Engineering Mathematics and Statistics (B39AX)
Fall 2023

Tutorial 6

Problem A. The Michelson-Morley experiment consisted in trying to measure the speed of light in the vacuum. The following values were obtained (in hundreds of millions m/s):

$$3.0\,,\ 3.2\,,\ 3.2\,,\ 3.2\,,\ 3.0\,,\ 3.4\,,\ 3.3\,,\ 3.3\,,\ 3.1\,.$$

Compute a 90% confidence interval for the speed of light (population mean).

Problem B. A Heriot-Watt statistician takes a random sample of 100 Heriot-Watt students traveling to work in 2023. The average value of the travel times this year (2023) was 47.2 minutes. Based on data from previous years, the statistician knows that travel times are well modeled by a normal distribution with standard deviation $\sigma = 15$ minutes, and are independent across students. Last year the mean value of the travel times was 45 minutes. Can the statistician say with 10% significance level that the mean value of travel times has increased?

Problem C. The average price of statistics textbooks last year was £24.96. This year a random sample of 40 such textbooks yielded a sample average of £26.10. Can we say that the mean value of statistics textbooks has increased, with a 10% significance level? Assume σ is £8.33.

Problem D. We want to determine whether or not students who work 20 or less hours/week get better grades than students who work more than 20 hours/week, at a significance level of 5%. Assume that the GPA of each student is normal distributed and independent from each other. We observed the data in Table 1.

Table 1: Data for problem D.

# students	Work hours	GPA average	GPA sample std
120	≤ 20	2.98	0.44
120	> 20	2.01	0.38