Problem 6

(a)

The Montecarlo simulation achieves at most 3 digits of accuracy and at least 2 digits of accuracy.

(b)

By using the Taylor series of arctan, I need 6 terms to achieve 3 digits of accuracy and 5 terms to achieve 2 digits. Thus, in order to obtain the same accuracy as the montecarlo simulation, I need to use 6 terms.

(c)

For the montecarlo simulation, every time I run the simulation will get a different result than previous. Also, the accuracy of the motecarlo simulation is not stable. Some results are better than others when I use montecarlo simulation for the same question. If I want to be more accurate, I need to spend more time on doing the montecarlo simulation.

For the Taylor series of acrtan, the results are always the same if the model has the same terms, and I can achieve more digits of accuracy by adding more terms to the model, which will also take more time to calculate. This means that Taylor series is more stable than montecarlo simulation.

When I compare the time used for both methods, I find out that to achieve 3 digits of accuracy, it will take my computer about 7 seconds to use montecarlo simulation to complete the task while it will take my computer less than 1 second to use Taylor series to complete the task. This is because in my method, montecarlo simulation runs 10,000,000 trials while Taylor series only need to do the 6 terms calculations. Thus, Taylor series is less time-consuming.

Therefore, Taylor series of arctan is a better way to calculate π in my case.