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PHYS250
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HW 4 Writeup

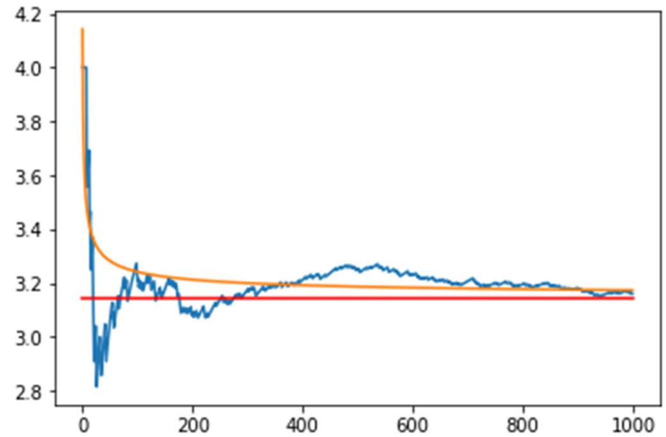
To see the speed of convergence of my calculation of π, I overplayed a plot (below) of the π values (in blue) with a plot of $N^{-1/2}$ (in orange). This envelope function that the value of my calculation does indeed converge to the actual value of π (in red) at the rate of $N^{-1/2}$. There is considerable noise for early values of π but that does not alter or obscure the convergence rate.

To analyze the precision and accuracy of my calculation, I tested increasing number of trials and zoomed in on large values of N on the plots. As I successively tested 1e3, 1e5, and 1e7, the precision of my calculated value increased accordingly. This can be seen both in the plots, particularly by comparing plots with the same axis values and the locality of the data points for far N, and it can also been seen in the number of decimal places in the calculation.

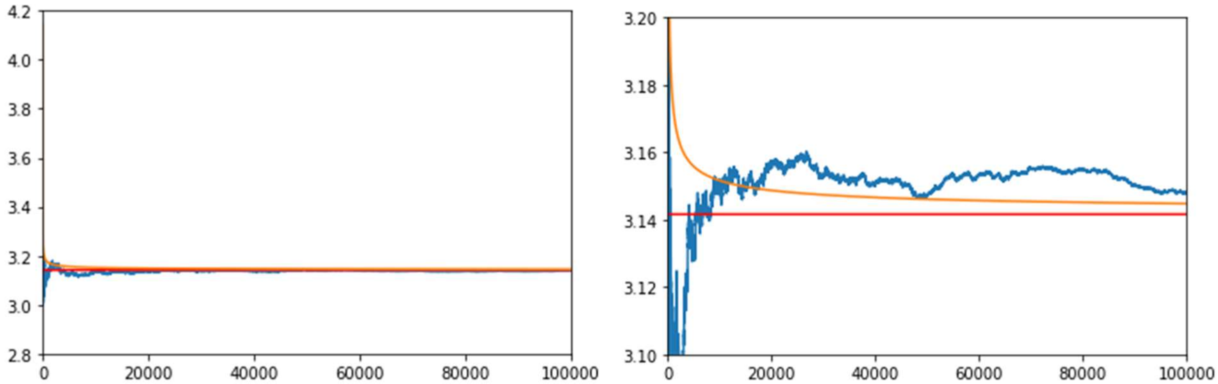
Accuracy can also be assessed in this manner. As I increased N the accuracy of my calculation also increased, that is the difference between my calculated value and the true value of π shrank. While it does appear that as N approaches infinity my calculation approaches the true value of π, it does not do so arbitrarily. This is because the accuracy of the calculation is dependent upon the (x,y) values that are created by a random number generator. Thus, accuracy has an inherent initial randomness that does not appear in the precision.

As a side note I coded this calculation in both Fortran and Python… Fortran was faster BUT Python was easier to plot with so I guess the jury is still out.

1e3: 3.164



1e5: 3.13936



1e7: 3.1412184