Probabilitat i Estadística 1

Problemas Tema 8. Contrastes de hipótesis

1. In order to ensure efficient usage of a server, it is necessary to estimate the mean number of concurrent users (that at a given moment can be assumed to be normally distributed). According to records, the average number of concurrent users at 100 randomly selected times is 37.7, with a known standard deviation $\sigma = 9.2$. At the 1% significance level, do these data provide significant evidence that the mean number of concurrent users is greater than 35?

Resultat: Sí.

2. Salaries of entry-level computer engineers have Normal distribution with unknown mean and variance. Three randomly selected computer engineers have salaries (in $1000s):

$$30, 50, 70$$

Does this sample provide a significant evidence, at a 10% level of significance, that the average salary of all entry-level computer engineers is different from $80,000? Explain.

Resultat: No.

3. We have to accept or reject a large shipment of items. For quality control purposes, we collect a sample of 200 items and find 24 defective items in it. The manufacturer claims that at most one in 10 items in the shipment is defective. At the 4% level of significance, do we have sufficient evidence to disprove this claim? Do we have it at the 15% level?

Resultat: No. No.

4. Refer to Exercise 3. Having looked at the collected sample, we consider an alternative supplier. A sample of 150 items produced by the new supplier contains 13 defective items. Is there significant evidence that the quality of items produced by the new supplier is higher than the quality of items in Exercise 3? What is the p-value?

Resultat: $p - \text{value} = 0.1580$

5. The number of concurrent users for some internet service provider has always averaged 5000 with a standard deviation of 800. After an equipment upgrade, the average number of users at 100 randomly selected moments of time is 5200. Compute a p-value for the right-tail test and state your conclusion about a significant increase in the number of concurrent users. Assume that the standard deviation of the number of concurrent users has not changed.

Resultat: p-value=0.0062

6. An account on server A is more expensive than an account on server B. However, server A is faster. To see if it's optimal to go with the faster but more expensive server, a manager needs to know how much faster it is. A certain computer algorithm is executed 30 times on server A and 20 times on server B with the following results,

	Server A	Server B
Sample mean	6.7 min	7.5 min
Sample standard deviation	0.6 min	1.2 min

Is there significant difference in speed between the two servers?
Indication: First, assume equal variances in both servers. Then solve again the problem without this assumption.

(a) Use a confidence interval to conduct a two-sided test at the 5% level of significance.

(b) Compute a p-value of the two-sided test in the previous point.

(c) Is server A really faster? How strong is the evidence? Formulate the suitable hypothesis and alternative and compute the corresponding p-value.

Resultat: (a) $[-1.3151, -0.2849]$, $[-1.3964, -0.2036]$ (b) 0.0030, 0.0106 (c) 0.0015, 0.0053

7. A sample of 250 items from lot A contains 10 defective items, and a sample of 300 items from lot B is found to contain 18 defective items. At a significance level $\alpha = 0.02$, is there a significant difference between the quality of the two lots?

Resultat: No.