Assignment 2
MEEN 357

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Task 6

Problem 1. Machine Epsilon

Machine epsilon for this 9-bit floating-point number would be half the difference between the following floats: 000000000 and 000000001. This can be found as:

$$\begin{aligned}\epsilon &= \frac{-1^0 * 2^{1-3} * 0.00001 - -1^0 * 2^{1-3} * 0.00000}{2} \\ &= \frac{(0.00000010.0000000)}{2} \\ &= 0.00000001_2 \\ &= 2^{-8} \\ &= 0.00390625\end{aligned}$$

Problem 2. Floats

i

$$\begin{aligned}0\,110\,11111 &= 2^(2^2 + 2^1 3)x1.11111 \\ &= 1111.112 \\ &= 2^4 + 2^3 + \ldots + 2^{-2} \\ &= 15.75_1 0\end{aligned}$$

ii

$$\begin{aligned}0\,001\,00001 &= 2^{1-3} * 1.00001 \\ &= .0100001_2 \\ &= 2^{-2} + 2^{-7} \\ &= 0.2578125_1 0\end{aligned}$$

iii

$$\begin{aligned} 0\,000\,11111 &= 2^{1-3} * 0.11111 \\ &= 0.0011111_2 \\ &= 2^{-3} + \ldots + 2^{-7} \\ &= 0.2421875_10 \end{aligned}$$

iv

$$\begin{aligned} 0\,000\,00001 &= 2^{1-3} * 0.00001 \\ &= 0.0000001_2 \\ &= 2^{-7} \\ &= 0.0000078125_10 \end{aligned}$$

Problem 3. Floating Point Binary

Number	Number in Binary	Exponential	Exponential Binary	Binary Float Representation
0	0	0	000	0 000 00000
1	1	0+3	011	0 011 00000
2	10	1+3	100	0 100 00000
3	11	1+3	100	0 100 10000
4	100	2+3	101	0 101 00000
5	101	2+3	101	0 101 01000
6	110	2+3	101	0 101 10000
7	111	2+3	101	0 101 11000
8	1000	3+3	110	0 110 00000
9	1001	3+3	110	0 110 00100
10	1010	3+3	110	0 110 01000
11	1011	3+3	110	0 110 01100
12	1100	3+3	110	0 110 10000
13	1101	3+3	110	0 110 10100
14	1110	3+3	110	0 110 11000
15	1111	3+3	110	0 110 11100