S115_LE2_003

Statistics 115
Sample Second Long Examination

Basic Statistical Methods

I. Write TRUE if the statement is correct, otherwise write FALSE.

1. An estimator for the estimated parameter is unbiased if the average of the estimates it produces under repeated sampling from the same population is equal to the true value of the estimated parameter.
2. If the parameter of interest is the population mean, then $P(T_1 < \tau < T_2)$ is the probability that the population mean lies between T_1 and T_2.
3. As the confidence coefficient increases, the length of interval also increases for a fixed sample size *n*.
4. If the computed interval estimate contains 0, then we do not have sufficient evidence to conclude that the two means are different from each other.
5. The null distribution is the sampling distribution of the test statistic given that the alternative hypothesis is true.
6. The process of inferring on the ratio of the population variances of two populations is not robust.
7. Different samples will yield different values of $\overline{X}$ and therefore produce different interval estimates of the parameter μ.
8. The point estimator for the parameter $\frac{\sigma_x^2}{\sigma_y^2}$ is simply the ratio between their sample variances.
9. As the sample size *n* goes to ∞, the length of the confidence interval for the proportion approaches 0.
10. If the unbiased estimator for a parameter has a small variance, then it is the most efficient estimator.

II. Fill in the blanks.

1. _______________ is an inference about a parameter that is made by finding a single value or a range of values computed from the sample data that may be used to make a statement about the unknown value of the parameter.
2. A single statistic whose realized value is used to estimate the true but unknown value of the population parameter is called _______________.
3. The realized pair of numbers computed from the estimator is called _______________.
4. _______________ is a measure of reliability.
5. The _______________ is the upper bound on the absolute difference between the estimator and the parameter.
6. The selection of the random sample from one population will not affect the selection of the random sample from the other population is called _______________.

For numbers 7 – 10, use the following data.

Suppose a random sample of students were selected and data on their daily allowance are as presented below:

60	75	75	100	110	120	150	150	150	160
175	175	175	200	200	200	200	250	275	300

7. The estimate for the mean daily allowance, μ, is __________.
8. __________ is the estimate for the proportion of students with daily allowance greater than Php 100.00.
9. The estimate for the variation of the values of $\overline{X}$ from one sample to another is _________.
10. The estimate for the variation of the values of $\hat{P}$ from one sample to another is _________.

III. Problem Solving.

1. A random sample of the contents of 10 similar tetra packs of a commercial juice drink are 102, 97, 101, 103, 101, 98, 99, 104, 103 and 98 ml. Find a 99% confidence interval for the mean drink content of all such tetra packs, assuming an approximate normal distribution.

2. In a random sample of 500 viewers watching *How I Met Your Mother*, it was found that x=160 of them don't believe on The Dobler-Domer Theory. Construct a 95% confidence interval for the actual proportion of viewers who really don't believe in the theory.

3. The following are the total hours of sleep in a span of two weeks of 10 UP students: 46.4, 46.1, 45.8, 47.0, 46.1, 45.9, 45.8, 46.9, 45.2, and 46.0. Assuming the total hours of sleep to follow a normal distribution, find a 95% confidence interval for the variance.

4. Math 53 is taught to 12 students by the large class system. A second group of 10 students was given the same course by the small class system. At the end of the semester, the same examination was given to each group. The 12 students made an average of 85 with a standard deviation of 4, while the 10 students made an average of 81 with a standard deviation of 5.

   (a) Find a 90% confidence interval for the difference between the population means assuming that the populations are approximately normally distributed with equal variances.
   (b) Find a 90% confidence interval for the difference between the population means assuming that the populations are approximately normally distributed with unequal variances.

5. It is claimed that a new diet will reduce a person's weight by 4.5 kilos on the average in a period of two weeks. The weights of 7 fat people who followed this diet were recorded before and after a 2-week period:

	Fat Person						
	1	2	3	4	5	6	7
Weight before	58.5	60.3	61.7	69.0	64.0	62.6	56.7
Weight after	60.0	54.9	58.1	62.1	58.5	59.9	54.4

   Test the manufacturer's claim by computing a 95% confidence interval for the mean difference in the weight. Assume the distribution of weights to be approximately normal.

6. A study is made to determine if having friends results in more students to cut their classes. Two groups of students are selected at random, one group contains students with a lot of friends and the other group contains the alone students. Of the 300 students from the first group, 64 students cut their classes and of the 400 students from the second group, 51 cut their classes. Find a 95% confidence interval for the difference between the fractions of students who cut classes in the two groups.

Formulas:

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

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

"Let the numbers speak to you. That is what Statistics is all about."
– Gian Louisse A. Roy