DEPARTMENT OF COMPUTER SCIENCE

COLORADOSCHOOLOFMINES
EARTH • ENERGY • ENVIRONMENT

CSCI 341: Computer Organization
WS 2: Floating Point Numbers

1 Given a 32 bit register, show where each part of a floating point number will be. Fill out the table below.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Solution:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
S	E	E	E	E	E	E	E	E	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F

2 Write down the formula for converting a binary floating point number to decimal.

Solution: $(-1)^S(1+F)\left(2^{E-b}\right)$

3 Write down the formula for converting a denormal binary floating point number to decimal.

Solution: $(-1)^S(0+F)\left(2^{1-b}\right)$

4 Convert the following floating point numbers to decimal

1. 1001 0010 0100 1000 0000 0000 0000 0000
2. 0111 1011 0100 1000 0000 0000 0000 0000

Solution:

$$1\ 00100100\ 10010000000000000000000$$
$$(-1)^1(1+2^{-1}+2^{-4})(2^{36-127}) = -6.31089 * 10^{-28}$$
$$0\ 11110110\ 10010000000000000000000$$
$$(-1)^0(1+2^{-1}+2^{-4})(2^{246-127}) = 1.03846 * 10^{36}$$

5 Convert the following floating point numbers to decimal. Show enough decimal places for the numbers to be distinguishable.

1. 1000 0000 0100 1000 0000 0000 0000 0000
2. 0000 0000 0100 1000 0000 0000 0000 0001

Solution:

	1 00000000 10010000000000000000000 $(-1)^1(0 + 2^{-1} + 2^{-4})(2^{1-127}) = -6.61215572 * 10^{-39}$ 0 00000000 10010000000000000000001 $(-1)^0(0 + 2^{-1} + 2^{-4} + 2^{-23})(2^{1-127}) = 6.61215712 * 10^{-39}$