

Week 2 Hand-in

NumIntro 2019
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Version 1

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1. Exercise

The decimal number $\frac{4}{5}$ cannot be displayed in binary with a finite amount of numbers. It looks as follows:

$$0.\overline{1100}$$

Meaning that the sequence "1100" repeats forever.

2. Exercise

(a)

10^{40} is a machine number in Marc-32

(b)

$2^{-1} + 2^{-29}$ is not a machine number in Marc-32

(c)

$\frac{1}{3}$ is not a machine number in Marc-32

(d)

$\frac{1}{5}$ is not a machine number in Marc-32

3. Exercise

(a)

$$11001_2 = (1 * 2^4) + (1 * 2^3) + (0 * 2^2) + (0 * 2^1) + (1 * 2^0) = 25_{10}$$

(b)

$$\begin{aligned} 1101.001_2 &= \\ &= (1 * 2^3) + (1 * 2^2) + (0 * 2^1) + (1 * 2^0) + (0 * 2^{-1}) + (0 * 2^{-2}) + (1 * 2^{-3}) \\ &= 13.125_{10} \end{aligned}$$

4. Exercise

This exercise has been submitted on Absalon under Q0008

5. Exercise

To show this approximation, we first use a truncated Taylor series for $\cos(x)$. We can do this because $x \rightarrow 0$:

$$\cos(x) \approx 1 - \frac{x^2}{2} + \frac{x^4}{24} - \frac{x^6}{720}$$

Then we can say:

$$1 \approx 1 - \frac{x^2}{2} + \frac{x^4}{24} - \frac{x^6}{720}$$

This means that our error is:

$$\frac{x^2}{2} + \frac{x^4}{24} - \frac{x^6}{720}$$

We can then solve:

$$\frac{1}{2} * 10^{-8} = \frac{x^2}{2} + \frac{x^4}{24} - \frac{x^6}{720}$$

The solution for this approximates to $x \approx 0.0001$. This means that for the approximation $\cos(x) \approx 1$, to be accurate, x would have to be less than or equal to roughly 0.0001.

6. Exercise

This exercise has been submitted on Absalon under Q0006