Homework 05

General comments:

- Do not forget to run some test cases.

Problem 1 (5 points)

Estimate the Euler's number $e = 2.71\ldots$ via evaluation of the following integral with the Monte-Carlo method

$$e = \int_0^1 (e^x + 1)dx$$

Problem 2 (5 points)

For the problem above. Plot (in loglog space) the deviation of integral from its true value as a function of the random points number (N) spanning from 10 to 10^6. For each N do it at least 100 times, mark such points as small dots (matlab `'.'` marker specifier) on your plot, calculate and plot the mean of the integral value estimation at particular N with a circle marker (matlab `'o'` marker specifier).

Does the e estimate error drops as $1/\sqrt{N}$?

Problem 3 (5 points)

Consider the LCG random generator with $a = 11$, $c = 2$, $m = 65535$, and $r_1 = 1$. What is the best case scenario for the length/period of the random sequence of a LC generator with $m = 65535$? Estimate the actual length of the non repeating sequence.

Problem 4 (5 points)

Modify the colony life script example to take in account helping neighbors. Leave the probability to heal for a cell without alive neighbors as it is, double healing probability for the cell with one alive neighbor, and triple it if a cell with alive neighbors on both sides. We model that illness does not prevent a helping/healing action, i.e. a neighbor must be alive to help but it might have an illness.

Make sure that you are using matlab random generator i.e. `rand`.

Does the saying "the best neighbor is the dead neighbor" still applies?