

Homework Assignment 4 (Due Wednesday, March 6, 2024)

The homework is due at 10.30am in the dropbox on the Course Plus page (you can find the dropbox under the 'Resources' tab in the upper right). For exercises involving R code, please knit a document from your R markdown (Rmd) file. Generate a single pdf file for your entire submission and give it a name that makes it identifiable (calling it 140.615.HW.Number.Lastname.Firstname or similar). Show your work.

1. Suppose I measure some treatment response on a set of 10 mice from strain A, and get these data:

84 106 99 101 100 99 127 105 101 108

Suppose I measure the same treatment response on a set of 5 mice from strain B, and get these data:

56 62 67 81 69

Calculate a 95% and a 99% confidence interval for the difference in the mean treatment responses of strains A and B, assuming that the standard deviations within the two groups are the same. What is the p-value for the hypothesis test that the means are the same?

2. Suppose we wish to estimate the concentration (in $\mu\text{g/ml}$) of a specific dose of ampicillin in urine. We recruit 25 volunteers and find that they have a sample mean concentration of $7.0 \mu\text{g/ml}$, and a sample standard deviation $3.0 \mu\text{g/ml}$. Find a 90% confidence interval for the population mean concentration, assuming that the underlying population distribution of concentrations is normal.

3. Consider data for some measurement on 6 mice before and after some treatment.

Mouse	1	2	3	4	5	6
Before	81	101	76	67	125	144
After	138	210	162	105	259	319

Does the treatment have an effect?

4. E.canis infection is a tick-borne disease of dogs that is sometimes contracted by humans. Among infected humans, the distribution of white blood cell counts has an unknown mean μ and an unknown standard deviation σ . In the general population, the mean white blood cell count is $7250/\text{mm}^3$. It is believed that persons infected with E.canis must on average have a lower white blood cell count.

(a) What are the null and alternative hypotheses for a one-sided test?

(b) For a sample of 15 infected persons, the mean white blood cell count is $\bar{x} = 4767/\text{mm}^3$, and the standard deviation is $s = 3204/\text{mm}^3$. Carry out the one-sided test using a 0.05 significance level.

(c) What do you conclude?

5. A researcher in your department asks you for some statistical advice.
- (a) She is very concerned about falsely rejecting her null hypothesis. As a result she decides to increase the sample size of her study. Explain why she is on the wrong track. What should she do instead?
 - (b) She also wants to know if a one-sample t-test for a mean with the data recorded in pounds always agree with the same test conducted on the same data recorded in kilograms. Explain.