

1. The life of a light bulb is a random variable following a normal distribution with standard deviation equal to 6 minutes. Having chosen 100 units randomly, the sample life was 14,35 minutes. Elaborate the 99% c.i. for the mean life of the light bulbs.
2. Multiple Foods is a company wanting to determine the proportion of customers satisfied with certain product. Aimed at that a survey over 100 people, randomly selected, is carried out. The results show that 20 of them are satisfied and the rest of them dissatisfied. Answer:
  - a. Both, the estimation and the estimate of the proportion of satisfied customers.
  - b. If we use the previous result in order to estimate the population standard deviation, obtain the 95% c.i. for the proportion of satisfied customers.
3. A certain company needs to estimate the demand for a new product it will launch. With that purpose a s.r.s. of 10 clients has been selected, observing that the number of units to be purchased are:

Number of units	Number of clients
2	2
3	2
5	1
6	2
8	1
10	1
12	1

Find:

- a. The estimates of the demand, both the mean and the standard deviation.
  - b. Based on the previous information determine the 95% c.i. for the mean of the demand in two situations:
    - i. Without assuming any probability distribution for the demand.
    - ii. Assuming that the demand behaves as a normal variable.
4. A s.r.s. has been obtained from a normal population, the observations being: 163, 162, 166, 164, 165, 170, 169, 165, 168. Answer:
  - a. Build the 90% c.i. for the population mean.
  - b. Calculate the sample size needed for increasing the level of confidence till 95% keeping the precision of the estimation unchanged.

5. The life, in months, of certain electronic device follows a normal distribution. In order to estimate its dispersion a s.r.s. has been selected. The 7 observations taken are:

2,70	2,71	2,70	2,76	2,74	2,78	2,73
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Elaborate and interpret the 98% c.i. for the population variance.

6. Let  $\xi$  be a  $N(\theta, 2)$  random variable. If the sample mean is used as a point estimator of  $\theta$ , find the size  $n$  required in a s.r.s. for a 95% c.i. estimation with the sampling error being lower than 0.2
7. Let  $\xi$  be a  $N(\theta, 4)$ . Build a 95% c.i. for the estimation of  $\theta$ , based on a s.r.s. of size 100, knowing that:

$$\sum_i x_i = 300$$

Now, calculate the required size of a s.r.s. in these two situations:

- Rising the level of confidence till 99%, keeping the precision unchanged.
  - Doubling the precision, keeping the 95% level of confidence.
8. The number of liters of a certain drink sold daily by a supermarket follows a normal population. A s.r.s. of size 7 has been obtained from the population with the following result:

$$\sum_{i=1}^n (x_i - a_x)^2 = 80$$

Find and interpret a 90% c.i. for both, the variance and the standard deviation.

9. Fashions is a company looking forward to get insight into its sales. Aimed at that it has measured its daily sales in € taking a s.r.s of 100 days. These are the results:

$$\sum x_i = 2000 \qquad \sum x_i^2 = 44851$$

Find:

- The 95% c.i. for the expected sales in a given day. Interpret.
  - The sample size needed in order to reach a 99% level of confidence, keeping the same precision
  - The 90% c.i. for the variance of the sales, assuming sales are normally distributed.
10. When analyzing 50 coins in a roman site, it has been detected silver mixed with other minerals in 13 of them. Determine the 95% c.i. for the proportion of pure silver coins. Is it possible to obtain the 95% c.i. for the proportion of impure silver coins based on the previous result?

11. Conchita, the owner of a shop, knows that her monthly income in thousands of euros behave as a normal random variable. Then she takes a s.r.s. on purpose, selecting the last 8 months. These are the results:

$$\sum x_i = 132 \qquad \sum x_i^2 = 2360$$

Find and interpret:

- The 95% c.i. for the mean of the income.
  - The 95% c.i. for the variance of the income.
12. Teachers in Statistics admit that grades in final exams follow a normal distribution with standard deviation being equal to 2.3. Having selected 20 students randomly, they have obtained the following results:

$$\sum x_i = 124 \qquad \sum x_i^2 = 840$$

Then build the 90% c.i. for the mean of the grades, interpreting the result in these two situations:

- Assuming population standard deviation is 2.3.
  - Assuming population standard deviation is unknown.
13. The grades in Statistics achieved by students of GADE in a university follows a normal distribution. In order to infer the value of the population mean, three estimators from s.r.s. are proposed:

$$\theta_1^* = x_1 \qquad \theta_2^* = \frac{x_1 + x_2}{n} \qquad \theta_3^* = \text{media muestral}$$

- Choose the best of them. Support your choice on the properties fulfilled.
  - Elaborate the 98% c.i. for the mean of the grades. Consider a s.r.s. of size 30 has been taken with sample mean of 5.8 and sample variance of 9.
14. In a survey realized to a s.r.s. of 100 citizens in Madrid, 65 of them affirmed that the city is dirty. Under these conditions determine, explaining your reasoning:
- A 99% c.i. for the proportion of citizens in Madrid who agree with that affirmation, interpreting the result.
  - Explain, without any calculation, how we could improve the precision of the estimation.
15. Hoping to get some insights into the public opinion concerning the economic situation, a s.r.s. of 1000 Europeans has been selected. In that sample, 3 out of 4 people consider that economic difficulties will last along this year.
- Choose an unbiased estimator of the proportion europeans agreeing with that consideration, giving its sampling distribution
  - Obtain a 95% c.i. of the population proportion, interpreting the result

- c. Calculate the sample size required to rise the level of confidence till 99% keeping the precision unchanged
16. An insurance company has organized an intensive course in sales techniques for its agents. In order to measure the course effectiveness, a s.r.s. of 8 agents has been selected. Then those agents have been asked for the number of policies sold after and before the course. The results are shown in this table:

Agents	X: Number of policies sold after	Y: Number of policies sold before
1	29	24
2	32	29
3	31	27
4	34	30
5	40	36
6	29	26
7	31	35
8	30	40

- Assuming that the insurance sales follow a normal distribution, estimate the 99% c.i. for the difference between the policies sold after and before the course. Then justify the effectiveness of the course.
17. The owner of a hotel receives a given model of light bulbs from two different trademarks and wants to know which one of them lasts longer. Then he select two s.r.s. from every supplier with 100 units each. After he observes that sample mean is 1500 hours in bulbs from trademark A and 1250 for those from trademark B. Moreover, the sample standard deviation is 150 hours for bulbs in class A and 125 for those in class B. Under these conditions find the 90% c.i. for the difference between population means, answering the question.
18. A candidate for a post as a mayor's office wants to know if there is a significance difference between the proportion of voters supporting him in two districts of the city. With that purpose he obtains a s.r.s. of 200 citizens in the West district, verifying that 130 would vote him. Meanwhile, he selects another s.r.s. of 150 citizens living in the East district (this s.r.s. being independent from the former one) where 95 would support him. Based on this, obtain the 99% c.i. for the difference between the proportion of voters in both districts and answer the question.
19. The number of units sold per day by a car dealer (brand A) from Monday through Friday in a given week have been: 5, 8, 10, 9 and 12. Meanwhile corresponding figures from another car dealer (brand B) located next to the former have been: 7, 9, 4, 5 y 15. If in both cases sales follow a normal distribution, answer:

- a. Build a 97% c.i. for the difference of cars (means) sold, considering that the population variances are known: 9 for dealer A and 16 for dealer B. Interpret the result.
- b. Build a 97% c.i. for the difference of cars (means) sold, considering that the population variances are unknown but equal. Interpret the result.
- c. Build a 95% c.i. for the quotient of population variances (obviously considering that they are unknown). Interpret the result.
20. The owner of a copy machine has called the maintenance service after detecting failures in its operations. In order to test the efficiency of that service and assuming the number of failures produced in an hour behave as a normal random variable, he has selected a s.r.s. of 10 hours before and after the visit of the repairmen. Results are included in this table:

Hour	X: Number of errors after the call	Y: Number of errors before the call
1	5	16
2	8	12
3	10	14
4	14	16
5	12	12
6	8	10
7	6	15
8	8	16
9	4	10
10	6	8

Elaborate the 98% c.i. for the difference between the number of failures after the call and before that. Based on that justify the efficiency of the service.