ITU Computer and Informatics Faculty
BLG 202E Numerical Methods in CE 2018-2019 Spring
Homework-1

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Due 12.03.2019

- Prepare a report for this homework in PDF format using Word or Latex. The handwritten parts of the solutions must be present on white paper legibly and put in the appropriate places in the report after scanned clearly. The written MATLAB codes should be included in the submitted report.
- Only **one** page should be used for each answer.
- Write your name and number at the top of the page.
- No late submissions will be accepted.
- In Case of Cheating and Plagiarism Strong **disciplinary action will be taken**.

**Submissions:** Please submit your report through Ninova e-Learning System. Another way of submission will not be accepted.

**1)** (20 pts.) Is there a finite floating point system (i.e., some finite integer base β and precision t) in which numbers e and π have an exact representation? If yes, then describe such a system.

**2)** (20 pts.) The number $\frac{8}{7}$ = 1.14285714285714... obviously has no exact representation in any decimal floating point system (β = 10) with finite precision $t$. Is there a finite floating point system (i.e., some finite integer base $β$ and precision $t$) in which this number does have an exact representation? If yes, then describe such a system.

**3)** (25 pts.) Suggest a way to determine approximately the rounding unit of your calculator. State the type of calculator you have and the rounding unit you have come up with. If you do not have a calculator, write a short MATLAB script to show that your algorithm works well on the standard IEEE floating point system.

**4)** Consider the polynomial function [8]

$$f(x) = (x-2)^9$$
$$= x^9 - 18x^8 + 144x^7 - 672x^6 + 2016x^5 - 4032x^4 + 5376x^3 - 4608x^2 + 2304x - 512.$$

**a.** (20 pts.) Write a MATLAB script which evaluates this function at 161 equidistant points in the interval [1.92,2.08] using two methods:

    i. Apply nested evaluation for evaluating the polynomial in the expanded form $= x^9 - 18x^8 + ...$

    ii. Calculate $(x-2)^9$ directly.

Plot the results in two separate figures.

**b.** (15 pts.) Explain the difference between the two graphs.