Lab Assignment 1

MTH 308: Numerical Analysis and Scientific Computing–I

Department of Mathematics and Statistics, IIT Kanpur

2026 Even Semester: January 09, 2026

This lab will have you implement different features of a given floating-point number system. Please write a single script file `Lab1LastnameRollNumber.m` and run them all. If you click on the **Publish** button in MATLAB, it will automatically create a folder named `html` containing a file named `Lab1LastnameRollNumber.html` and figures in `.png` format (if any are generated). For example, if my roll number is `260102`, my script file should be `Lab1Biswas260102.m`, and the `html` folder should contain the file `Lab1Biswas260102.html` and output figures.

Each solution should:

- Be contained in a separate **code cell** (starting with `%%`) that includes the problem number and a short description.
- Run independently of other cells.
- Be adequately commented to explain your logic.

Your output must be printed using the `fprintf` function. Example format:

```
UFL: 0.500, Total number: 33, OFL: 3.500
```

1. Consider the floating-point number system $F(\beta, t, L, U) = F(2, 3, -1, 2)$.

(i) Write a MATLAB program to generate all representable (normalized) floating-point numbers in this system.

(ii) Write a program to determine the *Underflow Level* (UFL), the *Overflow Level* (OFL), and the total number of elements in the system.

2. Plot all representable numbers for the system defined in Problem 1 on the real line. Briefly comment on the spacing (density) of the numbers across different ranges of the line.