

Answer on Question #63963 – Math – Statistics and Probability

Question

Car insurance companies assume that the longer a person has been driving, the less likely they will be in an accident, and therefore charge new drivers higher insurance premiums than experienced drivers. To determine whether driving experience is related to the number of car accidents, you survey a random sample of 12 Torontonians and ask them about the number of years they have been driving, and the number of car accidents they have been involved in during the past year. The data are presented below:

Driver # of years driving (X) # of car accidents (Y)

A	4.5	3
B	2.5	5
C	1.5	3
D	3	3
E	1.5	6
F	5	2
G	5	0
H	2	4
I	3	1
J	4	2
K	1	5
L	3	2

- a.** Determine whether the assumptions of car insurance companies are valid. Assuming $\alpha=0.05$, include the hypotheses for a one-tailed test, critical test statistic, conclusion, and all formulas and calculations.
- b.** Is it appropriate to conclude that lack of driving experience causes accidents? Why or why not?

Solution

a. To find if there is a statistically significant linear relationship between number of years driving and accidents we need to test the significance of correlation coefficient.

$$H_0: \rho = 0$$

$$H_1: \rho < 0$$

The correlation coefficient:

$$r = \frac{n \sum xy - (\sum x)(\sum y)}{\sqrt{(n \sum x^2 - (\sum x)^2)(n \sum y^2 - (\sum y)^2)}} = \frac{12 \cdot 88.5 - (36)(36)}{\sqrt{(12 \cdot 129 - (36)^2)(12 \cdot 142 - (36)^2)}} = -0.73.$$

Test statistic is

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{(-0.73)\sqrt{12-2}}{\sqrt{1-(-0.73)^2}} = -3.38$$

The critical value for $\alpha=0.05$ and $12 - 2 = 10$ degrees of freedom is $t_{cr} = 1.81$.

Test statistic is less than $-t_{cr}$. Thus, we reject the null hypothesis.

There is a sufficient evidence at 5% significance level to conclude that there is negative linear relationship between driving experience and the number of car accidents in the population.

b. No. It is not appropriate to conclude that lack of driving experience causes accidents. Correlation does not imply causation.