
Department of CSIT

Information Technology

# MODULE 1

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## CSIT_230,01SP21

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1. Problem 1

(40 pts) Binary to decimal … and back (Need to show all steps )

(a) Convert the following unsigned binary number to decimal: $(111111)_2 = (?)_{10}$

(111111)2

1*2^5 + 1*2^4 + 1*2^3 + 1*2^2 + 1*2^1 + 1*2^0

1*32 + 1*16 + 1*8 + 1*4 + 1*2 + 1*1

32+16+8+4+2+1

**Answer: 63**

(b) Convert the following unsigned binary number to decimal: $(0.1111111\cdots1)_2 = (?)_{10}$

(0.1111111…1)2

1*2^0 + 1*2^-1 + 1*2^-2 + 1*2^-3 + 1*2^-4 + 1*2^-5 + 1*2^-6 + 1*2^-7

1*1 + 1*0.5 + 1*0.25 + 1*0.125 + 1*0.0625 + 1*0.03125 + 1*0.015625 + 1*0.00778125

**Answer: 1.99215625….**

(c) Convert the following decimal number to binary: $(1111.111)_{10} = (?)_2$

(1111.111)2

Divide the number by 2 until 0 is the final remainder

1111.111/2 = 555.5555; 1
555.5555/2 = 277.7775; 0
277.7775/2 = 138.88875;0
138.88875/2 = 69.444375; 0
69.444375/2 = 34.7221875; 0
34.7221875/2 = 17.7221875; 0
17.7221875/2 = 8.680546875; 0
8.680546875/2 = 4.3402734375; 0
2.17013671875/2 = 0;

**The Answer: 00000001**

(d) Convert the following hexadecimal number to binary, then the binary to decimal: $(FFFF)_{16} = (?)_2 = (?)_{10}$

first we break down the digits

= 15*16^0 + 15 * 16^1 + 15* 16^2 + 15*16^3
= 15*1 + 15 * 16 + 15 * 256 + 15*4096
= 65535

**The decimal Number is (65535)10**

Long division for binary:

65535/2 = 32767 left over 1
32767/2 = 16383 left over 1
16383/2 = 8191 left over 1
8191/2 = 4095 left over 1
4095/2 = 2047 left over 1
2047/2 = 1023 left over 1
1023/2 = 511 left over 1
511/2 = 255 left over 1
255/2 = 127 left over 1
127/2 = 63 left over 1
63/2 = 31 left over 1
31/2 = 15 left over 1
15/2 = 7 left over 1
7/2 = 3 left over 1
3/2 = 1 left over 1
½ = 0 left over 1

**Final Answer: 1111111111111111**

2. Problem 2

(20 pts) Perform the following (subtraction) operation (Need to show all steps):

- $(1 - 11)_{10}$ Using signed binary, 8–bit 2's complement arithmetic.

$+1_{10}$ - $11_{10}$

Find out the binary numbers

+1 = 1

-11 = - 1011

Subtraction:

1 – (-1011) = -1010

3. Problem 3

(40 pts) 32–bit FPN (IEEE 754) to decimal and back (Need to show all steps)

(a) Convert the following 32–bit FPN (IEEE 754) to decimal number:

1 10000000 11001000000000000000000

1 10000000 11001000000000000000000
Positive Integer
8 bits
Fraction bits
We can see the first number is 1 which is negative.
The 8 bit conversion after the sign bit
(10000000)2 -> 1*2^0 + 0*2^1 + 0*2^2 + 0*2^3 + 0*2^4 + 0*2^5 +0*2^6 + 0*2^7 + 0*2^8
1 +0+0+0+0+0+0+0
= 1

Exp bias = 127

E = 1-127 = -126

M = 1*2^-1 + 1*2^-2 + 0*2^-3 + 0*2^-4 + 0*2^-5
= 0.5 + 0.25 + 0.125 + 0.0625 + 0.03125
= 0.96875

(-1)^s (1+m) * 2^e = (-1)^0 *(1 + 0.96875) * 2*7
= -1 * 1.96875 * 128
**Answer = -252**

(b) Convert the following decimal number to 32–bit FPN (IEEE 754) number:

$(-3.125)_{10}$

3/2 = 1.5; remainder 1
1.5/2 = 0.75; remainder 1

= 11.001

0.125 * 2 = 0.25; 0
0.25 * 2 = 0.5;0
0.5*2 = 1;1

11.001* 2^1 =

First bit would be the sign bit, since its negative it would be 1

8 bits would be 127 + 1 = 128

128 converted to binary would be : 10000000

The final number would be 1 10000000 0011100000000