Department of Industrial Engineering & Operations Research

IEOR 165 (Spring 2016)

Homework 2

Due: Friday, Feb 26

Question 1. The following data indicate the gain in reading speed (G) versus the number of weeks in the program (W) of 10 students in a speed-reading program. Suppose we want to build a linear model to predict the speed gain of a student who plans to take the program for 12 weeks.

Number of Weeks (W)	Speed Gain (G) (wds/min)
2	21
3	42
8	102
11	130
4	52
9	105
6	85
5	62
7	90

a) Specify the response and the predictor, and construct the linear model.
b) Assume the variance of the gain in reading speed is proportional to the number of weeks in the program, i.e. $\text{Var}(G|W) = \text{Var}(\epsilon|W) \propto W$. Use the weighted least squares to estimate the parameters in the linear model you construct.

Question 2. Use the semiparametric approach to estimate the parameters for Question 1 (choose $k = 3$)

Question 3. Let $X_1, \ldots, X_n$ be iid from the pdf

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

Find the MLE of θ.

Question 4. Let $X_1, \ldots, X_n$ be iid with pdf

$$f_\theta(x) = \frac{1}{\theta}, \quad 0 \le x \le \theta, \quad \theta > 0$$

Find the MLE of θ.

Question 5. The chlorine residual (C) in a swimming pool at various times after being cleaned (T) is as given:

Time (hr)	Chlorine Residual (pt/million)
2	1.80
4	1.50
6	1.45
8	1.42
10	1.38
12	1.36

Assume the following relationship

$$C \approx a \exp(-bT)$$

What would you predict for the chlorine residual 15 hours after a cleaning?