

M.Sc. IN HIGH-PERFORMANCE COMPUTING

5633 - NUMERICAL METHODS

ASSIGNMENT 0

Marina Krstic Marinkovic
(mmarina@maths.tcd.ie)
School of Mathematics, TCD

RULES

To submit, make a single tar-ball with all your code and a pdf of any written part you want to include. Submit this via `msc.tchpc.tcd.ie` or via email to `mmarina@maths.tcd.ie` by the end of **Friday November 4th**. Instead of R, you may/ use Matlab or Python for the numerical/plotting part. Late submissions without prior arrangement or a valid explanation will result in reduced marks.

QUESTION

1. Convert the following nubers into IEEE 754 single precision numbers:

- (a) 55
- (b) 55.5

and then use their binary representation to write these numbers in hexadecimal representation. The conversion table between decimal, binary and hexadecimal representation is given in Figure 1.

2. Consider the Runge function:

$$f(x) = \frac{1}{1 + 25x^2}$$

and construct its:

- (a) natural spline approximation
- (b) complete spline approximation

using equally spaced points on the interval $[-1,1]$, $h = x_k - x_{k-1}$, for different choices of grid points $h^{-1} = 2, 4, 8, 16$.

Write an R script that makes a plot of each of the approximations (a) and (b), as well as the plots of the associated errors. Compare these plots to the polynomial fits shown in class and comment briefly on your observations.

Binary	Hex	Decimal
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	A	10
1011	B	11
1100	C	12
1101	D	13
1110	E	14
1111	F	15

Figure 1: Conversion table between decimal, binary and hexadecimal representation.