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CSC-17A
Final Problem 6
Convert following to base: 2, 8, 16; then to NASA Hex float; then scaled int bin, then IEEE 754 format

a) 5.75
b) 0.9
c) 99.7

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a) 5.75_{10}

① Convert to different bases.
First, int and float conversions are done seperately

int
$5_{10} = 0101_2 = 5_8 = 5_{16}$

float
0.75_{10} | 0.1100_2 converted from base 8 and 16 | $0.75 \cdot 8^1 = 6.0$ ∴ $0.75_{10} = 0.6_8$ | $0.75 \cdot 16^1 = 12.0$ ∴ $0.75_{10} = 0.C_{16}$

So, combining int and float gives us:

$5.75_{10} = 0101.1100_2 = 5.6_8 = 5.C_{16}$

② convert to NASA hex

$101.11_2 = 0.10111 \cdot 2^3$

0.1011100	00000000	00000000	00000011
⇒ 5 C	0 0	0 0	0 3

$5.75_{10} = 5C000003$ Nasa float

③ convert a) to scaled int binary 1 unsigned byte max bits

To burnt out to learn and finish this part. I'm sorry. :(

④ convert to IEEE

$0.10111_2 \cdot 2^3 = 1.0111_2 \cdot 2^2$ ← knock off first '1' bit.

+	power of 2 ↓ +127	1	0111000	00000000	00000000
0	10000000				
4	0	B	8	0 0	0 0

40B00000 IEEE 754

b) 0.9_{10} conversion

$0.9_{10} = \underset{16}{0.E\overline{6}} = \underset{8}{0.7\overline{314631}} = \underset{2}{0.1110\overline{0110}}$

$0.9 \times 16^1 = 14.4$
$0.4 \times 16^2 = 6.4$
$0.4 \times 16^3 = 6.4$
$\Rightarrow \underset{16}{0.E\overline{6}}$

$0.1110\overline{0110}\ \overline{0110} \cdot 2^0$

16 8 2

$\begin{array}{l} 0\,0\,0\,0\,0\,0\,0\,1 \Rightarrow +1 \\ 1\,1\,1\,1\,1\,1\,1\,0 \Rightarrow \text{flip to use 2's comp.} \\ 1\,1\,1\,1\,1\,1\,1\,1 \Rightarrow -1 \end{array}$

Nasa hex

0.1110	1100	1100	1100	0000	0000
E	6	6	6	0	0

$\Rightarrow$ $0.9_{10} = E666\,00$ Nasa hex

Scaled int bin 2 unsigned byte max bits

IEEE

$0.1110\overline{0110}\ \overline{0110} \cdot 2^0 = 1.\overline{1001100}\ \overline{1100} \cdot 2^{-1}$

0	0111 1110	1100 1100	1100 1100
	127 − 1		
3	F	6	6 6 6

$0.9_{10} = 3F666666$ IEEE 754

c) 99.7_{10} conversion

int

$99_{10} = \underline{01100011}_2 = \underline{63}_{16} = \underline{143}_P$

0110 0011
6 3

$99\%16 = 3$
$int(99/16)\%16$
$6\%16 = 6$

00110011
1 4 3

float

$0.7_{10} = \underline{0.B3}_{16} = \underline{0.1011\,0011}_2 = \underline{0.5\overline{4631}}_8$

$0.7 \cdot 16^1 = 11.2$
$0.2 \cdot 16^2 = 3.2$
$0.2 \times 16^3 = 3.2$
$\therefore 0.7_{10} = 0.B\overline{3}_{16}$

B 3
1011 0011

0.1011 0011 0011 0011 0011...
0.5463146314

Combine int + float

$99_{10} = 63.B\overline{3}_{16} = 143.5\overline{4631}_P = 1100\,0111.1011\,\overline{0011}_2$

convert nasa hex

$1100\,0111.1011\,\overline{0011} \cdot 2^0 = 0.1100\,0111\,1011\,\overline{0011} \cdot 2^7$

0 1100 0111 | 1011 1001 1 | 0011 0011 | 0000 0111

6 3 B 3 3 3 0 7

$99.7_{10} = 63B33307$ Nasa hex

convert to scaled int bin 3 unsigned byte mixbits

IEEE 754

$0.1100\,0111\,1011\,\overline{0011} \cdot 2^7 = 1.1000\,1111\,0110\,\overline{0011} \cdot 2^6$

+ 127+7
128+6

0 1000 0111 | 1000 1111 | 0110 0110 | 0110 0110

4 3 4 7 6 6 6 6

$\therefore 99.7_{10} = 43476666$ IEEE 754