
Exercise Set 8

Goals

- 1) Practice two-sample T-tests.
- 2) Use the chi-square test to decide if the results an experiment are unexpected, or to compare two sets of data.

1 Comparing two analysis methods for the nitrogen content of earth samples [basic]

The nitrogen content of 15 earth samples has been measured by two different analysis methods, $M1$ and $M2$. $M1$ is the established industry gold standard, it is very reliable but also very expensive. $M2$ on the other hand is a new method, invented by a startup company. Its fast, convenient, cheap, and the testing apparatus has bluetooth. Challenged by $M2$, the company producing $M1$ claims that its test is much more reliable than $M2$. To demonstrate this, they bought a testing unit $M2$ and compare the results. Each sample has been measured once by $M1$ and then the same sample is measured again using $M2$. The results (in parts-per-million) are given in the table below. Can the company claim that $M2$ significantly deviates from the results of $M1$ at a 97.5% level of confidence?

$M1$	3.57	2.62	4.38	3.38	2.79	3.43	2.89	3.43	2.98	3.29
	2.30	4.22	3.15	2.53	3.30					
$M2$	3.72	2.69	4.35	3.55	2.58	3.59	3.05	3.48	2.92	3.37
	2.48	4.27	3.10	2.69	4.02					

2 Novel diet for a healthy lifestyle - revisited [normal]

In the last exercise, we have treated two groups subjected to different new diet plans separately. Now you can use 2-sample tests and test for the null hypothesis that *both diets are equivalent* at a level of significance $\alpha = 0.02$?

Diet 1	86	96	82	103	91	88	94	90	97	87	97	105
Diet 2	106	118	106	91	96	102	100	100	108	105	118	93

3 Are the dice fair? [normal]

Four dice are cast. We then count how many of them were even (e.g. the result [1,4,2,6] would give 3). We repeat this "experiment" 200 times and find the results below.

Number of even dice in one event:	0	1	2	3	4
How often this occurs:	10	41	70	57	22

Find the probability, and the measured relative frequency for each of the 5 outcomes.

Using a level of confidence of 95%, use a relevant statistical test to answer whether the null hypothesis ("the dice are fair") can be rejected.

4 Are politicians living the same life as the "average" person? [normal]

A sociologist from the country of Fisa researches the following question:

Do politicians from the governing FFA party and the opposition party FS have the same average salary as "average" Fisian people? (Two null hypotheses: "FFA politicians have the same average revenue than the average Fisan people" and "FS politicians have the same average revenue a the average people".)

Answer these questions with at the 95% level of confidence.

2 random groups of a) members of FFA, b) members of the FS were asked in a survey to state their income brackets. The following table lists how many people landed in each bracket: Below, we have the overall Fisian population, given in millions.

Affiliation	> 200 kF\$	100 to 200 kF\$	75 to 100 kF\$	< 75 kF\$
FFA	50	25	15	10
FS	30	40	45	45
Fisan people	1	2	6	3