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The F-distribution - Quiz

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Question 1

0/1 point (graded)

True or False: Suppose you draw two random samples of size n_1 and n_2 from two different populations. $X_1 \sim N(\mu_1, \sigma_1^2)$ and $X_2 \sim N(\mu_2, \sigma_2^2)$. You estimate the sample variances, s_1^2 and s_2^2 . The ratio of your estimates of the sample variances, $\frac{s_1^2}{s_2^2}$, follows an F distribution with $n_1 - 1, n_2 - 1$ degrees of freedom.

☐ a. True

☒ b. False ✖


Explanation

Recall that $s^2 = \frac{\sum (X_i - \bar{X})^2}{n-1}$, and $(n-1)s^2 \sim \chi_{n-1}^2$ for $i = 1, 2$. So


$$\frac{s_1^2}{s_2^2} \sim \frac{\chi_{(n_1-1)}^2 / (n_1-1)}{\chi_{(n_2-1)}^2 / (n_2-1)}$$

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[Assessing and Deriving Estimators](#)

Finger Exercises due Nov 14, 2016
at 05:00 IST 

[Confidence Intervals and Hypothesis Testing](#)

Finger Exercises due Nov 14, 2016
at 05:00 IST 

[Module 7: Homework](#)

Homework due Nov 07, 2016 at
05:00 IST 

. And we know that the ratio of two independent chi squared distributions with n and m degrees of freedom respectively, divided by their degrees of freedom follows an F distribution with n, m . Letting $n = n_1 - 1$ and $m = n_2 - 1$, it is clear that the above statement is true.

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✘ Incorrect (0/1 point)

Question 2

1/1 point (graded)

Which distribution is useful for testing the following hypotheses:

Scenario A. You think the true variance is σ^2 , and you want to use your data to make inferences about σ^2 .

✔ Answer: χ^2

Scenario B. You think the true mean is 0, and you want to use your data to test whether $\mu = 0$. You don't know the true variance.

✔ Answer: t

Scenario C: You want to compare the variances in two independent population

✔ Answer: F

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Explanation

For **Scenario A**, since you know that $(n - 1)s^2 \sim \chi_{n-1}^2$, you can construct your test-statistic, and compare that to the χ^2 with $n - 1$ degrees of freedom.

For **Scenario B**, as Professor Ellison explained in class, when the population variance is unknown, the standardized sample mean follows a t-distribution with $n - 1$ degrees of freedom. So by comparing your test statistic to the t-distribution you can make inferences about the sample mean.

For **Scenario C**, as explained in question 1, we know that the ratio of the sample variances divided by their degrees of freedom follows an F distribution if the variances are equal. So if you compare the test statistic you obtained with the F distribution, you can test whether the variances are in fact equal.

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Discussion

Topic: Module 7 / The F-distribution - Quiz

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