
Assessed Problem Set 4

Due: 23rd Nov, 23:59PM

Delivery method: E-dimension

Format: Portable Document Format (PDF)

For all the python based questions in this problem set, please copy and past the code that you used for each function/operation and the result of the calculation.

Problem 1: MLE

I analysed the flow of students into SUTD's student shop at appromimately 3 pm last Friday afternoon. I recorded the following times (in minutes) between the arrivals of 10 students: 3.2, 2.1, 5.3, 4.2, 1.2, 2.8, 6.4, 1.5, 1.9, and 3.0. Let's assume that the interarrival time can be modelled by the following PDF:

$$f(x; \beta) = \begin{cases} \frac{1}{\beta} e^{-\frac{x}{\beta}} & ; x \geq 0, \\ 0 & ; x < 0 \end{cases}$$

Write a python code that plots the likelihood as a function of β and state the maximum likelihood estimate of β . Please include a copy of the plot in your solution sheet.

Problem 2: Hotelling

The population means for a multivariate dataset are: weight= 60 kg, shoe size= 24 cm, and height= 161 cm. A random sample of people were analysed and the data in Table 1 were obtained:

Weight (kg)	Shoe Size (cm)	Height (cm)
65	28	175
80	26	159
70	27	180
62	29	167
74	24	170

Table 1: Body Measurement Data

- (a) Evaluate T^2 .
- (b) Based on the calculated T^2 , is this sample significantly different from the population means at the $\alpha = 0.01$ significance level?

Problem 3: ANOVA

(a) Fill in the missing data in the one-way ANOVA Table 2:

Source	DoF	SS	MS	F	P
Factor (between)	3	36.15	?	?	?
Error (within)	?	?	?		
Total	19	196.04			

Table 2: One way ANOVA table for problem 3(a)

A textile company weaves a fabric on a large number of looms. It would like the looms to be homogeneous so that it obtains a fabric of uniform strength. The process engineer suspects that, in addition to the usual variation in strength within samples of fabric from the same loom, there may also be significant variations in strength between looms. To investigate this, she selects four looms at random and makes four strength determinations on the fabric manufactured on each loom. This experiment is run in random order, and the data obtained are shown in Table 3.

Loom	Observations				y_i
	1	2	3	4	
1	98	97	99	96	390
2	91	90	93	92	366
3	96	95	97	95	383
4	95	96	99	98	388

Table 3: Strength Data for problem 3(b-f)

- (b) Calculate the variation due to the different groups (SSB)
- (c) Calculate the mean square variation between the groups (MSB)
- (d) Calculate the variation (error) within the groups (SSE)
- (e) Calculate the mean square variation within the groups (MSE)
- (f) Is there a significant difference between the looms at the $\alpha = 0.05$ significance level?