MATH 4720 Test 3 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Point totals are in parentheses next to each problem. Please show all work for partial credit.

1. Consider the simple linear regression model “through the origin”.

Find the maximum likelihood estimators for and .

(Hint: )

(12)

1. Credit scores can help determine whether an individual will qualify for a mortgage loan, and they are even used to determine the interest rates that will be charged. Six customers of a local bank are randomly selected and their credit scores (between 300 and 850) with corresponding interest charged (in percent) on a car loan are recorded. Summary statistics are listed below: (x = credit score, y = interest rate)

1. Find , ,

(5)

1. Compute r, the sample correlation coefficient

(3)

1. Find the coefficient of determination and interpret the value in terms of credit scores and interest rates.

(3)

1. Use Fisher’s Z transformation to test vs. at α = 0.02

(5)

1. Let be a random sample from . Find the form of the Generalized Likelihood Ratio Test for .
2. Find the maximum likelihood estimators under and Ω.

(5)

1. Evaluate to find the form of the GLR test. (Hint: Use to determine when λ itself is increasing or decreasing as a function of sample data.)

(10)

1. A farmer would like to examine the relationship between rainfall (in inches, X) and yield of wheat (in bushels per acre, Y). He collects data for 8 different harvests and records summary information below:

1. Determine the least squares regression line and predict the yield of wheat if the rainfall was 14 inches.

(6)

1. Test vs. (at α = 0.05)

(6)

1. Construct a 95% prediction interval for the yield of wheat if the rainfall was 14 inches.

(5)

1. A study was conducted to determine the effect of early child care on infant-mother attachment patterns. In the study, 93 infants were classified either “secure” or “anxious” using the Ainsworth strange-situation paradigm. In addition, the infants were classified according to the average number of hours per week that they spent in child care. The data appear below in the table:

Hours in Child Care

Low (0 – 3 hrs) Moderate (4-19 hrs) High (20 – 54 hours)

Attachment

Pattern

Secure 24 35 5

Anxious 11 10 8

Do the data indicate a dependence between attachment patterns and the number of hours spent in child care? Test using α = 0.05.

(10)

1. The FBI claims that in Boston (the bank robbery capital of the world) there is a 40% chance of no bank robberies in a month, a 30% chance of one bank robbery each month, a 20% chance of two bank robberies each month, and a 10% chance of 3 bank robberies in a month. Using the observed data below collected for 10 years, is there evidence to reject the FBI’s hypothesis on probabilities regarding bank robberies per month in Boston. Use α = 0.05.

No. of bank robberies in the month 0 1 2 3

Count 57 36 15 12

(10)

1. Let be a random sample from with prior distribution for where are known constants.
2. Find the joint density for .

(3)

1. Use your result from part (a) to find the marginal density for

(8)

(7 cont.)

1. Use your results from parts (a) and (b) to show that the posterior density for is and identify .

(6)

1. Use your result in part (c) to find the Bayes estimator for . (Hint: the Bayes estimator is the mean of the posterior distribution)

(3)