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1) Convert decimal to Binary

a. 23

16	8	4	2	1
1	0	1	1	1

=) $(10111)_2$

b. -32

32	16	8	4	2	1
1	0	0	0	0	0

⇒ $(0100000)_2$

↳ 1's comp

10011111 ← 2's comp

+ 1

11000000

=) $(11000000)_2$

c) 22.25

⇒ 22 → 10110

0.25 × 2 → 0.50 → 0

0.50 × 2 → 1

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=) $(10110.101)_2$

d. 7.546

7 → 111
0.546 × 2 → 1.7092 → 1
0.7092 × 2 → 1.4184 → 1
0.4184 × 2 → 0.8368 → 0
→ 1

=) (111.1001)2

2. Convert binary to decimal

a) 1010101

64	32	16	8	4	2	1
1	0	1	0	1	0	1

=) $(85)_{10}$

b) 1001.110101

1001 =) 9
.110101 =) $2^{-1} + 2^{-2} + 0 + 2^{-4} + 0 + 2^{-6}$
=) 0.5 + 0.125 + 0 + 0.0625 +
=) 0.7031

=) $(9.7031)_{10}$

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0.110110111

0 → 0

.110110111 → $2^{-1}+2^{-2}+0+2^{-4}+2^{-5}+0+2^{-7}+2^{-8}+2^{-9}$

= 0.8574

= $(0.8574)_{10}$

1111.111

1111 → 15

.111 → $2^{-1}+2^{-2}+2^{-3}$

= 0.875

$(15.875)_{10}$

Convert the following decimal numbers to binary using 6-bit 2's complement representation

-16

16 → 010000

1's comp → 101111

2's comp → 110000

=) $(110000)_2$

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~~a)~~

b) -3

3 → ~~0 1 1~~ 000011

1's comp → 111100

2's comp → 111101

=) $(111101)_2$

c) ~~-~~ 13

13 → $(00\ 1101)_2$

d) 25

25 → $(011001)_2$

e) -30

30 → $(011110)_2$

1's comp → 100001

2's comp → 100010

=) $(100010)_2$

f) -10

10 → $(001010)_2$

1's comp → 110101

2's comp → ~~0 0 1 0 1 0~~ 110110

=) ~~(00 1010)2~~ $(110110)_2$

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Solve using 2s comp using registers of size 8

-21-21

=) -21-21

=-42

42 → 00101010

1's comp → 11010101

2's comp → 11010110

=) (11010110)2

2+5

=) 7

7 → 00000111 =) (00000111)2

1's comp → 11111000

2's comp → 11111001

=) (11111001)2

-(-6)

=) 6

6 → (00000110)2

26-15

=) 9

9 → (000001001)2

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e) -31-6

=) -37

37 → (00100101)2
1's comp → (11011010)2
2's comp → (11011011)2
=) (11011011)2

f) 144-156

=) -12

12 → (00001100)2
1's comp → (11110011)2
2's comp → ~~(00001)~~ (11110100)2
=) (11110100)2

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5) Express the following expressions as powers of 2:-

a) 246

=) $2^{\log_2 246}$

b) 64K

=) $2^{\log_2 64000}$

c) 32M

=) $2\log_2 32M$

d) 512

=) $2\log_2 512$

e) 9B

=) $2\log_2 9B$

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6. Convert 1327.76 to binary (upto 6 binary fractional digits).

1327.76

soln,,

1327 → 10100101111

now for the decimal part

0.76 × 2 = 1.52 → 1

0.52 × 2 = 1.04 → 1

0.04 × 2 = 0.08 → 0

0.08 × 2 = 0.16 → 0

0.16 × 2 = 0.32 → 0

0.32 × 2 = 0.64 → 0

0.76 → (0.110000)2

=) $(10100101111.110000)_2$

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3) Using the ASCII-code, find the binary streams represented by following character strings.

a) BCU-UK

soln,,

B :- 66 (:- 64 32 16 8 4 2 1
0 1 0 0 0 0 1 0

(66)

B :- 128 64 32 16 8 4 2 1
0 1 0 0 0 0 1 0

(67)

C :- 128 64 32 16 8 4 2 1
0 1 0 0 0 0 1 1

(85)

U :- 128 64 32 16 8 4 2 1
0 1 0 1 0 1 0 1

(45)

- :- 128 64 32 16 8 4 2 1
0 0 1 0 1 1 0 1

(75)

K :- 128 64 32 16 8 4 2 1
0 1 0 0 1 0 1 1

2) (01000010 01000011 01010101 00101101 01001011

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b. Your name

=) Shubha

(83)

S :→ 01010011

(104)

h :→ 128 64 32 16 8 4 2 1

1 1 1 0 1 0 0 0

(117)

u :→ 128 64 32 16 8 4 2 1

0 1 1 1 0 1 0 1

(98)

b :→ 128 64 32 16 8 4 2 1

0 1 1 0 0 0 1 0

(104)

h :→ 128 64 32 16 8 4 2 1

0 1 1 0 1 0 0 0

(97)

a :→ 128 64 32 16 8 4 2 1

0 1 1 0 0 0 0 1

=) (01010011 11101000 01110101 01100010 01101000 01100001)$_2$

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• ASCII

soln,,

(46)

. :→ 01001110

(65)

A :→ 01000001

(83)

S :→ 01010011

(67)

C :→ 01000011

(73)

I :→ 01001001

(73)

I :→ 01001001

01001110 01000001 01010011 01000011 01001001 01001001)2

What is the largest & smallest number one can represent in a 12-bit 2's complement code) write in binary and decimal

The largest is $2^{12-1} - 1 = 2047$

=) 011111111111

The smallest is $-(2^{12-1}) = -2048$

=) 100000000000

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9) What is the largest & smallest number one can represent in n-bit 2's complement code?

largest is given by $(2^{n-1} - 1)$
smallest is given by (-2^{n-1})

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