Homework 05

General comments:

- Do not forget to run some test cases.
- Matlab has built-in numerical integration methods. For example quad is one of them. You might check validity of your implementations with answers produced by this Matlab built-in function. quad **requires your function to be able to work with an array of x points**, otherwise it will fail.
  - Of course, it is always better to compare to the exact analytically calculated value.

Problem 1 (2 points):

Implement the rectangle numerical integration method. Call you function `rectInt(f,a,b,N)`, where a and b are left and right limits of integration, N the number of points, and f is handle to the function.

Problem 2 (3 points):

Implement the trapezoidal numerical integration method. Call you function `trapezInt(f,a,b,N)`.

Problem 3 (5 points):

Implement the Simpson numerical integration method. Call you function `simpsonInt(f,a,b,N)`. Remember about special form of N=2k+1.

Problem 4 (5 points):

Implement the Monte-Carlo numerical integration method. Call you function `montecarloInt(f,a,b,N)`.

Problem 5 (5 points):

For your tests calculate

$$\int_0^{10} [\exp(-x) + (x/1000)^3] dx$$

Plot the integral absolute error (not the estimates provided in class) for the above 4 methods vs. different number of points N. Try to do it from small N=3 to N=10^6. Use `loglog` plotting function for better representation (make sure that you have enough points in all areas of the plot). Why the error start to grow with a larger N? Does it grow for all methods? Why is it so?

Problem 6 (5 points):

Calculate

$$\int_0^{\pi/2} \sin(401x) dx$$

Compare your result with the exact answer 1/401. Provide a discussion about required number of points to calculate this integral.