

## Math 2802 N1-N3 Worksheet 9

March 30th, 2018

1. Let  $A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 0 \end{pmatrix}$  and  $b = \begin{pmatrix} 1 \\ 2 \\ -3 \end{pmatrix}$ . Find the least-squares solution to  $Ax = b$

- a) using the normal equations
- b) using that the columns of  $A$  are orthogonal

2. The table below gives the crude male death rate for lung cancer in 1950 and the per capita consumption of cigarettes in 1930 in various countries.

Country	Cigarette Consumption (per capita)	Lung cancer deaths (per million males)
Country A	270	96
Country B	300	124
Country C	360	166
Country D	460	171

- a) Obtain the straight line that best fits the data.
  - b) According to the terminology of statistical analysis: give the design matrix, the observation vector and the unknown parameter vector.
  - c) In 1930, the per capita cigarette consumption in Country  $E$  was 1200. Estimate (extrapolate) the male lung cancer rate in Country  $E$  in 1950.
3. Compute the error associated to the least-squares best fit line in Problem 2. Sketch a picture of the data and the best fit line that shows

*'the best-fit line minimizes the sum of the squares of the residuals'*

4. The table below gives the prices per bar of chocolate according to the number of boxes of chocolate bar produced by a company. Each box contains 20 chocolate bars.

Boxes produced	1	2	3	4	5
Cost per bar	1.8	2.7	3.4	3.8	3.9

- a) Obtain the parabola  $y = \beta_2 x^2 + \beta_1 x$  that best fits the data.
- b) According to the terminology of statistical analysis: give the design matrix, the observation vector and the unknown parameter vector.
- c) Estimate (extrapolate) the cost of each chocolate bar if the company would produce 10 boxes of chocolate bars.