Problem 1 : [to be checked by the teaching assistant before you leave the room]

In this problem, we write a program to calculate the area of a circle.

1) Write a Monte Carlo program, which computes the area of a circle, as discussed in the notes above.

2) Test this program by using a 10000 pebbles (random points in the square) and compare the obtained circle area with the exact result, A=π

3) Add a "write" command in the program to show the obtained estimate for the area of the circle as the number of pebbles (random points) is increasing, e.g. show the estimate for the area obtained with 2 pebbles, 3 pebbles, …, 10000 pebbles.

4) write into a file the same information as in (3), but write both the iteration index "i" and the area of the circle obtained at this corresponding iteration.

5) Plot the result by using the command xmgace.

6) Repat (4 and 5) above but show now the difference between the estimate and the exact area of the circle. This gives the error of your method.

7) Plot the error as a function of the number of iteration. How does it scale? Does it decay faster or slower than 1 / N ?

We now generalize the problem to the case of the volume of a sphere:

8) By implementing a small correction in your code, extend your code to the case of calculating the volume of a sphere

9) Show the deviance from the exact results as in problem 1, point VI. How does it scale now?

10) Can you think of a way to extend your code to the case of an arbitrary number of dimensions?

[The solution of past week problem is available on KEATS]