Information Technology University, Lahore

Numerical Analysis

BSEE-19 Spring-2022

Assignment # 01

Issue Date: Friday 25/03/2022

Due Date: Thursday 31/03/2022 (Upload on Google classroom before 11:00 am)

Instructions

1. **Please review the University Plagiarism Policy.**
2. **Late submission will not be accepted.**
3. **This Assignment will access your CLOs as per OBE.**
4. **This Assignment is based on CLO1.**
5. **Assignment should be uploaded as PDF file.**
6. **Your PDF file must contain screenshots of MATLAB codes and results.**
7. **Also provide the MATLAB code file.**
8. **The name of the file should be your Roll Number as; BSEEXXXX.**
9. **Please submit your own work only.**

Question 1:

a) Compose your own program based on the pseudo-code given in figure 1 and use it to determine your computer's machine epsilon.

```
epsilon = 1
DO
  IF (epsilon+1 ≤ 1)EXIT
  epsilon = epsilon/2
END DO
epsilon = 2 × epsilon
```

Figure 1

b) In a fashion similar to that of figure 1, write a short program to determine the smallest number, x_{min}, used on the computer you will be employing along with the book. Note that your computer will be unable to reliably distinguish between zero and a quantity that is smaller than this number.

Question 2:

The infinite series

$$f(n) = \sum_{i=1}^{n} \frac{1}{i^4}$$

converges on a value of $f(n) = \pi^4/90$ as n approaches infinity. Write a program in single precession to calculate f(n) for n = 10,000 by computing the sum from i = 1 to 10,000. Then repeat the calculation but in the reverse order, that is, from i = 10,000 to 1 using increments of -1. In each case, compute the true percent relative error. Explain the result.

Question 3:

Evaluate e^{-5} using two approaches

$$e^{-x} = 1 - x + \frac{x^2}{2} - \frac{x^3}{3!} + \cdots$$

and

$$e^{-x} = \frac{1}{e^x} = \frac{1}{1 + x + \frac{x^2}{2} + \frac{x^3}{3!} + \cdots}$$

and compare with the true value of 6.737947×10^{-3}. Use 20 terms to evaluate each series and compute true and approximate relative. Also provide a hand written solution along with a computer program.

Question 4:

The "divide" and "average" method, an old-time method for approximating the square root of any positive number a, can be formulated as

$$x = \frac{x + a/x}{2}$$

Write a well-structured function to implement this algorithm based on the algorithm outlined in figure 2.

```
FUNCTION IterMeth(val, es, maxit)
iter = 1
sol = val
ea = 100
DO
  solold = sol
  sol = ...
  iter = iter + 1
  IF sol ≠ 0 ea=abs((sol − solold)/sol)*100
  IF ea ≤ es OR iter ≥ maxit EXIT
END DO
IterMeth = sol
END IterMeth
```

Figure 2