PASS
PEER ASSISTED STUDY SESSIONS

FACIL: Neil Douglas **WEEK:** 9

EMAIL: neildouglas@cmail.carleton.ca **OFFICE:** CSAS, 4th Floor MacOdrum Library

COURSE: ECOR 2606 **OFFICE HOURS:** Fridays 3:00 – 4:00

Opener (5 mins)

Core concepts covered today: Lots of curve-fitting stuff!

- Fitting a linear regression to a set of data (i.e., finding a straight-line that best fits the data)
- Fitting a general least squares regression to a set of data (we will be finding a best-fit cubic function to fit the data)
- Finding the power equation that best fits a set of data
    - We will also briefly discuss finding the exponential growth/decay equation and saturation growth rate equation that best fits a set of data

Before we get started, I have a quick problem you. If you know the answer to this, it will help you in Activity 2. Let's work as a class to fill in the blanks in the MATLAB code below:

```
x=[2 4 6 8];
y=[8 66 210 530];

p=polyfit(x,y,3); % This finds a _____ in the
form of _____ that best matches (best fits)
the data.

fprintf('The equation of the best-fit _____ is y =
%f*x^3 + %f*x^2 + %f*x + %f', _____, _____,_____,
_____)
```

PASS
PEER ASSISTED STUDY SESSIONS

FACIL: Neil Douglas
WEEK: 9
EMAIL: neildouglas@cmail.carleton.ca
OFFICE: CSAS, 4th Floor MacOdrum Library
COURSE: ECOR 2606
OFFICE HOURS: Fridays 3:00 – 4:00

Activity 1 (35 mins)

For this activity, we will be working with the following data:

x	y
1	7
2	10
3	15
4	19

(a) Fit a general least squares cubic function of the form $y = ax^3 + b$ to the data.

Tips:

- To solve this problem, all I am really asking is for you to find a and b.
- This can be done by solving $Z^T Za = Z^T y$, where Z, Z^T, and y are all matrices and a = [a; b].
- The tricky part is finding your Z matrix, but once you know how to do that the solution is pretty straight-forward.

(b) Come to think of it, a straight line would probably model the relationship between x and y much more accurately. So, fit a linear regression to the data. (By this I mean find the best-fit straight line, of the form y = ax +b, to fit the data). What is the correlation coefficient for this linear line? Does this line accurately represent the relationship between x and y?

Equations needed:

PASS
PEER ASSISTED STUDY SESSIONS

FACIL: Neil Douglas

EMAIL: neildouglas@cmail.carleton.ca

COURSE: ECOR 2606

WEEK: 9

OFFICE: CSAS, 4th Floor MacOdrum Library

OFFICE HOURS: Fridays 3:00 – 4:00

PASS
PEER ASSISTED STUDY SESSIONS

FACIL: Neil Douglas
WEEK: 9
EMAIL: neildouglas@cmail.carleton.ca
OFFICE: CSAS, 4th Floor MacOdrum Library
COURSE: ECOR 2606
OFFICE HOURS: Fridays 3:00 – 4:00

Activity 2 (35 mins)

(a) Find the best-fit power equation for the following set of data. We will be writing MATLAB code to help us get our solution.

x	y
1	5
2	51
3	170
4	383
5	754

Power Equation: $\boldsymbol{y = \alpha x^{\beta}}$

Basically, what I am asking is for you to solve for α and β. Before using MATLAB to solve for these, we need to do some math to derive a solution. (Hint: Look at the Lecture 16 slides).

MATLAB solution to solve for α and β:

(b) (Time Permitting)

I need two volunteers to come up and explain how we would derive a solution for finding α and β in (i) the exponential growth/decay equation, $\boldsymbol{y = \alpha e^{\beta x}}$, and (ii) the saturation growth rate equation, $\boldsymbol{y = \frac{\alpha x}{\beta + x}}$. (Again, look at Lecture 16 slides).

(i)

(ii)

Closer (5 mins)

Believe it or not, soon it will be time for me to start preparing your mock final! So, I would like know what you would like to see on it. Write down on a piece of paper three topics that we have covered so far from after the midterm that you would like to see covered on the mock-final.

Just as a refresher, here are some of the main topics that we have covered since the midterm:

- Solving series of linear equations:
  - Using Gaussian Elimination
  - Using Gauss-Jordan Elimination
  - Using the Jacobi Method
  - Using the Gauss-Seidel Method
  - Using LU Factorization
- Curve-fitting
  - Fitting a linear regression (straight line) to a data set
  - Fitting a general least squares regression to a data set ($Z^T Za = Z^T y$)
  - Fitting special functions to a data set
    - Exponential growth/decay equations
    - Power equations
    - Saturation growth rate equations