Department of Industrial Engineering & Operations Research

IEOR 165 (Spring 2016)

Homework 1

Due: Friday, Feb 12

Question 1. Let $X_1, \ldots, X_n$ be iid from the pdf

$$f(x) = \theta x^{\theta-1}, \quad 0 \leq x \leq 1,\ 0 < \theta < \infty$$

Find the method of moments estimator of θ. (*hint:* $E(X) = \int_0^1 \theta x^{\theta-1} \cdot x dx$)

Question 2. Let $X_1, \ldots, X_n$ be iid from the uniform distribution on (θ_1, θ_2), where $\theta_1 < \theta_2 < \infty$. Use the method of moments to estimate θ_1 and θ_2.

Question 3. The following data set specifies the number of units of a good ordered and the price of the good at six different locations. Suppose we would like to build a linear model that predicts the number ordered as a function of price.

Number Ordered	88	112	123	136	158	172
Price	50	40	35	30	20	15

a) State the predictor and the response.
b) What is the linear model?
c) Estimate the parameters of the linear model using least squares.

Question 4. The corrosion of a certain metallic substance has been studied in dry oxygen at 500 degrees Centigrade. In this experiment, the gain in weight after various periods of exposure was used as a measure of the amount of oxygen that had reacted with the sample. Here are the data:

Hour	Percent Gain
1.0	0.020
2.0	0.030
2.5	0.035
3.0	0.042
3.5	0.050
4.0	0.054

Suppose we would like to build a linear model that predicts the percent weight gain as a function of time of exposure.
a) State the predictor and the response.
b) What is the linear model?

c) Estimate the parameters of the linear model using least squares.
d) Predict the percent weight gain when the metal is exposed for 4.5 hours.

Question 5. Imagine you are a consultant for the Bay Area Bike Share system and the following information is available:

- Average bike demand per day
- Average wind speed
- Average temperature
- Weekday $\in \{Sun, Mon, \ldots, Sat\}$

Suppose you would like to build a linear model to predict the demand based on wind speed, temperature and the weekday information. Please specify the response and predictor variables.