

Homework #0 (practice)

Please try to have your solutions ready by class on **Wednesday, February 9**, during which we will practice submitting the solutions online to Scorelator.

Although I recommend that you develop and test the code for each problem in a separate M-file, before uploading the assignment to Scorelator you must put all the scripts in a single “master” file. For example:

```
% Problem 1
clear all;
<script for solving Problem 1>

% Problem 2
clear all;
<script for solving Problem 2>

% Problem 3
clear all;
<script for solving Problem 3>
```

Any functions you wrote which are called in the master script can (and should) stay as separate M-files.

Problem 1

Recall that in class we wrote a Matlab function `quadform.m` to implement the quadratic formula for finding the two solutions of $ax^2 + bx + c = 0$.

Now write another function that:

- takes as input the coefficients a, b, c of the quadratic function;
- first uses the quadratic formula to compute the solution x_1 of greater magnitude (NOTE: whether this is $\frac{-b + \sqrt{b^2 - 4ac}}{2a}$ or $\frac{-b - \sqrt{b^2 - 4ac}}{2a}$ depends on the sign of b);
- then uses the relation $x_1 x_2 = \frac{c}{a}$ to compute the second solution x_2 ;
- returns x_1 and x_2 as output arguments.

Write a script to compute the solutions of $x^2 - (10^8 + 10^{-8})x + 1 = 0$ using both `quadform.m` and the new function you wrote, saving the results to an ascii file `A1.dat` whose first line contains the solutions computed by `quadform.m` and whose second line contains the solutions computed by your new function; the results should be expressed in scientific notation with 5 decimal places in the mantissa.

Problem 2

The following three expressions are all mathematically equal to zero:

$$1000 - \sum_{k=1}^{10000} 0.1, \quad 10000 - \sum_{k=1}^{100000} 0.1, \quad 100000 - \sum_{k=1}^{1000000} 0.1.$$

Write a Matlab script to compute the value of each expression by repeated subtraction and save the results (as a vertical list) to an ascii file `A2.dat`; the results should be expressed in scientific notation with 6 decimal places in the mantissa.

Problem 3

The series $\sum_{k=1}^{\infty} \frac{(-1)^k}{k}$ converges to a limit; that is, the sequence of partial sums $S_n = \sum_{k=1}^n \frac{(-1)^k}{k}$ tends to a finite number as $n \rightarrow \infty$. Write a script to approximate the value of this limit: save to an ascii file `A3.dat` the values of N , S_{N-1} and S_N (in a vertical list), where N is the smallest n such that $|S_n - S_{n-1}| \leq 10^{-5}$; the values of S_{N-1} and S_N should be expressed in standard floating point (decimal) format to 6 decimal places.