

Troy Schultz

## CSCI-21 Floating-Point homework

Do this on paper to turn in. Show your work for full credit. Due 10/27/20

- 1) Represent the following decimal values as IEEE standard 754 32-bit floating-point values. Show your work. Express the values in both binary and hexadecimal.

	<i>S</i> <i>Exp + bias</i> <i>fractional mantissa significand</i>	
a) 17.625	01000001100011010000000000000000	0x 41870000
b) -265.875	11000011100001001111000000000000	0x C384F000
c) 12.265625	01000001010001000000000000000000	0x 41444000
d) 0.5	01111100000000000000000000000000	0x 3F000000
e) 1.0	01111111000000000000000000000000	0x 3F800000
f) -1.0	10111111100000000000000000000000	0x BF800000
g) 0.0	00000000000000000000000000000000	0x 00000000
h) 0.015625	00111001000000000000000000000000	0x 3C800000

- 2) Convert the following IEEE 754 32-bit floating-point values given in hexadecimal to their equivalent decimal values. Show your work.

a) 43800000	256
b) C380D000	-257.625
c) 41B40000	22.5
d) 437F0000	255
e) 3F000000	0.5
f) 00000000	0
g) 3B800000	$3.90625 \times 10^{-3}$

You may check your answers with a Web-based IEEE standard 754 floating-point calculator before you turn them in, but NOT before you do these!



#1

C) 12.265625

$\frac{12}{2} = 1100$

$\frac{265625}{2} = 132812.5$

$\frac{132812.5}{2} = 66406.25$

$\frac{66406.25}{2} = 33203.125$

$\frac{33203.125}{2} = 16601.5625$

$\frac{16601.5625}{2} = 8300.78125$

$\frac{8300.78125}{2} = 4150.390625$

$\frac{4150.390625}{2} = 2075.1953125$

$\frac{2075.1953125}{2} = 1037.59765625$

$\frac{1037.59765625}{2} = 518.798828125$

$\frac{518.798828125}{2} = 259.3994140625$

$\frac{259.3994140625}{2} = 129.69970703125$

$\frac{129.69970703125}{2} = 64.849853515625$

$\frac{64.849853515625}{2} = 32.4249267578125$

$\frac{32.4249267578125}{2} = 16.21246337890625$

$\frac{16.21246337890625}{2} = 8.106231689453125$

$\frac{8.106231689453125}{2} = 4.0531158447265625$

$\frac{4.0531158447265625}{2} = 2.02655792236328125$

$\frac{2.02655792236328125}{2} = 1.0132789611816406$

$\frac{1.0132789611816406}{2} = 0.5066394805908203$

$\frac{0.5066394805908203}{2} = 0.25331974029541015$

$\frac{0.25331974029541015}{2} = 0.12665987014770507$

$\frac{0.12665987014770507}{2} = 0.06332993507385253$

$\frac{0.06332993507385253}{2} = 0.031664967536926265$

$\frac{0.031664967536926265}{2} = 0.01583248376846313$

$\frac{0.01583248376846313}{2} = 0.007916241884231565$

$\frac{0.007916241884231565}{2} = 0.0039581209421157825$

$\frac{0.0039581209421157825}{2} = 0.0019790604710578912$

$\frac{0.0019790604710578912}{2} = 0.0009895302355289456$

$\frac{0.0009895302355289456}{2} = 0.0004947651177644728$

$\frac{0.0004947651177644728}{2} = 0.0002473825588822364$

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$\frac{0.000000000000000000000000026192647243611625486214916441011875461805177312221875}{2} = 0.00000000000000000000000001309632362280581274310745822205593752309025865611109375$

$\frac{0.00000000000000000000000001309632362280581274310745822205593752309025865611109375}{2} = 0.000000000000000000000000006548161811402906371553729111102968751154512780555546875$

$\frac{0.000000000000000000000000006548161811402906371553729111102968751154512780555546875}{2} = 0.000000000000000000000000003274080905701453185776864555551484375577256392777789375$

$\frac{0.000000000000000000000000003274080905701453185776864555551484375577256392777789375}{2} = 0.000000000000000000000000001637040452850726592883432277777522375288198893989375$

$\frac{0.000000000000000000000000001637040452850726592883432277777522375288198893989375}{2} = 0.0000000000000$



# CSCI Floating Point HW

5#

#2 Convert IEEE754 FP Hex to decimal equivalent.

a) 43800000

$256_{10}$

$$\begin{array}{r} \text{+ sign} \quad \text{Exponent} \\ \xrightarrow{\quad 0100\ 0011 \quad} 135 - 127 = 8 \\ \text{+ bias} \end{array}$$

$128 + 4 + 2 + 1 = 135$

$1.0000000000000000000000000000000$

$2^8 = 256$

b) C3800000

$$\begin{array}{r} \text{- sign} \\ \xrightarrow{\quad 1100\ 0011 \quad} 135 - 127 = 8 \\ = 1 \end{array}$$

$1.0000000000000000000000000000000$

$8 \text{ jumps}$

$10000000_2 \times 101_2 = \frac{1}{2} + \frac{1}{8} = 0.5 + 0.125 = 0.625$

$= 1 \cdot 2^8 + 1 \cdot 2^0 = -257.625$

$= -257.625$

c) 41B40000

$$\begin{array}{r} \text{+ sign} = 0 \xrightarrow{\quad 0100\ 0001 \quad} 131 - 127 + 4 = 8 \\ \text{Exponent + bias} \end{array}$$

$1.0110100000000000000000000000000$

$10110_2 \times 1000000000000000000000000000000$

$2^4 + 2^3 + 2^2 = 16 + 8 + 4 = 22.5$

$= 22.5$

d) 437F0000

$$\begin{array}{r} \text{+ sign} = 0 \xrightarrow{\quad 0100\ 0011 \quad} 131 - 127 + 7 = 7 \text{ jumps} \\ \text{Exp + Bias} \end{array}$$

$1.111110000000000000000000000000$

$1111111_2 \times 0000000000000000000000000000000$

$2^7 + 2^6 + 2^5 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0$

$= 128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 = 255.0$

