BST169: Course Work Project answer

sn0wfree

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1 BST169: Course Work Project

there are 5 questions

1.1 topic 1:

1. Consider the model:

$$y_i = \beta_0 + \beta_1 * x_{1,i} + \beta_2 * x_{2,i} + e_i \ (1)$$

What is the requirement for e_i such that the following test statstics will be valid to test H0: $\beta_1 + \beta_2 = 1$?

- $W = N * (SSR_R - SSR_U)/SSR_U$ (Wald).
- $LM = N * (SSR_R - SSR_U)/SSR_R$ (Lagrange Multiplier),
- $LR = N * ln(SSR_R/SSR_U)$ (Likelihood Ratio)

where SSR_R is the sum of squared residuals obtained from the restricted model, while SSR_R is from the unrestricted model.

1.2 topic 2

2. For the data set **pbp.csv**, can we use the **three test statistics** mentioned in the previous question to test H0 : $\beta_1 + \beta_2 = 1$? Why? If W and LM are not valid, how can one modify them for the test? What is your conclusion from the valid test?

1.3 topic 3

3. Generate y_i from the following model,

$$y_i = \beta_0 + \beta_1 * x_{1,i} + (1 = \beta_1) * x_{2,i} + \sqrt{x_{1,i}} * \epsilon_1 \ (2)$$

where $x_{1,i}$ follows chi-squared distribution with 2 degrees of freedom. Generate ϵ_1 from student t distribution with 6 degrees of freedom and $x_{2,i}$ $U(0, 10)$. Check whether W, LM and LR in Question 1 follow chi-squared distribution by Monte Carlo. (The R command ks.test(,'pchisq',2) can be used.) If W and LM are not valid, calculate the correct test statistics and also verify them by Monte Carlo. Please consider different sample sizes.

1.4 topic 4

Compare the size of di erent test statistics (frequencies of making Type 1 error) from Monte Carlo using 5% level of significance for di erent sample sizes. Explain the results.

1.5 topic 5

For the data set pbp.csv, suppose Equation (2) is the true model. Use proper bootstrapped errors from the true model to study whether different test statistics for H0 : $\beta_1 + \beta_2 = 1$ in the previous questions follow chi-squared distribution. Explain your results.