

The following are multiple-choice exam questions that were previously given during the COVID-19 period through online exams.

Although this semester's exam will be in a short-answer format and not identical in style, the concepts and formulas required to solve the questions are similar. Please refer to them for your study.

1. The shape of a t-distribution varies depending on its degrees of freedom. Among the following degrees of freedom, which one yields the highest probability density at $x = 0$?

2. A linear regression model was trained on a dataset with 29 samples and 6 explanatory variables, with a numerical dependent variable. You want to test the significance of the model using an F-test. Given a significance level of 0.01, select all the test statistics from the choices that would indicate the model is statistically significant.

3. A dataset has 30 samples and 8 explanatory variables. You want to test the significance of individual variables in a linear regression model using a t-test. If you set the significance level to 0.10 and perform a two-tailed test, choose all variables that are statistically significant for predicting the target variable based on the coefficient and standard error (SE) provided.

4. Samples were drawn i.i.d. from a normal distribution. Given the observed sample values $D = [-0.85, 0.03, -0.31, 0.45, -0.03]$, calculate the variance using the maximum likelihood estimation (MLE) method.

5. What is the output of the logistic function when the input value is 1.99?

6. A logistic regression model was trained on binary classification data using variables x_1 and x_2 . The trained model has an intercept $b_0 = 0.38$, a coefficient for x_1 : $b_1 = 0.17$, and a coefficient for x_2 : $b_2 = -0.36$. Given $x_1 = 0.86$ and $x_2 = 0.18$, calculate the odds.

7. There are two discrete random variables, A and B. A can take on values A1 or A2, and B can take on values B1, B2, or B3. Given: $P(A1|B1)=0.29$, $P(A1|B2)=0.76$, $P(A2|B3)=0.75$, $P(B1)=0.20$, $P(B2)=0.13$. Find $P(A1)$.

8. Suppose the explanatory variable x is binary. Among the samples with class label 0, the values of x are given as: $x=[0,1,0,1,1,0,1,1]$. Estimate the parameter for class 0 of this variable using the naive Bayes classifier (without smoothing).