

STAT 2509B
Test#1

(February 2nd, 2011)

All solutions must be shown clearly.

1. The study was conducted to evaluate how the limited tread warranty influences the price of tire. The following table gives information on the limited tread warranties (in thousand of miles) and the price of 12 randomly selected tires at a national tire retailer as of July 2009.

Warranty	60	70	75	50	80	55	65	65	70	65	60	65
Price/tire	95	70	94	90	121	70	84	80	92	79	66	95

$$\begin{aligned} \sum y_i &= 1\,036 & \sum x_i &= 780 \\ \sum y_i^2 &= 91\,944 & \sum x_i^2 &= 51\,450 & \sum x_i y_i &= 68\,050 \end{aligned}$$

- [1] (a) The response variable, y , is: _____
- [1] (b) The explanatory variable, x , is: _____
- [6] (c) State a SLR model making sure you give all assumptions necessary for statistical inference.
- [5] (d) Find the least squares estimates of β_0 and β_1 . Find the least squares fitted regression line.

Assuming no violations of the assumptions, answer the following questions:

- [6] (e) Find s^2 , an estimate of σ^2 .
- [6] (f) Use the t-test to test whether there is a significant linear relationship between the limited warranty and the price of a tire. Use $\alpha = 0.05$.
- [4] (g) Find a 95% confidence interval for the true population slope, β_1 .
- [23] (h) Complete the following ANOVA table and hence test whether there is a significant linear relationship between the limited warranty and the price of a tire. Use $\alpha = 0.05$.

Source	d.f.	SS	MS	F
Regression				
Error				
Total		2502.667		

- [5] (i) Find the values of the coefficient of correlation, r , and coefficient of determination, r^2 , and interpret their meanings in this problem. What is your conclusion about the model?

- [5] (j) Find a 95% confidence Interval of the average price of a tire when a limited tread warranty is 73 (in thousands of miles)
- [5] (k) Find a 95% Prediction Interval of the price of a tire with a limited tread warranty of 73 (in thousands of miles).

2. Refers to 1.

Warranty x_i	Price y_{ij}	n_i	\bar{y}_i	$\sum_j (y_{ij} - \bar{y}_i)^2$
50	90	1	90	0
55	70	1	70	0
60	95, 66	2	80.5	420.5
65	84, 80, 79, 95	4	84.5	161
70	70, 92	2	81	242
75	94	1	94	0
80	121	1	121	0

- [5] (a) Decompose SSE into the sum of squares due to the pure error, SSPE, and sum of squares due to the lack of fit, SSLF.

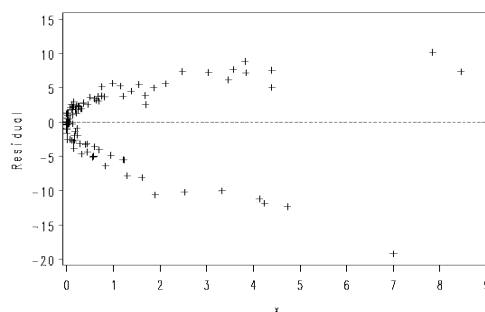
Hint: $SSPE = \sum_i \sum_j (y_{ij} - \bar{y}_i)^2 = 823.5$

$$\sum x_i = 780 \quad \sum x_i^2 = 51\,450 \quad \sum y_i = 1\,036 \quad \sum y_i^2 = 91\,944 \quad \sum x_i y_i = 68\,050$$

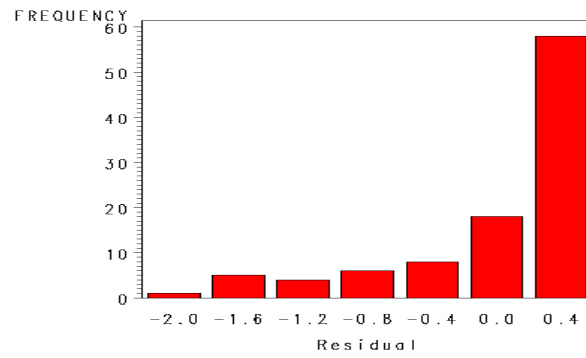
- [6] (b) Test whether the linear model $y = \beta_0 + \beta_1 x + \varepsilon$ is appropriate. Use $\alpha = 0.05$.

3. State which violations of the SLR model (if any) are indicated by each of the following residual plots. Give reasons for your answer.

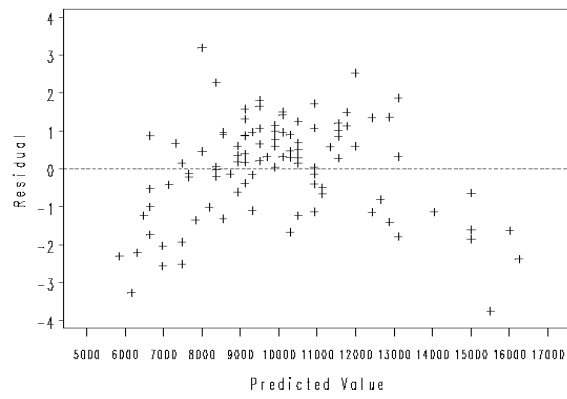
- [3] (a)



[3] (b)



[3] (c)



[3] (d)

