7+1\times2^6+0\times2^5+1\times2^4+0\times2^3+1\times2^2+0\times2^1+1\times2^0$
$+0\times2^{-1}+1\times2^{-2}+1\times2^{-3} = 213.375_{10}$

Problem 2: The length of the integer part is 10 bits so we put two zeros at its left to make it a multiple of 3. The length of the fractional part is 2 bits so we put a zero at its right to make it a multiple of 3. We now have:

$000\ 111\ 010\ 101\ .\ 110_2$

$0\ \ 7\ \ 2\ \ 5\ .\ 6_8$

Problem 3: $7645.32_8 =$

111110100101.011010_2

Problem 4: Neither the length of the integer part nor the length of the fractional part are multiples of 4. We therefore put two zeros at the left of the integer part and two zeros at the right of the fractional part to make their length multiples of 4.

Pr. 4 cont: we now have:

$$\underbrace{0001}_{1}\ \underbrace{1101}_{D}\ \underbrace{0101}_{5} . \underbrace{1100}_{C}{}_2 = 1D5.C_{16}$$

Problem 5: $7FA.B9_{16}$ =

$0111\ 1111\ 1010 . 1011\ 1001_2$

Pr 6: Integer part or 139

	Quotient	Remainder
139/2	69	1 LSB
69/2	34	1
34/2	17	0
17/2	8	1
8/2	4	0
4/2	2	0
2/2	1	0
1/2	0	1 MSB

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Pr 6 cont:

	fract. part	Integer part
$0.375 \times 2 = 0.75$	0.75	0 MSB
$0.75 \times 2 = 1.5$	0.5	1
$0.5 \times 2 = 1.0$	0	1 LSB

So $139.375_{10} = 10001011.011_2$

Problem 7:

	fract. part	Integer part
$0.7 \times 2 = 1.4$	0.4	1 MSB
$0.4 \times 2 = 0.8$	0.8	0
$0.8 \times 2 = 1.6$	0.6	1
$0.6 \times 2 = 1.2$	0.2	1
$0.2 \times 2 = 0.4$	0.4	0
$0.4 \times 2 = 0.8$	0.8	0
$0.8 \times 2 = 1.6$	0.6	1
$0.6 \times 2 = 1.2$	0.2	1
$0.2 \times 2 = 0.4$	0.4	0

Process doesn't terminate. what we get is:

$0.7_{10} = 0.1011\,0\,0110\,0110\,\ldots_2$

Above is a binary fraction with infinite number of bits

Problem 8: DR = [0 $2^{10}-1$] = [0 1023]

Problem 9:

$$\begin{array}{rl} 0\,000100 & \text{carry} \\ 101011 & \\ +)\ 010010 & \\ \hline 0\ 111101 & \text{sum} \end{array}$$

carry out → 0

Here overall carry out is C=0, so overflow didn't occur. The correct result is $111101_2 = 61_{10}$. Here the Dynamic Range is DR = [0 63] and 61<63.

Problem 10: As said in prob. 9, DR = [0 63].

$$\begin{array}{rl} 1\ 11110 & \text{carry} \\ 101111 & \\ +)\ 010111 & \\ \hline 1000110 & \text{sum} \end{array}$$

carry out → 1

Here overall carry out is C=1, so overflow occured.
Here $X+Y = 1000110_2 = 70_{10}$ and 70 > 63

Problem 11: $DR = [-(2^{10-1}-1) \quad +(2^{10-1}-1)]$

$= [-(2^9-1) \quad 2^9-1] = [-511 \quad 511]$

Problem 12: $DR = [-2^{8-1} \quad 2^{8-1}-1] = [-2^7 \quad 2^7-1]$

$= [-128 \quad 127]$

Problem 13: $10011101_2 = -2^7 \times 1 + 2^4 + 2^3 + 2^2 + 2^0 =$

$-128 + 16 + 8 + 4 + 1 = -99_{10}$

Prob. 14:

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    01010101
       ↓      complement bits
    10101010
+)         1
   ---------
    10101011
```

Pr 15:

```
          1 ← initial carry in of 1
     101001
     111001
   ---------
   1 100011
```

1 ← ignore

$\hookrightarrow X - Y = 100011_2 = -29_{10}$.