PES University, Bangalore

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UE19CS203 – STATISTICS FOR DATA SCIENCE

Unit-4 - Hypothesis and Inference

QUESTION BANK – SOLVED

Drawing conclusions from the result of Hypothesis Test:

Exercises for section 6.2: [Text Book Exercise 6.2– Pg. No. [411 – 413]]

1. George performed a hypothesis test. Luis checked George's work by redoing the calculations. Both George and Luis agree that the result was statistically significant the 5% level, but they got different *P*-values. George got a *P*-value of 0.20 and Luis got a *P*-value of 0.02.
a. Is it possible that George's work is correct? Explain.
b. Is it possible that Luis's work is correct? Explain.

[Text Book Exercise – Section 6.2 – Q. No.6 – Pg. No. 411]

Solution:

Given α = 5%=0.05

a) P = 0.20

If the P-value is smaller than the significance level α, then the null hypothesis is rejected. If the null hypothesis is rejected, then the test is statistically significant.

P > 0.05 => Fail to reject H_0

Since we failed to reject the null hypothesis, the test is not statistically significant for the P-value of 0.20 and thus George's work is not correct.

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b) P = 0.02

If the P-value is smaller than the significance level α, then the null hypothesis is rejected. If the null hypothesis is rejected, then the test is statistically significant.

$P < 0.05 \Rightarrow$ Reject H_0

Since we reject the null hypothesis, the test is not statistically significant for the P-value of 0.02 and thus Luis's work is correct.

2. A scientist computes a 90% confidence interval to be *(*4.38*,* 6.02*)*. Using the same data, she also computes a 95% confidence interval to be *(*4.22*,* 6.18*)*, and a 99% confidence interval to be *(*3.91*,* 6.49*)*. Now she wants to test $H_0 : \mu = 4 \, versus \, H_1 : \mu \neq 4$. Regarding the *P*-value, which one of the following statements is true?

$i. P > 0.10.$
$ii. 0.05 < P < 0.10.$
$iii. 0.01 < P < 0.05.$
$iv. P < 0.01.$

[Text Book Exercise – Section 6.2 – Q. No.16 – Pg. No. 412]

Solution:

Given 90% confidence interval: (4.38,6.02)
95% confidence interval: (4.22, 6.18)
99% confidence interval: (3.91,6.49)

$H_0: \mu = 4$
$H_1: \mu \neq 4$

We note that the 99% confidence interval contains the mean 4 of the null hypothesis, which indicates that we would fail to reject the null hypothesis at the significance level α = 1 – c = 1 - 0.99 = 0.01. We reject the null hypothesis, if the P-value is less than the significance level and thus we know that the P-value is larger than 0.01.

$$P > 0.01$$

We note that the 95% confidence interval does not contain the mean 4 of the null hypothesis, which indicates that we would reject the null hypothesis at the significance level α = 1 – c = 1 - 0.95 = 0.05. We reject the null hypothesis, if the P-value is less than the significance level and thus we know that the P-value is less than 0.05.

$$P < 0.05$$

Combining the two inequalities, we then obtain:

$$0.01 < P < 0.05$$

Hence the answer is (iii)option.