S115_LE2_002

Statistics 115
Sample Second Long Examination

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I. TRUE OR FALSE. Write ‘True’ if the statement is always true; otherwise, write ‘False’.

1. An unbiased estimator of μ is a statistic whose value is equal to □ for a particular sample.
2. The sample variance is an unbiased estimator of the population variance when the sample is selected using simple random sampling with replacement.
3. When we select a random sample from an infinite population and the standard error of the sample mean as a point estimator of the population mean μ is close to 0 then we are assured that the values of the estimates from sample to sample are close the value of μ.
4. When we select a random sample from an infinite population and the standard error of T as a point estimator for the parameter τ is close to 0 then we are assured that the values of the estimates from sample to sample are close to the value of τ.
5. The sample mean is the most efficient estimator of μ when sampling from the normal distribution.
6. The sample mean is the most efficient estimator of μ.
7. When the margin of error of the sample mean is equal to 10 kilos then we can conclude that the distance between the estimate using the sample mean and the value of μ will not exceed 10 kilos for all possible samples.
8. When the margin of error of the sample mean is equal to 10 kilos then we can conclude that when we repeatedly take samples and compute for the sample mean, the distance between the estimate using the sample mean and the value of μ will not exceed 10 kilos 95% of the time.
9. Using the same sample data, increasing the confidence coefficient in interval estimation will result in an increase in the length of the interval estimate.
10. If the 90% confidence interval estimate of μ is (15.7, 18.1) then the chance that the value of □ is in this interval is 0.90.
11. The 95% confidence interval estimate for μ based on a random sample of size 20 from a normal distribution with known variance is always longer than the 95% confidence interval estimate based on a random sample of size 50 from the same population.
12. The confidence interval estimator of μ when we sample from a normal distribution is sensitive to the assumption of normality.
13. The confidence interval estimator of σ^2 when we sample from a normal distribution is sensitive to the assumption of normality.
14. The parameter of interest when we wish to compare the variances σ_X^2 and σ_Y^2 is the difference $\sigma_X^2 - \sigma_Y^2$
15. If the computed interval estimate for $\mu_Y - \mu_X$ contains positive values only then we are highly confident that μ_X is greater than μ_Y.

II. PROBLEM SOLVING. Show all the important steps and write down the formulas used in answering the following problems.

1. An airline researcher studied reservation records for a sample of 35 flights selected using simple random sampling with replacement and determined the number of no-shows (persons who fail to keep their reservations) on the daily 4 p.m. flight to Cebu. The records revealed the following numbers of no-shows:

0 0 0 0 0 0 1 1 1 1
1 1 1 1 1 1 1 2 2 2
2 2 3 3 3 3 4 4 4 5
5 6 7 7 9

Use the sample data to estimate the following parameters:

a) mean number of no-shows

b) standard error of the point estimator used in (a)

c) proportion of flights with more than 1 no-shows

d) standard error of the point estimator used in (c)

2. The Federation of Independent Television Station Owners conducted a survey in Metro Manila. It interviews a random sample of 100 people to determine the number of hours per week they spend watching television. The results of survey appear below:

17	33	19	47	56	39	18	26	28	11
26	6	45	9	26	7	16	43	33	5
9	36	27	29	13	15	17	3	41	38
38	36	15	25	32	42	45	41	38	12
25	25	1	41	26	5	57	11	27	40
18	27	10	39	25	34	7	37	37	26
18	44	26	14	0	46	8	28	24	40
57	27	14	33	27	40	8	16	43	6
17	15	16	44	56	25	42	2	40	10
29	34	42	39	26	12	4	37	11	39

a) Compute for a 99% confidence interval estimate for the mean number of hours per week the residents in Metro Manila spend watching television if it is known that the population standard deviation is 12 hours.

b) Compute for a 99% confidence interval estimate for the mean number of hours per week the residents in Metro Manila spend watching television if the population standard deviation is unknown.

c) Compute for an approximate 95% confident interval estimate for the proportion of residents in Metro Manila who spend watching television for more than 35 hours per week.

3. An educational psychologist studied whether two mathematics achievement tests lead to different achievement scores. Two sections of students with about the same IQ's were selected. Test 1 was randomly assigned to one of the sections and Test 2 to the other section. The test scores follow, where X and Y denote the scores in test 1 and test 2, respectively:

X	93 70 79 106 123 124 94
Y	103 102 101 102 100 104 99 103 100 102 101

Let μ_X be the mean achievement score in Test 1 and μ_Y be the mean achievement score in Test 2.

a) Assuming that both populations are normal with equal variances, compute a 90% confidence interval estimate for $\mu_X - \mu_Y$.

b) Assuming that both populations are normal with unequal variances, compute a 90% confidence interval estimate for $\mu_X - \mu_Y$.

c) Using the result in (b), does the educational psychologist have sufficient evidence that the mean achievement score in Test 1 is different from the mean achievement score in Test 2?

4. A social psychologist wishes to compare the attitudes of people toward a particular social behavior before and after they view an informational film about the behavior, based on a random sample of 10 subjects. For each subject, an attitude measurement was made before viewing the film and a second measurement was taken after viewing the film. The larger the attitude score, the more favorable is the subject toward the social behavior. The attitude scores for the sample are as follows:

Before	41.0	60.3	23.9	36.2	52.7	22.5	67.5	50.3	50.9	24.6
After	46.9	64.5	33.3	36.0	43.5	56.8	60.7	57.3	65.4	41.9

Let μ_X be the mean attitude score after viewing the film and μ_Y be the mean attitude score before viewing the film. Assuming normality, compute for a 95% confidence interval estimate for $\mu_X - \mu_Y$.

5. A random sample of 200 males was selected to be a part of a test panel and another random sample of 200 females was also selected to be another part of this test panel. Both groups were shown a preview of a film of a new musical to be released shortly. Each panel member was asked to indicate whether the amount of dancing is too much, about right, or too little. The results, cross-classified by opinion and sex of viewer were as follows:

	Sex of Viewer	
Opinion	Male	Female
Too much	65	40
About right	120	80
Too little	15	60

Let p_1 be the proportion of males who think that the amount of dancing in the film is just right while p_2 be the proportion of females who think that the amount of dancing in the film is just right. Compute for an approximate 90% confidence interval estimate for $p_1 - p_2$.

Formulas:

$$S_P^2 = \frac{(n_1 - 1)S_X^2 + (n_2 - 1)S_Y^2}{n_1 + n_2 - 2}$$

$$v = \frac{\left(s_X^2/n_1 + s_Y^2/n_2 \right)^2}{\frac{\left(s_X^2/n_1 \right)^2}{n_1 - 1} + \frac{\left(s_Y^2/n_2 \right)^2}{n_2 - 1}}$$