AMS 209: Homework 2 Report

Due: *October 16, 2017*

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Contents

Problem 2

We approximate π using an infinite series.

Answer:
As we vary the threshold we get the following answers:

Table 1: Number of iterations, with the corresponding approximation, as we vary the threshold.

Threshold	10^{-4}	10^{-8}	10^{-12}	10^{-16}
N	2	4	7	10
Value	3.14158	3.1415926	3.14159265358	3.1415926535897931

What we observe in this problem, is that a lower threshold corresponds to a larger number of iterations. A lower threshold means that we are computing π more accurately. Therefore, our result is logical since the formula we are using is exactly equal to π as $N \to \infty$.

To run my program in file `pi.f90` is used the following command:
`gf pi.f90 -o myprogram && ./myprogram`

where `gf` is an alias defined in my `.cshrc` file as:
`alias gf 'gfortran -Wall -Wextra -Wimplicit-interface -fPIC -fmax-errors=1 -g -fcheck=all -fbacktrace -fdefault-real-8 -fdefault-double-8'`

Problem 3

We approximate use the trapezoidal rule to approximate integration.

Answer:
The error in the subroutine and the function are the same therefore in the following table only one error is reported. Also we compute the error as :
`error = actual_value - approximated_value`

Table 2: Approximation error, as we vary the N.

N	25	50	100	200	400
Error	-2.67×10^{-4}	-6.67×10^{-5}	-1.67×10^{-5}	-4.17×10^{-6}	-1.04×10^{-6}

What we observe in this problem, that as we increase N our integral approximation approaches the actual value.
To run my program in file `pi.f90` is used the following command:
`gf integrate.f90 -o myprogram && ./myprogram`

where `gf` is the same alias used in Problem 2.