A Slice of Pi and a ruler for my Euler

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1 Introduction

Hello, this paper will go over what it was like implementing multiple approximations of pi, an approximation of e, and a functioning implementation of square which uses Newton-Raphson method.

2 Implementation of e, Madhava and Bailey-Borwein-Plouffe, Viete, Euler-estimation of pi

Because I have failed to provide you with graphs I will instead go over every function and the meaning behind the comparisons.

When using the "-ebmv" flag, we will notice that our comparison is convincingly close to the math.h library's result. On many of the test which we perform, we will notice that the difference is around the $1 * 10^{-15}$ decimal place. Although these may seem accurate (and according to Professor Long will be sufficient to "Throw something and have it land on the moon" granted someone could throw precisely enough. Furthermore, these approximations are all relatively reasonable when it came to iterations with the average being about 20 iterations collectively.

But when comparing these approximations to that of Euler's pi approximation, it is very clear just how slow this formula is to approximate pi. Through Long's provided example graph of Euler's formula, we see that the approximation has increasing extremely diminishing results as each term moves forward. It would not be uncommon for some to get millions to billions of iterations for a run of the approximation.

As stated in many lectures, floats are not a precise number and whenever we use them especially comparatively it is important to not compare the equivalence of them directly.

3 Implementation of Square Root Using Newton-Raphson Method

Although irrational numbers are impossible to represent precisely in practice due to the fact that they expand infinitely in a non-repeating sequence.

This does not stop us from approximating a square root which is not a perfect square. This implementation uses the Newton-Raphson method which computes the inverse of x^2 iteratively.

With iteration, the precision increases "tangentially" and allows for a surprisingly small amount of iterations.

4 Reasoning for Differences in My Library vs Math.h

There is only about two major differences between the results of the difference of the two. The first would be EPSILON, clearly the Math.h library has a much higher precision by default in order to be a more reliable and consistent constant which people use to do calculations. But secondly, because of how floats work. Floats, like many other things relating to numbers and computers aren't perfect and at times even inconsistent. From different operating systems to different languages, numbers vary in how the early developers set them and thus aren't fully trust-able. And in this situation, we know that floats are a not exact number very very close to the true value of the number it is trying to approach. In this assignment, we essentially use approximations of numbers(floats) to get the approximations of other numbers(pi and e). Of course there is bound to be some error when it comes to things like this but what truly matters in the end is their relativity. Because our pi values are already small enough to satisfy the provided epsilon, we know that anything after that point is either pointless, for fun, or for the few who have reasons to manipulate such small numbers.

5 Final Remarks

Although I did turn this in late, every assignment so far is really fulfilling, I feel like having assignments like this help me get over a hurdle that I didn't have to face before. It is almost enjoyable in a sense how all the hours of burning my eyes and regret vanish after a program runs successfully. I found the process of turning these seemingly extremely complex formulas into functions satisfying and seeing as the iterations print a massive wall of numbers which ultimately help me calculate an irrational but significant number truly fun. If anything the stress of grades is the only thing that truly causes me real damage and slightly the fact that everyday I will wake up with anxiety about not completing assignments. But as Professor Long quoted from the marines on the morning of this submission. "Pain is weakness leaving the body"