Introduction to Scientific Computing with Fortran 90

Project I

Due: F 1/29

For this project undergraduates can either work by themselves or in pairs; graduates work solo. If you work with someone else, only one code and report need to be submitted.

Part I - mandatory for everyone

1. Write a code to approximate $\pi$ using Buffon’s Needle approach. The code should implement the algorithm we discussed in class. You are expected to have a well-documented and readable code and use variable names which are descriptive. You should ask the user to input the number of random numbers to be generated. You should output the number of random points you have generated, your approximation, and the error.

2. To run the program for a different number of points you need to re-execute your code. Modify your program to input the number of approximations you want to do and then put in a do loop in the appropriate place to perform this many approximations. Increase your number of approximations by a factor of 10 each time.

3. Make a table of your output using $10^k$, $k = 1, 2, \ldots, 6$ points.

Part II - mandatory for graduate students, extra credit for undergraduates


You can also check out the Wikipedia entry under the Monty Hall problem.

Suppose you’re on a game show and you’re given the choice of three doors. Behind one door is a car; behind the others, goats (that is, booby prizes). The car and the goats were placed randomly behind the doors before the show. The rules of the game show are as follows: After you have chosen a door, the door remains closed for the time being. The game show host, Monty Hall, who knows what is behind the doors, now has to open one of the two remaining doors, and the door he opens must have a goat behind it. If both remaining doors have goats behind them, he chooses one randomly. After Monty Hall opens a door with a goat, he will ask you to decide whether you want to stay with your first choice or to switch to the last remaining door. Imagine that you chose Door 1 and the host opens Door 3, which has a goat. He then asks you Do you want to switch to Door Number 2? Is it to your advantage to change your choice?

Your code should illustrate the counterintuitive answer that there is a two out of three chance of winning by switching to the other door. Output your results for a varying number of random choices.