

ME-310 Numerical Methods

Fall 2007

Homework Assignment 1

Due: Wednesday, 10 October 2007

The value of π can be calculated with the series

$$\pi = 4 \sum_{n=1}^{\infty} (-1)^{n-1} \frac{1}{2n-1} = 4 \left(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \dots \right)$$

Write a computer program that calculates the value of π by using n terms of the series and calculates the corresponding true relative error. For the true value of π , use the value your compiler gives. Use this program to calculate π and the true relative error for $n = 10, 20, 40,$ and 80 .

Suggested algorithm:

- Read n from the terminal
- Sum all positive terms of the series
- Sum all negative terms of the series
- Subtract the sum of negative terms from the sum of positive terms and multiply with 4
- Calculate true relative error (TRE)
- Write n , Real Value of π , Calculated value of π , and TRE on the terminal and a data file
- Repeat above for a new value of n , read from the terminal
- Stop the program when $n = 0$

Tabulate results and discuss how you would find the number of terms necessary for TRE less than 0.1 %.