AM 147: Computational Methods and Applications: Winter 2023
Homework #7

Instructor: Abhishek Halder

Due: March 17, 2023

NOTE: Please submit your Homework as a single zip file named `YourlastnameYourfirstnameHW7.zip` via CANVAS. For example, `HalderAbhishekHW7.zip`. Please strictly follow the capital and small letters in the filename of the zip file you submit. You may not receive full credit if you do not follow the file-naming conventions. Your zip file should contain all .m files (MATLAB scripts) and .pdf files for the questions below.

Your zip file must be uploaded to CANVAS by 11:59 PM Pacific Time on the due date. The uploads in CANVAS are time-stamped, so please don't wait till last moment. Late homework will not be accepted.

Problem 1

Regression for transistor data **(25 points)**

Download the starter code `W23HW7p1modified.m` from CANVAS File Section folder: "HW Problems and Solutions", and rename this file to `YourlastnameYourfirstnameHW7p1modified.m`.

In this file, the entries of the vector `yr` denote the years, and the entries of the vector `num_transistor` denote the number of transistors found in a typical microprocessor manufactured in the corresponding year. Line 16 makes a plot of this data.

Using this data, we want to find a model of the form

$$\log_{10} N \approx \theta_1 + \theta_2 \left(t - 1970\right),$$

where t is the year, N is the number of transistors, and $\log_{10}$ denotes the logarithm with base 10. Complete lines 22 and 23 to compute the least squares estimate of $\boldsymbol{\theta} := \begin{pmatrix}\theta_1\\ \theta_2\end{pmatrix}$ via line 25.

Already supplied line 27 will make a plot of your computed least squares model. You may find it useful to look up the command `log10` in MATLAB documentation.

Finally, complete line 30 in the MATLAB code to predict the number of transistors in a typical microprocessor manufactured in 2020 using your model.

Other than completing the right hand sides of lines 22, 23 and 30 in the starter file, you should not insert additional lines of code.

Problem 2

MathWorks tutorial for ordinary differential equations (25 **points**)

We will soon cover numerical algorithms to solve the ordinary differential equation (ODE) initial value problems. Since some of you may not have seen ODEs before, this exercise will prepare you to understand what they are and what does it mean to solve ODEs.

In your browser, go to

`https://matlabacademy.mathworks.com/details/solving-ordinary-differential-equations-with-matlab/odes`

On the top right corner of that page, login to your UCSC MathWorks account that you used to install MATLAB, and finish the ODE tutorial. This is similar to the OnRamp tutorial you did earlier in HW1. When finished, generate the certificate pdf file using "View/Print certificate". Submit this certificate as `YourlastnameYourfirstnameHW7p2.pdf`