Take Test: Quiz 5

Test Information

Description

Instructions

Multiple Attempts This test allows 3 attempts. This is attempt number 2.

Force Completion This test can be saved and resumed later.

Question Completion Status:

QUESTION 1

2 points Saved

Which of the following criteria/statistics can be used to select the order of polynomial regression? Check all that apply.

- [x] A. AIC
- [x] B. F-test
- [ ] C. RSS
- [ ] D. Magnitude of the coefficient for the highest polynomial term.

QUESTION 2

2 points Saved

Suppose g is a cubic spline defined on [a, b]. Which of the following statements are true? Circle all that apply.

- [x] A. g is a continuous function.
- [x] B. The first derivative of g is continuous.
- [ ] C. The third derivative of g is continuous.
- [x] D. The second derivative of g is continuous.

QUESTION 3

2 points Saved

A robot needs to follow a path that passes consecutively through six points (x_i, y_i) where without loss of generality, assume x_i's are arranged in an increasing order and they are unique. To find a smooth path you would recommend which of the following? Circle all that apply.

- [ ] A. Fit a linear regression model based on the 6 data points.
- [x] B. Fit a natural cubic spline function with knots at the six points (x1 to x6).
- [ ] C. Fit a cubic polynomial function of x based on the 6 data points.
- [x] D. Fit a cubic spline function with two knots {z1, z2}, where z1 is the average of (x1, x2, x3) and z2 is the average of (x4, x5, x6).

QUESTION 4

4 points Saved

A cubic spline function g is defined between 0 and 2 as follows

- g(x) = 1 + 2 x - x^3 if 0 <= x <1;
- g(x) = a + b(x-1) +c(x-1)^2 + d(x-1)^3, if 1<= x <=2.

Find the value of a, b, c, and d. If the value is not unique, write "NA" in the box.

- a= 2
- b= -1
- c= -3
- d= NA

Click Save and Submit to save and submit. Click Save All Answers to save all answers.

Save All Answers Save and

Load the data "Boston" from R library MASS

library(MASS)
data(Boston)

This question uses the variables "dis" (the weighted mean of distances to five Boston employment centers) and "nox" (nitrogen oxides concentration in parts per 10 million) from the Boston data.

Round your answer to the 2nd digits after the decimal point.

Use the poly() function to fit a cubic polynomial regression to predict "nox" using "dis".

- What's the residual sum of squares? 1.93 (A number between 1.50 and 2.10)
- What's the predicted "nox" when dis=6? 0.44 (A number between 0.30 and 0.60)
- Is the p-value for the cubic term less than 5%? Yes (Fill in "Yes" or "No")

Next use the poly() function to fit a fourth-degree polynomial regression model.

- What's the residual sum of squares? 1.93 (A number between 1.50 to 2.10)
- What's the predicted "nox" when dis=6? 0.44 (A number between 0.30 and 0.60)
- Is the p-value for the highest polynomial term less than 5%? No (Fill in "Yes" or "No")

QUESTION 6

2 points Saved

This question uses the variables "dis" and "nox" from the Boston data. We use the following R command to fit a cubic spline model to predict "nox" using "dis"

```
library(MASS)
attach(Boston)
myfit1 = lm(nox ~ bs(dis, df=3), data=Boston)
```

Which of the following R command would return the same model as "myfit1"? Circle all that apply.

- [x] A. lm(nox ~ bs(dis, df= 4, intercept=TRUE), data=Boston)
- [ ] B. lm(nox ~ bs(dis, knots=quantile(dis, prob=c(0.25, 0.5, 0.75)), data=Boston)
- [ ] C. lm(nox ~ bs(dis, knots=median(dis)), data=Boston)
- [x] D. lm(nox ~ poly(dis, 3), data=Boston)
- [ ] E. lm(nox ~ bs(dis, df= 5, intercept=TRUE), data=Boston)

QUESTION 7

2 points Saved

Suppose we use the following R command to fit a cubic spline model to predict "nox" using "dis"

```
myfit2 = lm(nox ~ bs(dis, df=4), data=Boston)
```

Which of the following R command would return the same model as "myfit2"? Circle all that apply.

- [x] A. lm(nox ~ bs(dis, df= 5, intercept=TRUE), data=Boston)
- [ ] B. lm(nox ~ bs(dis, knots=quantile(dis, prob=c(0.25, 0.5, 0.75)), data=Boston)
- [ ] C. lm(nox ~ poly(dis, 3), data=Boston)
- [x] D. lm(nox ~ bs(dis, knots=median(dis)), data=Boston)
- [ ] E. lm(nox ~ bs(dis, df= 4, intercept=TRUE), data=Boston)

QUESTION 8

3 points Saved

Suppose we fit a smoothing spline on n data points (x_i, y_i) where x_i's are unique and arranged in an increasing order. Which of the following statements are correct? Circle all that apply.

- [ ] Due to the roughness penalty, the fitted curve is no longer a piecewise cubic polynomial function.
- [x] The fitted curve is a piecewise cubic polynomial when x is between x_1 and x_n, but a linear function when x<x_1 and another linear function when x>x_n.
- [ ] Instead of tuning lambda, we can tune the degree of the freedom of a smoothing spline model (i.e., the df option in smooth.spline command). But we can only try integer values for df.
- [x] When the tuning parameter lambda is set to be zero, the curve returned by smoothing spline passes through all the data points (x_i, y_i).
- [ ] When the tuning parameter lambda is equal to infinity (or large enough), smoothing spline is equivalent to cubic polynomial regression.
- [ ] When the tuning parameter lambda is set to be zero, smoothing spline is equivalent to cubic polynomial regression.
- [ ] The data points divide the x-coordinate into (n+1) intervals, and the fitted curve is a linear function within each interval.
- [x] When the tuning parameter lambda is equal to infinity (or large enough), smoothing spline is equivalent to linear regression.

Click Save and Submit to save and submit. Click Save All Answers to save all answers.

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