MATH 3307

Homework 7 (Lessons 20 - 22)

Instructions: Answer all questions through the EMCF tab of casa under the assignment named "Homework 7" before the deadline.

There is no "Submit" button. Your answers will be automatically submitted once the deadline arrives.

Assignments will be graded out of 20 points.

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1. Determine the residual for bivariate values (69, 265) and a LSRL of $\hat{y}=152.1+37.65x$

   A. 196

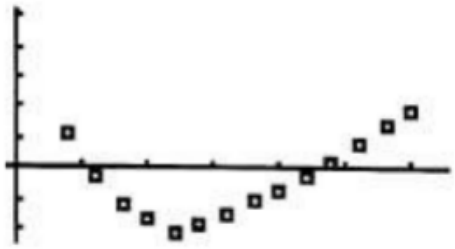
   B. 2484.95

   C. -2484.95

   D. 112.9

   E. No Residual Available

2. Based on the accompanying residual plot, what conclusion can be drawn about the LSRL?



   A. Due to the pattern in the residual plot, the LSRL is a good fit for the data.

   B. Due non-linear nature of the residual plot, we can conclude that the LSRL is a not a good fit to the data.

   C. Due to the pattern in the residual plot, the LSRL is not a good fit for the data.

   D. Since, for large values of x, the residual plot is increasing, we know that the LSRL must have a positive slope.

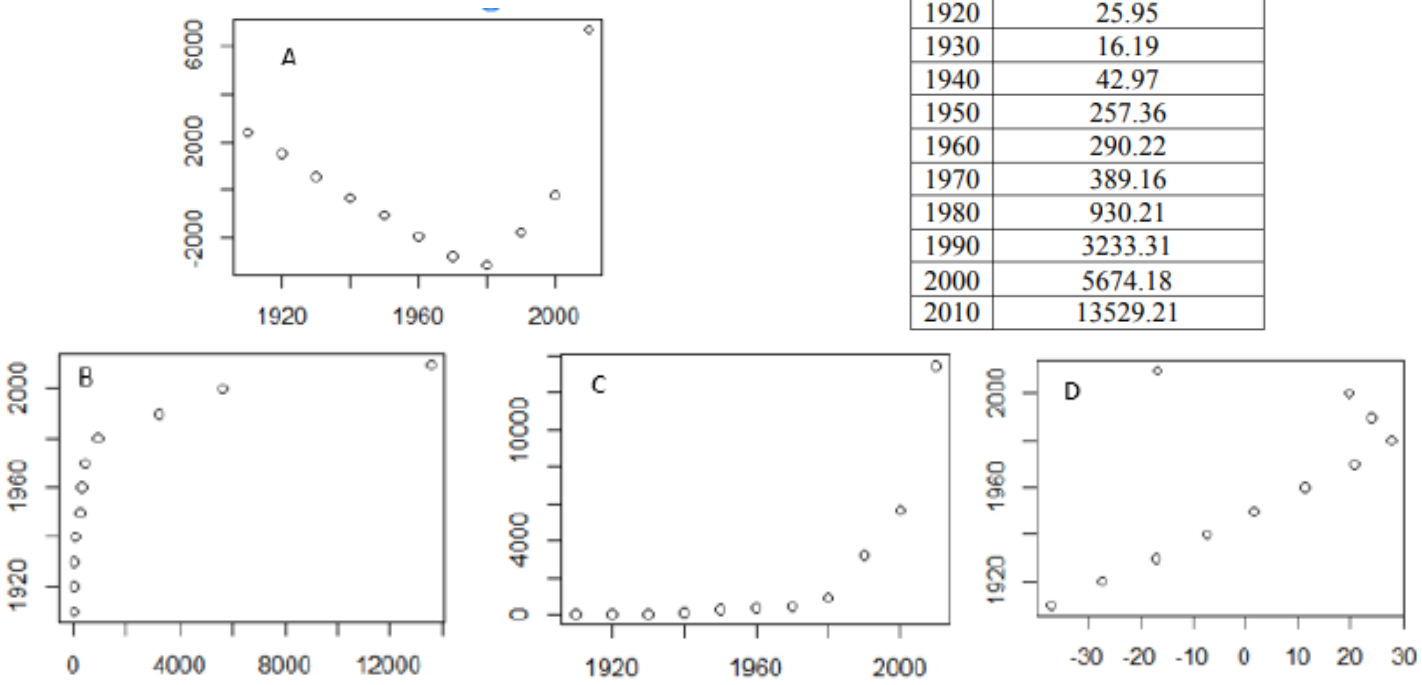
   E. The residual plot cannot be used to determine the accuracy or lack of accuracy in the model that created it.

Questions 3 - 6 are based on the following: The public debt in the US (in billions of dollars) has grown as follows:

Year	Spending (in billions of dollars)
1910	2.65
1920	25.95
1930	16.19
1940	42.97
1950	257.36
1960	290.22
1970	389.16
1980	930.21
1990	3233.31
2000	5674.18
2010	13529.21

3. Scatter Plot

4. Residual Plot



E. None of the above

5. Determine and justify a non-linear model.

A. Exponential Model, since the r^2 value is the highest

B. Quadratic Model, since the scatter-plot resembles a U-Shape.

C. Logarithmic Model, since the r^2 value is the highest when calculating cor(year, log(spending))^2.

D. Exponential Model, since the r value is the highest

E. Quadratic Model, since the r^2 value is the highest

6.Construct a non-linear model.

Note: Based on the system you use, you may get different formats of your answer. The left and right column answers are equivalent.

A. $\hat{y} = e^{148.925x - 0.07881}$ or $\hat{y} = (1.082 \times 10^{-65})2.1027^x$

B. $\hat{y} = e^{0.07881x - 148.925}$ or $\hat{y} = (2.1027 \times 10^{-65})1.082^x$

C. $\hat{y} = e^{0.07881x + 148.925}$ or $\hat{y} = (2.1027 \times 10^{-65})0.922^x$

D. $\hat{y} = e^{-0.07881x - 148.925}$ or $\hat{y} = (-2.1027 \times 10^{-65})1.082^x$

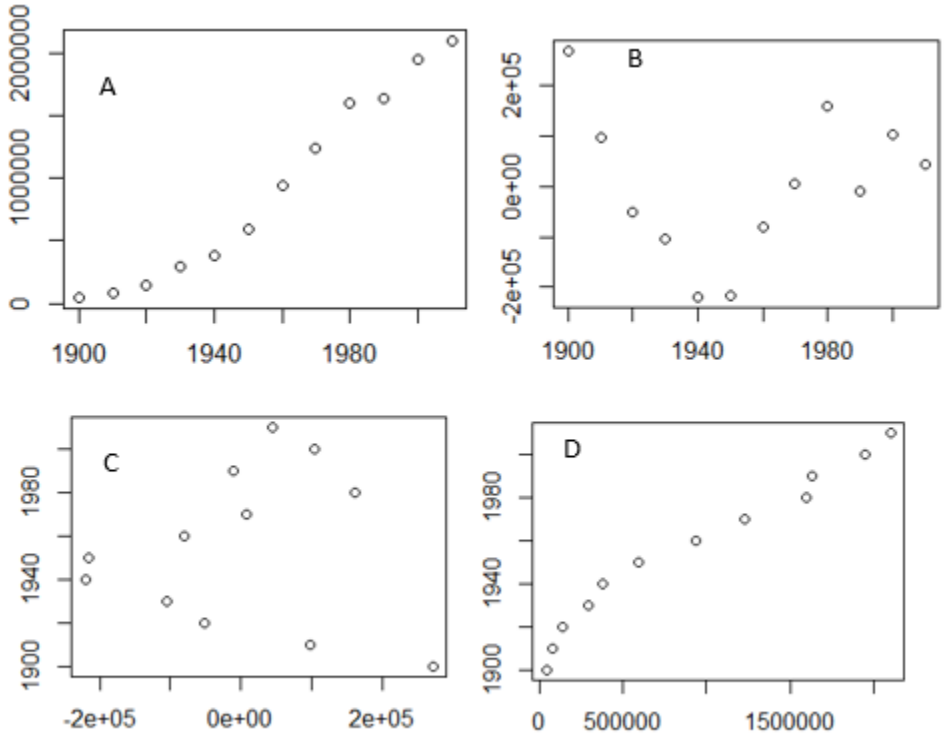
E. None of the above models.

Base Questions 7 - 10 on the following: The population in the city of Houston from 1900 to 2010 is shown:

Year	Population
1900	44,633
1910	78,800
1920	138,276
1930	292,352
1940	384,514
1950	596,163
1960	938,219
1970	1,233,505
1980	1,595,138
1990	1,631,766
2000	1,953,631
2010	2,100,263

7. Scatter Plot

8. Residual Plot



E. None of the above solutions

9. Proposed method for selection of non-linear model:

A. Select the model whose generic graph most matches the scatterplot

B. Select the model with the coefficient of determination closest to 1.0

C. Select the model that has a residual plot with the least obvious pattern

D. Any of choices A, B, or C are valid selection criteria.

E. None of the above choices are valid selection criteria.

10. Selection of non-linear model:

A. Linear B. Quadratic C. Exponential D. Logarithmic

Refer to the following data, using R Studio data, to answer Questions 11 - 14.

In R Studio use the data *airquality* to determine the following. *Hint: The data set is already in R studio use the quick reference guide to determine the following.*

[In R Studio, use command(file$column), such as mean(airquality$Temp)]

***Description**: The data gives several measurements of air quality in New York City from 1973.* Format: A data frame with 153 observations.

Temp numeric Temperature (in degrees F))

Wind numeric Wind speed (in mph)

11. Determine the LSRL for determining temperature (Response Variable) as it relates to wind speed (Explanatory Variable).

A. $\hat{y} = -1.23x - 90.13$ B. $\hat{y} = 1.23x - 90.13$

C. $\hat{y} = -90.13x + 1.23$ D. $\hat{y} = 90.13x - 1.23$ E. $\hat{y} = -1.23x + 90.13$

12. Interpret the slope of the LSRL.

A. There is an increase of 1.23 degrees for every 1 mph in wind speed.

B. There is a decrease of 1.23 degrees for every 1 mph in wind speed.

C. There is an increase of 1.23 degrees for every 90.13 mph in wind speed.

D. There is a decrease of 1.23 degrees for every 90.13 mph in wind speed.

E. The wind speed increasing by one mile per hour causes the temperature to drop by 1.23 degrees.

13. Find the values of the correlation coefficient and coefficient of determination.

A. $r = 0.2098$; $r^2 = 0.4580$ B. $r = -0.2098$; $r^2 = 0.4580$

C. $r = -0.4580$; $r^2 = 0.2098$ D. $r = 0.2098$; $r^2 = 0.0440$

E. $r = -0.2098$; r^2 = unreal answer

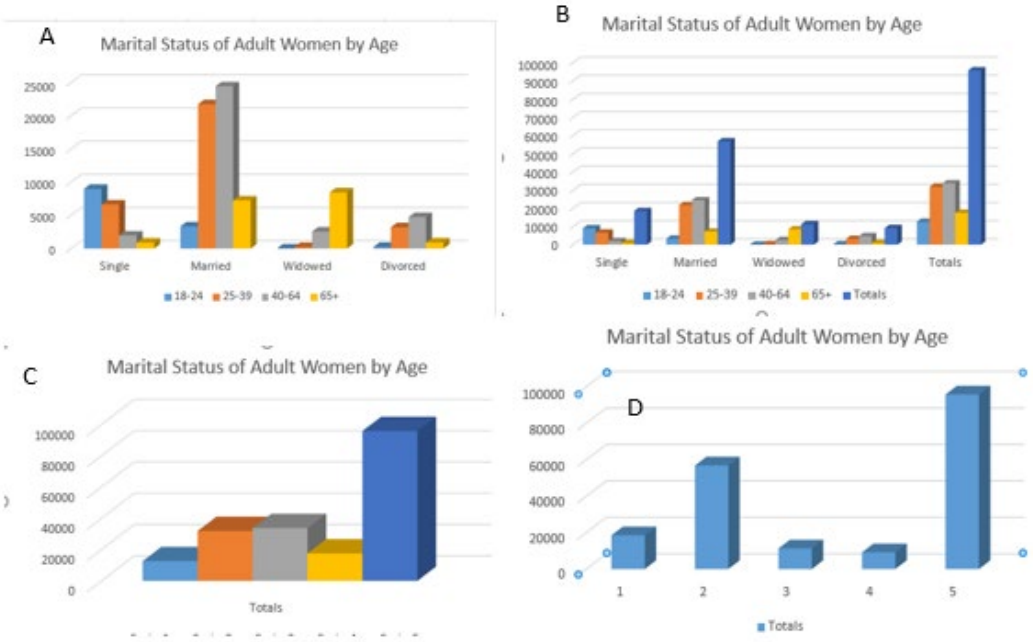
14. One of the data points indicated a day with a temperature of 84 degrees and a wind speed of 24 mph. Determine the residual of that data point.

A. -23.39 B. 37.19 C. 0.0 D. 23.39 E. 10.81

For Questions 15 - 16, refer to the following: The following two-way table describes the age and marital status of American women in 1991. The table entries are in thousands of women.

Age	Single	Married	Widowed	Divorced
18-24	9,008	3,352	8	257
25-39	6,658	21,769	248	3,224
40-64	1,975	24,462	2,570	4,755
65+	900	7,255	8,464	925

15. Draw a bar chart to display the marginal distribution of the marital status for all adult women.



16. (i) What proportion of adult women under the age of 25 have never been married? (ii) What proportion of 25 - 39 year old women are divorced?

A. (i) 0.0940; (ii) 0.0347

B. (i) 0.4858; (ii) 0.3628

C. (i 0.7135; (ii) 0.0347

D. (i) 0.4848; (ii) 0.1011

E. (i) 0.7135; (ii) 0.1011

17. In the least-squares regression line, the desired sum of the errors (residuals) should be

A. positive B. negative C. zero D. maximized

18. A prediction of the world's population in the year 2088 is an example of:

A. An outlier B. Seasonality C. Extrapolation D. Correlation

19. An observation that causes the values of the slope and the intercept in the line of best fit to be considerably different from what they would be if the observation were removed from the data set is said to be

A. A causation variable B. Extrapolation C. Influential D. A residual

20. For a set of data: x = (0,1,2,3,4,5,6) and y=(36, 28, 25, 24, 23, 21, 19), is it wise to use a linear regression to extrapolate data for x = 50?

Proposed Solution:

Since the coefficient of determination is 0.8582, the linear model is a reasonably good fit for the data, so extrapolation for any x-value is acceptable.

What is wrong with the proposed solution?

A. As the extrapolation value gets farther away from the known data points, the accuracy diminishes. An x-value of x = 50 is far too distant from the known data to obtain accurate results.

B. It is possible that other models (non-linear models) would have a coefficient of determination closer to 1.0, and therefore be a better model to make predictions from.

C. The coefficient of determination is a measure used to gauge the relative effectiveness of different data models, not as an indication of the accuracy of distant extrapolation.

D. Choices A, B, and C are all valid of the incorrectness of the proposed solution.

E. The proposed solution is correct.