CSe13s

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Assignment 0 Writeup

1 Monte Carlo Method

This project is to estimate the value of pi by using the Monte Carlo simulation. We take the ratio of the area of a circle over the area of a square to calculate our estimated pi value. Then will drop points in a box with a circle inside. Points that land inside the circle will be blue, those who land outside will be red.

2 Graphs

Figure 1 has gone through 500 random iterations of x and y coordinate points. The lack of blue and red structure can be improved by increasing the amount interactions.
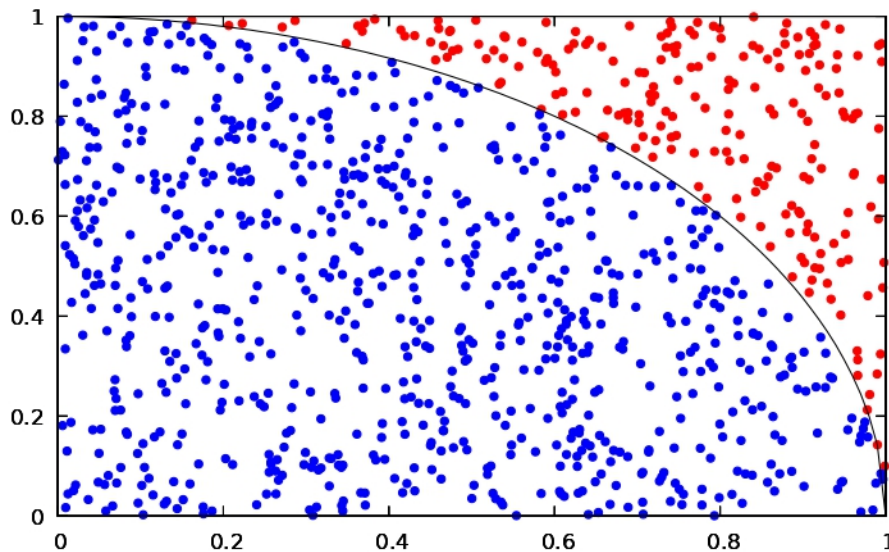

Figure 1: 500 iterations plot

Figure 2 has gone through 5000 iterations. As you can see Figure 2 has a lot more blue then Figure 1. This means that as the iterations increase so does to accuracy of our estimated value. Figure 3 will prove this. Figure 3, we subtracted the exact value of pi by the estimated value to get the error which is our y axis. The x axis is the amount of iterations. As said before on Figures 1 and 2, this proves as the amount of iterations computed increase the amount of error decreases or converges to zero error. The reason that the
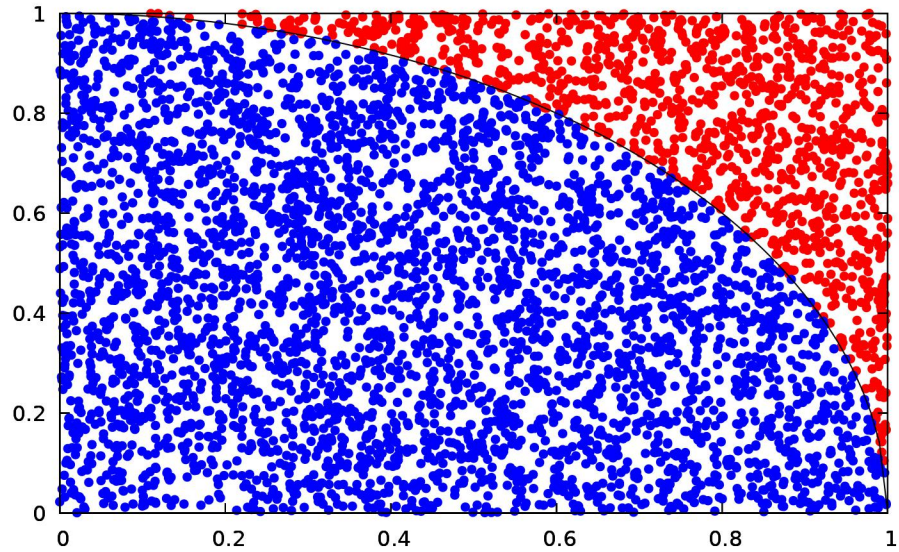
Figure 2: 5000 iterations plot

relationship of iterations and accuracy is true is because of the Law of Large numbers. The Law of Large numbers states that as the sample size increases so does the precision of the mean value. This is why on Figure 3, all five different seeds of data, all converge to less and less error.
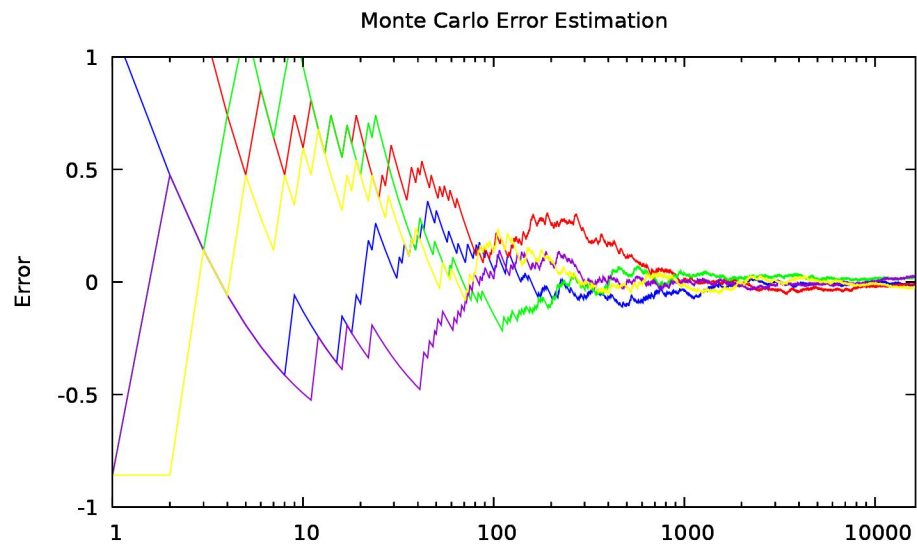

Figure 3: Error,iterations

3   UNIX commands

The first UNIX command I used was a for loop that would append i values from the Monte Carlo C file and store it in another file. The most useful command i used was definitely (awk 'print "some column/string/var"' file ¿ file.txt) where this command would allow me to manipulate the data very easily by swapping, adding, and formatting data. Being able to delete the first line on any file was a important obstacle so I used tail -n +2.(credit to Jacopo Belbo).I used a "while read fileName" to traverse the data file where only the Circle section of the data was in. Then aligned that data file with the data file that only had x and y coordinates. This made sorting very easy unfortunately I couldn't find a way to overwrite the current file so I had to create a file every time the while loop runs. Where the current file would append to the color file and then we would delete one line on the current file. Move it to the next file with the new data. So it might break your UTM if you try to create too many iterations because it will make that many files.

4   Conclusion

Overall my UTM broke down and wasn't able to start the project until Friday at like 7:40pm. But besides that this was actually a lot of fun. I learned a lot about bash and gnuplot. Especially the Monte Carlo method; I would've never know of the Law of Large numbers and how Monte Carlo originated from someone who wanted to measure the probability of wining a solitaire game. I still don't completely understand why a larger sample size lead to an increase in precision.

5   Credits

Jacopo Belbo, discord
MIT. (2017, May 19). 6. Monte Carlo Simulation. YouTube. Retrieved January 23, 2023, from https://www.youtube.com/watch?v=OgO1gpXSUzUamp;t=1136s
BashGuide - NTNU. (n.d.). Retrieved January 24, 2023, from https://folk.ntnu.no/geirha/bashguide.pdf