

**Problem 1:**

**Computer Science or Information Technology**

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Day, Month, Year

Day

CSIT 502

Department of CSIT

Assessment

Module-1

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## (60 pts) Binary, Hex, Decimal ... and back (Need to show all steps )

1. Convert the following unsigned binary number to decimal:

(111111)2 = (?)10

**Solution**

(1\*2^5)+ (1\*2^4)+ (1\*2^3)+ (1\*2^2)+ (1\*2^1)+ (1\*2^0)=

32 + 16 + 8 + 4 + 2 + 1 = 63

(111111)2 = (63)10

1. Convert the following unsigned binary number to decimal:

(0.1111111 · · ·1)2 = (?)10

**Solution**

(1\*2^-1) + (1\*2^-2)+ (1\*2^-3) + (1\*2^-∞) =

½ + ¼ + 1/8 + ∞ = This can be found by infinite geometric progression

The common ratio of this geometric progression is ½ = a.

The first term is ½ = r.

Therefore according to the formula for infinite geometric series (x = a/(1-r))

(0.1111111 · · ·1)2 = (1/2)/(1-(1/2)) = (1/2)/(1/2)= (1)10

(0.1111111 · · ·1)2 = (1)10

1. Convert the following decimal number to binary:

(1111.111)10 = (?)2

**Solution**

First the Integer part (1111)

1111/2 = 555 remainder 1

555/2 = 277 remainder 1

277/2 = 138 remainder 1

138/2 = 69 remainder 0

69/2 = 34 remainder 1

34/2 = 17 remainder 0

17/2 = 8 remainder 1

8/2 = 4 remainder 0

4/2 = 2 remainder 0

2/2 = 1 remainder 0

1/2 = 0 remainder 1

10001010111 = integer part

Fraction part (.111)

0.111 \* 2 = 0.222

0.222 \* 2 = 0.444

0.444 \* 2 = 0.888

0.888 \* 2 = 1.776

0.776 \* 2 = 1.552

0.552 \* 2 = 1.104

0.104 \* 2 = 0.208

0.208 \* 2 = 0.416

0.416 \* 2 = 0.832

0.832 \* 2 = 1.664

0.664 \* 2 = 1.328

0.328 \* 2 = 0.656

0.656 \* 2 = 1.312

0.312 \* 2 = 0.624

0.624 \* 2 = 1.248

0.248 \* 2 = 0.496

0.496 \* 2 = 0.992

0.992 \* 2 = 1.984

0.984 \* 2 = 1.968

0.968 \* 2 = 1.936

Let’s end here since a repeating pattern emerges and this can go on for infinity.

.00011100011010100111 = fraction part

Therefore

(1111.111)10 = (10001010111.00011100011010100111)2

1. Convert the following hexadecimal number to binary, then the binary to decimal:

(FFFF)16 = (?)2 = (?)10

**Solution**

(F)16 = (1111)2 Therefore

(FFFF)16 = (1111111111111111)2

To calculate for decimal we do the following.

(1\* 2^15) +(1\* 2^14) +(1\* 2^13) +(1\* 2^12) +(1\* 2^11) +(1\* 2^10) +

(1\* 2^9) +(1\* 2^8) +(1\* 2^7) +(1\* 2^6) +(1\* 2^5) +(1\* 2^4) +

(1\* 2^3) +(1\* 2^2) +(1\* 2^1) +(1\* 2^0) =65535

Therefore

(FFFF)16 = (1111111111111111)2 = (65535)10

1. Convert the following binary number to hexadecimal:

(10110001101011.11110011)2 = (?)16

**Solution**

Integer Part

(1011)2 = (B)16

(0110)2 = (6) 16

(1100)2 = (C)16

(0010)2 = (2)16

Fraction Part

(1111) = (F)16

(0011) = (3)16

Therefore

(10110001101011.11110011)2 = (2C6B.F3)16

1. Perform the following (subtraction) operation:

(1 − 11)10

Using signed binary, 8–bit 2’s complement arithmetic.

**Solution**

(1)10 = (00000001)2

(11)10=(00001011)2

We need to find the 2nd compliment of (00001011)2

1st compliment = (11110100)2

2nd compliment = (11110100)2 + (1)2 = (11110101)2

(00000001)2 + (11110101)2 = (11110110)2 in second compliment =

(10001010) in signed binary.

**Problem 2:**

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

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

1 10000000 11110000000000000000000

**Solution**

Sign is: 1, and therefore the decimal number will be negative

Biased exponent is: (10000000)2 = (128)10

Unbiased exponent is: 128-127= 1

F= 1.1111

Result = (-1.1111)\*(2^1)= (-11.111)2=(-3.875)10

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

(−2.75)10

**Solution**

Sign is negative, and therefore the FPN will start with 1

Now we convert 2.75 to binary, starting with the integer and then the fraction

(2)10 = (10)2

To find (.75)10 in binary we perform the following

0.75 \* 2 = 1.50

.50 \* 2 = 1.00

00 \* 2 = 0.00

Therefore (0.75)10 = (.11)2

Now combining the integer and decimal we get (10.11)2

10.11 = 1.011 \* 2^1

Biased exponent = 127 + 1 = 128

Unsigned binary of 128 = 10000000

Therefore the FPN (IEEE 754) number is the following

1 10000000 01100000000000000000000