

Department of CSIT

Information Technology

MODULE 1

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1. Problem 1

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

1. 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**

1. Convert the following unsigned binary number to decimal: (0.1111111 · · ·1)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**

1. 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**

1. 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.

+110  - 1110

Find out the binary numbers

+1 = 1

-11 = - 1011

Subtraction:

1 – (-1011) = -1010

1. 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