CS2035b Data Analysis and Visualization - Lab 9

General Lab Instructions to Help Labs Run Smoothly

- Read through the lab instructions **before** coming to the lab.

- Do any required pre-lab preparation.

- Bring a **printed** copy of the lab instructions to the lab.

- Note: you must both sign the signature sheet in the lab and submit your (mostly) completed lab via Owl by Saturday 10:55pm

Overview and Preparation

This (and all subsequent) labs will be using MatLab 2016b as installed in the Health Sciences the HSB 14 and HSB16 general computing labs. You must attend this lab in HSB14 or HSB16 in order to get assistance from the TA. Attendance will be taken. You can use your UWO login/password to login to these machines. Lab submission is to be done via Owl. Remember, labs are worth 10% of the total grade for this course (there are 11 labs in total, you must do 8 to receive full marks).

Upon completion of this lab, you should have done the following in the MatLab environment:

- Created a script file, lab09.m, containing the MatLab code to do the exercises below and the 2 generated jpg files. Submit these files via Owl.

Exercise 1: Polynomial Fitting via Least Squares

Consider the data in three **mat** files, **dataset1.mat**, **dataset2.mat** and **dataset3.mat** on the course webpage. An nth polynomial has the equation:

$$p_n(x) = a_n x^n + a_{n-1}^{n-1} + a_{n-2}^{n-2} + ... + a_2 x^2 + a_1 x + a_0.$$

For the 20 sets of **x** and **y** datasets in the 3 **mat** file, use Least Squares to determine a_n to a_0 for a polynomial of degree n for the 20 **y** values. Make plots of **x** versus **y** for `x=0:0.1:10` for $n = 1$ to 5.

Exercise 2: Polynomial Fitting via polyfit/polyval

For the same 3 datasets use **polyfit** to fit order n polynomials to the data, $n = 1$ to 5 and then use *polyval* to evaluate these polynominals for `x=0:0.1:10`. Plot these colours of the 5 plots for both Least Squares and Polyfit with corresponding colours. Put a legend on all graphs.

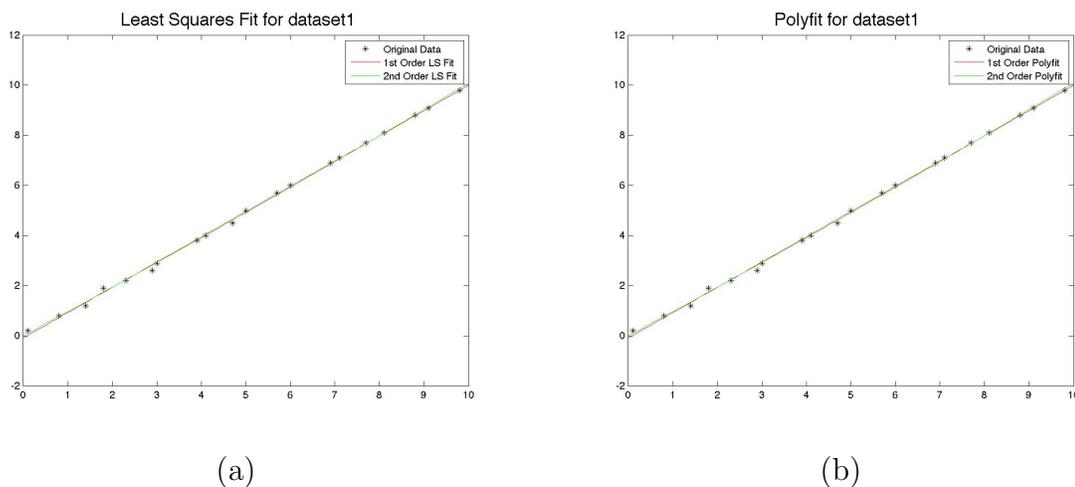# Discussion

| (a) | (b) |

Figure 1: (a) Least Squares and (b) Polyfit fits for dataset1.

You may notice a file **example_lab9.m** on the course webpage. This file contains an example MatLab code for fitting order 1 and 2 polynomials to the y data from **dataset1**, **dataset2** and **dataset3** using both least squares and polyfit. You just need to add fits for order 3 to 5 polynomials. Notice that you always obtain the same result both ways as **polyfit** computes the Least Squares fit. Also notice that you can save the 3 dataset names as character strings in a cell array: this allows one to use a loop to plot the Least Squares and Polyfit arguments against the y values for the 3 datasets. Lastly, note that you can "generate" the names of
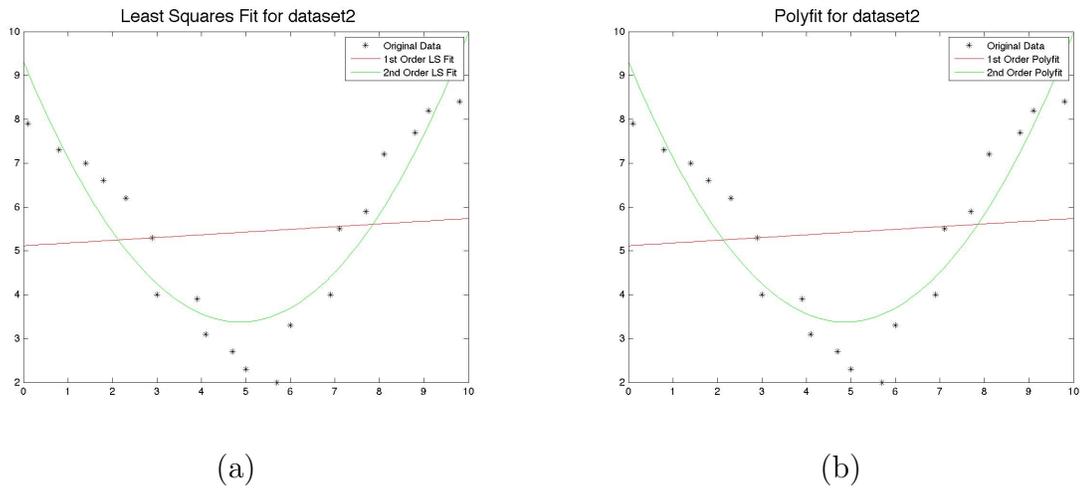
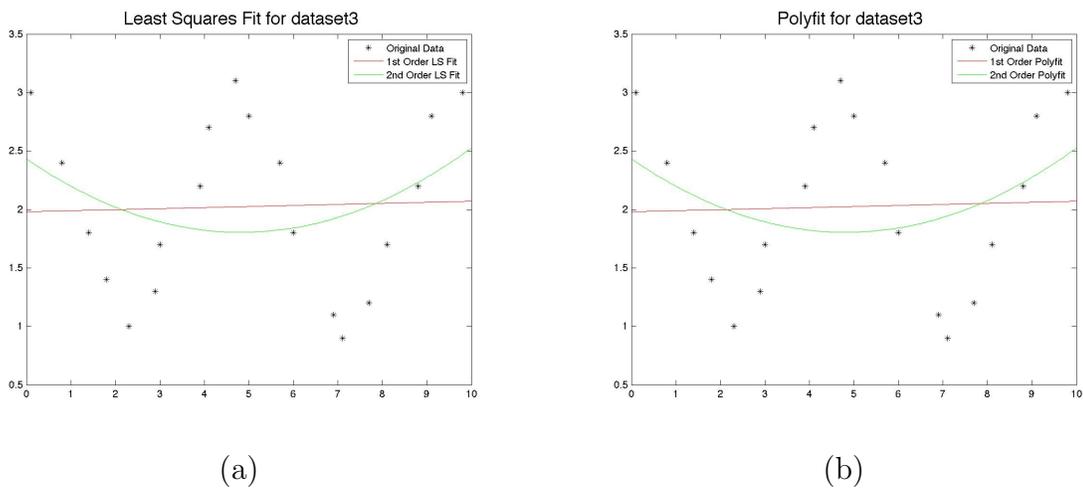Figure 2: (a) Least Squares and (b) Polyfit fits for dataset2.

Figure 3: (a) Least Squares and (b) Polyfit fits for dataset3.

the output filenames using the concatenation between the [and] symbols. Figures **??** to **??** show the fits to order 1 and 2 polymonials for the 3 datasets. Notice that the 1st dataset is essentially linear and all order polynomials do well. For the 2nd dataset, the quadratic fit (order 2) is significantly better that the 1st order fit, but not perfect. Both orders 1 and 2 fits perform poorly on the dataset 3. Maybe order 4 and 5 fits will perform better?