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CSE13s Winter 2022

Assignment 2 Writeup.pdf

Introduction

This writeup will focus on how having a different amount of partitions in an integral will change the accuracy of an integral. We will focus on the first option of the integral program that I wrote. The function that we will be looking at is (1 - x^4)^(½) from 0 to 1. We will be looking at how as we increase the number of partitions the closer we get to the actual answer to the integral. We will also be looking at how as we get closer to the integral, the change in answers gets smaller and smaller.

Theoretical vs Actual Answers

The big concept of calculus is being able to solve areas with increasingly small partitions. As we decrease the size of these partitions and increase the frequency of them the more accurate our integral is.

$$\int_0^1 \sqrt{1-x^4}\,dx$$

$$= 0.874019184764$$

Using Desmos, an online calculator and prior calculus knowledge, we are able to see the “actual” answer of the integral and compare it.

This screenshot shows only 10 partitions. You are able to see that when we had only 2 or 4 partitions it is not close to the actual answer. It is off on the 100ths place.

```
sqrt(1 - x^4), 0.000000, 1.000000, 1000
2,0.812163891034571
4,0.852988388966857
6,0.862714108378597
8,0.866720323920874
10,0.868814915051592
```

This screenshot shows 100 partitions. You can now see that we are accurate up to the 1000ths. For some applications this is sufficient but for most this is not enough accuracy.

```
90,0.873828739577633
92,0.873834921706512
94,0.873840776457364
96,0.873846327597446
98,0.873851596720659
100,0.873856603485616
```

This screenshot now shows 1000 partitions. We are now accurate up to the 100,000ths place. For a lot of applications this is sufficient. If we wanted more accuracy then all we needed to do is increase the amount of partitions.

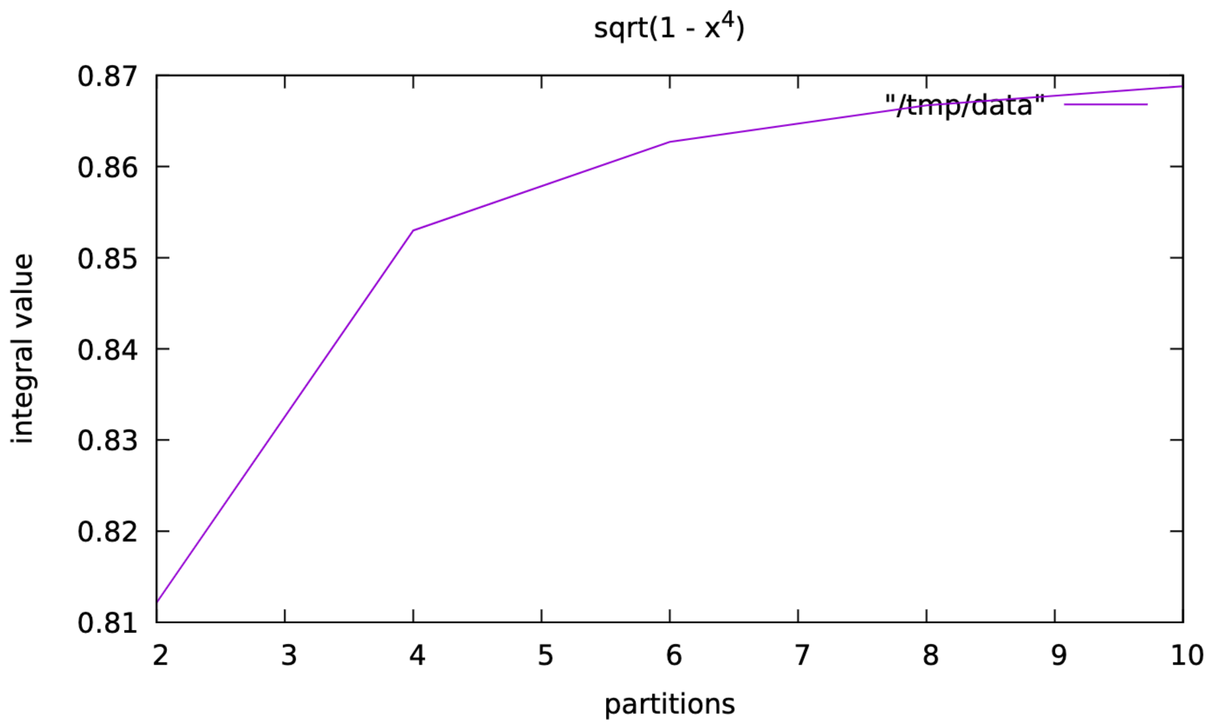
```
990,0.874013971520278
992,0.874013987279564
994,0.874014002959612
996,0.874014018560976
998,0.874014034084211
1000,0.874014049529860
```

To conclude this section, we are able to see that as we increase the amount of partitions the closer we are able to get to our actual answer. Depending on how accurate we are required to go, we can increase the amount of partitions based upon our needs.

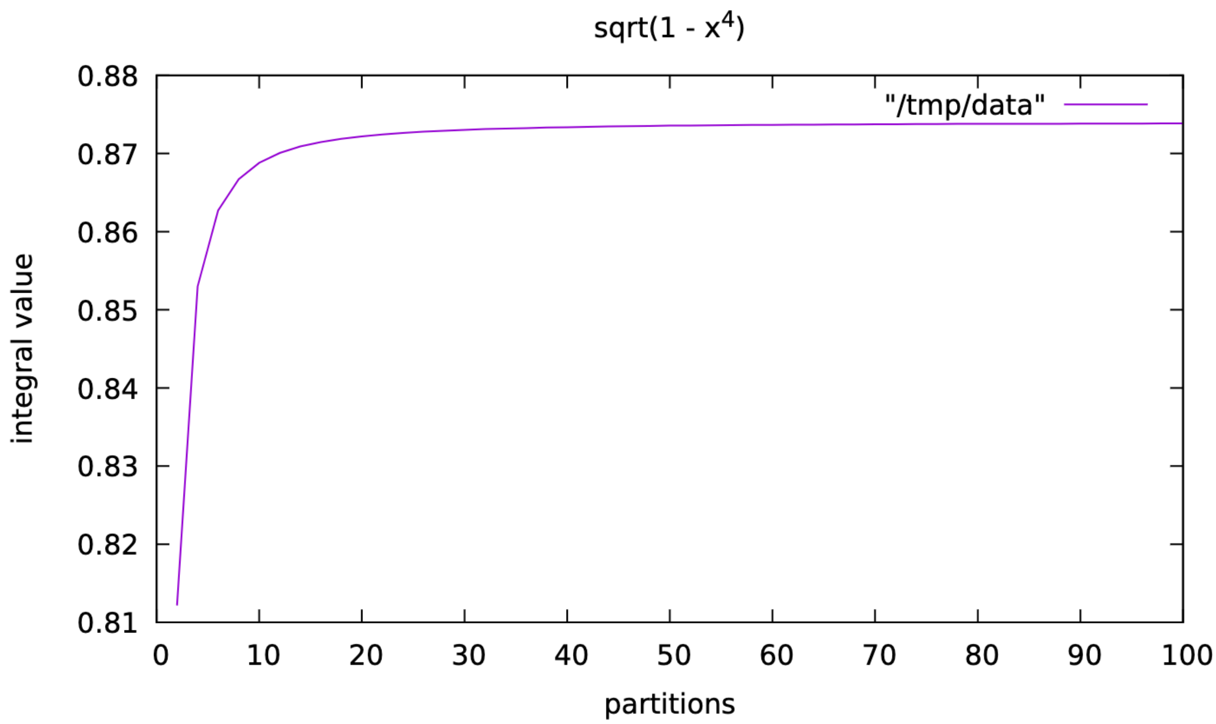
Smaller and Smaller Changes

Knowing when to stop is an important thing. When it is important to know when to stop adding when it comes to finding numbers such as Pi. We are not able to write out the infinite number of Pi, so knowing when to stop is important. In this section we will look at the same integral we did when we looked at *Theoretical vs Actual Answers*. The more partitions we add the smaller the jumps are, and the more accurate we are as well as stated in the previous section.

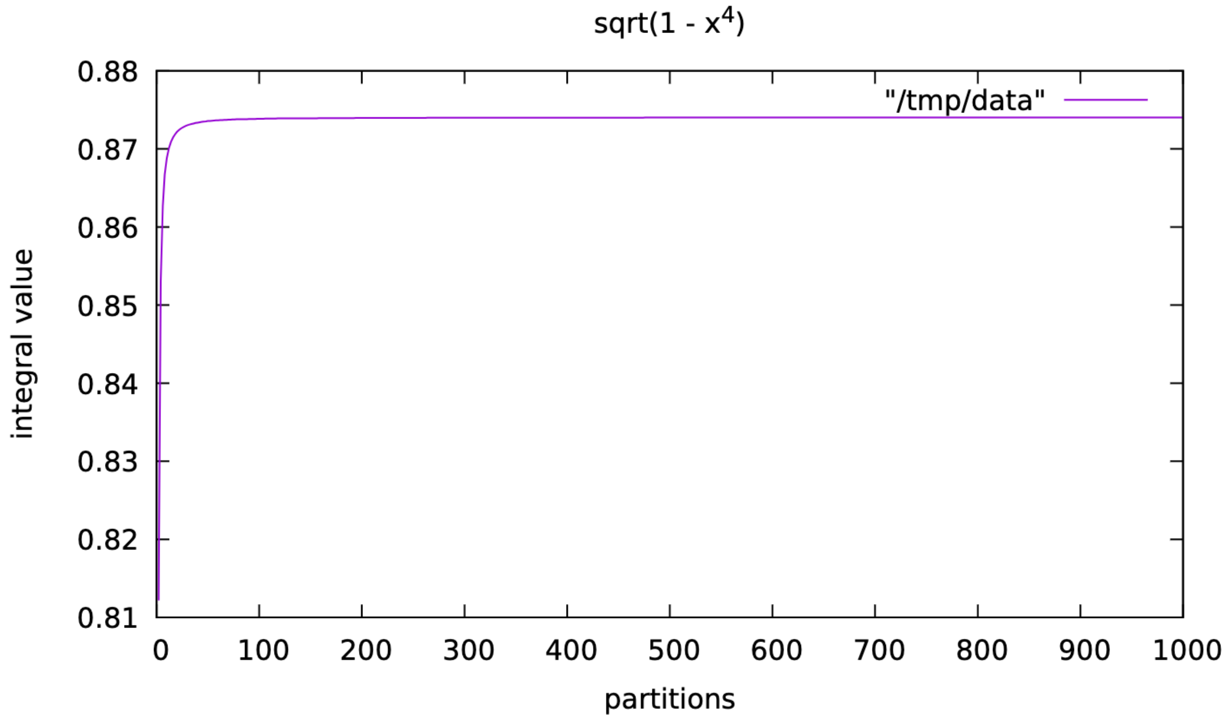
This graph shows big jumps. We can see that if we stopped here we would still have a ways to go before we reach an actual answer. The graph doesn't plateau, it still continues growing.



This graph shows smaller jumps. We are still able to see the individual jumps in the graph. We also can see that the graph at around 15 partitions starts to plateau, but we still see it grow very slightly.



This graph makes it hard to see any jumps. We are able to see that around 200 partitions it seems that the graph becomes straight. We can deduce that the change in integral value is so minimal that it does not make a difference if we keep adding.



We are able to conclude that the more partitions we have, the smaller the changes between jumps. We are able to use this to know when to stop calculating values. If we know that the value we are adding is very minimal to the overall value, we should stop as it does not add anything meaningful. We used this concept in our code when it comes to *EPSILON*. We used this in order to know when to stop calculating our values for the math library.

Summary

In summary, the more partitions we have the better answer we get. We get a more accurate answer, because in a way our tools are more accurate. We also are able to look at the changes between partitions to know when to stop calculating. We are able to do this because as we increase the amount of partitions we see smaller and smaller changes. The small changes allow us to stop calculating due to the small value adding very little to our overall value.