Tutorial letter 015/0/2021

Descriptive Statistics and Probability

STA1501

Year module

Department of Statistics

Assignment 5 Questions

ASSIGNMENT 05
Fixed closing date: 22 October 2021

Please study Chapters 11 and 12 and corresponding parts of the study guide before answering the following questions.

QUESTION 1

The following data give the distance travelled to work by a sample of employees.

$$14.8 \quad 12.9 \quad 13.2 \quad 15.0 \quad 13.5 \quad 12.1 \quad 14.8 \quad 16.1 \quad 15.1 \quad 16.2$$

Test at the 5% level of significance the claim that the average distance travelled is less than 15 kilometres if you are given a population standard deviation of 2.5 kilometers.

(a) State the null and alternative hypothesis. (2)

(b) Calculate the sample mean average distance travelled. (3)

(c) State and calculate the appropriate test statistic. (7)

(d) Determine the critical value of the test. (2)

(e) State whether or not you reject the null hypothesis, giving the reason. (3)

(f) Draw an appropriate conclusion. (3)

[20]

QUESTION 2

In a survey taken 10 years ago, it was found that 10% of customers of a supermarket brought along their own shopping bags. A recent survey aimed to prove that the current percentage of customers bringing along their own shopping bags is different from 10%. In the survey, it was found that 92 of the $1\,000$ customers surveyed brought along their own shopping bags. We want to test the claim that the current percentage is not 10%, at the 5% significance level.

(a) State the appropriate null and alternative hypothesis. (2)

(b) State and calculate the appropriate test statistic. (8)

(c) Determine the critical value of the test or the p–value of the test. (4)

(d) State whether or not you reject the null hypothesis, giving the reason. (3)

(e) Draw an appropriate conclusion. (3)

[20]

QUESTION 3

A new manufacturing method is supposed to increase the average life span of electronic components, while the variance of the life span is expected to stay the same. Using the previous manufacturing method, the average life span was 110 hours with a variance of 9 hours. The manufacturer measures the life spans of a sample of components manufactured using the new method. The sample of 20 yields a sample mean of 125 for the life spans of the components. Does the data provide sufficient evidence for the claim at the 1% level of significance? Clearly show how you draw a conclusion when you test this hypothesis, **using both methods,** i.e.

(a) critical value approach, and (15)

(b) p-value approach. (5)

[20]

QUESTION 4

A survey of the number of children in families in a small town gave the following results.

$$2 \quad 3 \quad 1 \quad 3 \quad 1 \quad 2 \quad 0 \quad 0 \quad 1 \quad 2 \quad 1 \quad 0 \quad 1 \quad 3 \quad 1$$

Does this data provide sufficient evidence that the average number of children per family is less than 2, at the 10% significance level? Clearly show how you draw a conclusion when you test this hypothesis. Show calculations of all statistics used.

[20]

QUESTION 5

The park officials of Kruger Park believe that 50% of the buffaloes in the southern part have tuberculosis. The characteristic being studied is the occurrence of tuberculosis. A random sample of 100 buffalo is obtained from the southern part of the Kruger Park for which 65 are tested positively for tuberculosis.

(a) Do the data indicate that the proportion of buffalo in the southern part that have tuberculosis is greater than assumed? Perform a proper hypothesis test and **test at the 5% significance level.** Clearly show how you draw a conclusion when you test this hypothesis, **using both methods,** i.e.

(i) critical value approach, and (10)

(ii) p-value approach. (3)

(b) Assume that for **practical importance** the park officials would be concerned if the occurrence of tuberculosis is more than an additional 10% of the existing proportion. What practical conclusion might they draw from the results?

[**Hint**: Compute a 95% lower one-sided confidence bound. You can refer to previous chapter of confidence interval for this calculation.] (7)

[20]

Total marks: [100]