Technische Universität Berlin   Selected Sections of Adjustment Calculation

Chair of Geodesy and   Summer Term 2019
Adjustment Theory

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Exercise 2: Hypothesis Testing

- Type I and II errors, statistical tests -

Group:	Surname, Given Name:	Matriculation number:	Signature*:

* With my signature I declare that I was involved in the elaboration of this exercise.

Deadline: 10.05.2019

Test Certificate

Received on: _____   _____   _____
                   Date   Grade   Signature

Objective

This exercise deals with hypothesis testing of a population mean, population variance and the ratio of two population variances.
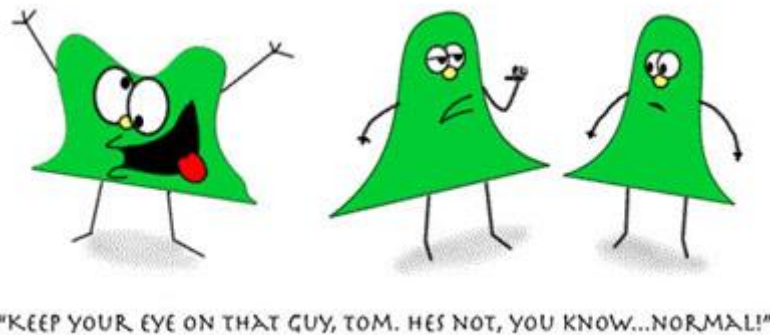

"KEEP YOUR EYE ON THAT GUY, TOM. HES NOT, YOU KNOW...NORMAL!"

Figure 1: source: http://pip.ucalgary.ca/psyc-312/introduction-to-hypothesis-testing/the-normal-distribution/properties.html

Task 1:

The zero correction of an Electronic Distance Meter (EDM) is given by the manufacturer as $E(x) = 0$ mm. The calibration of this EDM by students of TU Berlin yields $\bar{x} = 3.5$ mm for the zero correction, determined with a standard deviation of $s_{\bar{x}} = 1.7$ mm and a degree of freedom $f = 9$. Is the resulting zero correction $\bar{x} = 3.5$ mm significant different from zero (larger) or is the deviation with respect to $E(x)$ random?

Task 2:

The manufacturer of an EDM gives the value $\sigma_d = 2.0$ mm for distances up to 20 m. To check the instrument a distance was measured 10 times and the resulting standard deviation is $s_d = 2.2$ mm. Is the deviation between the obtained and given standard deviation significant different?

Task 3:

A baseline is observed repeatedly over a period of time using an EDM instrument. Each day, 10 observations were taken and averaged. The variances of the observations are listed below. At a significance level of 95%, are the results of day 2 significantly larger from those of day 5?

Day	1	2	3	4	5
s^2	50.0	61.0	51.0	53.0	54.0

Task 4 (Homework):

Student claims he studied at least 6 hours a week. A sample of 16 weeks shows that the average number of hours he studied was 5.5, with a standard deviation of 1.0. Is his claim true?

Task 5 (Homework):

A mean value $\bar{x} = 10.0$ with a variance of $s^2 = 0.07$ is obtained after 12 observations. Is the deviation between the obtained and given variance of $\sigma^2 = 0.10$ significant different, with an error level of 5%?

Task 6 (Homework):

The diameter of steel rods manufactured on two different extrusion machines is being investigated. Two random samples of sizes $n_1 = 15$ and $n_2 = 17$ are selected, and the sample means and sample variances are $\bar{x}_1 = 8.73$, $s_1^2 = 0.35$, $\bar{x}_2 = 8.68$ and $s_2^2 = 0.40$, respectively. Assume that $\sigma_1^2 = \sigma_2^2$ and that the data are drawn from a normal distribution.

- Is there evidence to support the claim that the two machines produce rods with different mean diameters with an error level of 5%?