

IE300 (BL1) – Analysis of Data

Assignment #7

Due Date: April 15, 2020**INSTRUCTIONS:** This assignment must be submitted in the designated folder on Compass by the deadline.

Assignments should be submitted as a single PDF file, with the filename “IE300_HW7_GroupNN.pdf”, where NN is your group number. As stated in the syllabus, this assignment may be submitted in groups of up to three students (see the syllabus for guidelines and restrictions). Discussion of each of the questions is strongly encouraged among your group. Include your group number and the names of all group members on the top of your assignment. Multi-page submissions must be stapled. **Present and explain your solutions clearly.**

QUESTIONS:

- 1.) Consider the following continuous probability density function with unknown population parameter θ .

$$f(x) = \begin{cases} \theta 2^\theta x^{-\theta-1} & \text{for } x > 2 \\ 0 & \text{otherwise} \end{cases}$$

- (a) Demonstrate that $\int_{-\infty}^{+\infty} f(x) dx = 1$ (you may assume $\theta > 0$)
- (b) Determine the moment estimator for θ (based on a random sample of n observations).

- 2.) Consider the following continuous probability density function with unknown population parameter θ .

$$f(x) = \begin{cases} 2\theta x(1-x^2)^{\theta-1} & \text{for } 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$$

- (a) Demonstrate that $\int_{-\infty}^{+\infty} f(x) dx = 1$ (you may assume $\theta > 0$)
- (b) Determine the maximum likelihood estimator for θ (based on a random sample of n observations).

- 3.) Consider an electronics company designing a new long-lasting smart phone battery. The company manufactures and fully charges 140 batteries, and measures the time until charge depletion under peak usage for each. The times until depletion (in hours) for these batteries are contained in the file posted on Compass under the name “HW7_DATA.csv”. Provide the following visual summaries of these data:

- (a) A box plot
- (b) A histogram (use $m = 12$ ($\approx n^{1/2}$) bins; set overall upper and lower bounds as $L = 78$ hrs and $U = 82$ hrs)

[NOTE: You may use software to carry out your computations and construct both visual summaries, but you must explain how you analyzed the data in order to construct them. Clearly annotate both visual summaries (e.g., list the counts and intervals for each histogram bin, and the values of all quartiles, whisker endpoints, outliers, and extreme outliers in your boxplot).]