CPH576C Individual Project Report

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Abstract

1 INTRODUCTION

1.1 STUDY OBJECTIVES

1.2 STATISTICAL METHODS

Deleting observation
Missing data
summary statistics
Fitting data
Assessment of assumptions
Constant variance
Sensitivity test
Interpretation of results

2 VALIDATION OF ANALYSIS

3 REFERENCES

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-0.58	2.80	-0.21	0.8371
X	15.04	0.48	31.12	0.0000

Table 1: Parameter Estimates from regression model

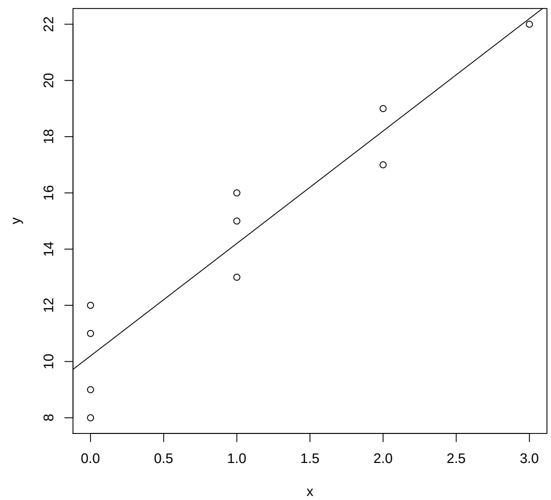

Figure 1: Airfreight breakage

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	10.20	0.66	15.38	0.0000
x	4.00	0.47	8.53	0.0000

Table 2: Parameter Estimates from regression model

4 LIST OF TABLES AND FIGURES

5 APPENDICES

6 problem 2.46

7 Distance

We can use the distance formula

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \tag{1}$$

to determine the distance between any two points (x_1, y_1) and (x_2, y_2) in $\mathbb{R}^2$. For our example, $(x_1, y_1) = (-1, 16)$ and $(x_2, y_2) = (3, 1)$, so plugging these values into the distance formula (**??**) tell us the distance between the two points is

$$d = \sqrt{(3 - (-1))^2 + (1 - 16)^2} = \sqrt{4^2 + (-15)^2} = \sqrt{241}.$$

8 Linear Fit

Consider a linear equation $y = mx + b$ through the two points. We will first determine the slope m of the line in Section **??**, and we will then determine the y-intercept b of the line in Section **??**.

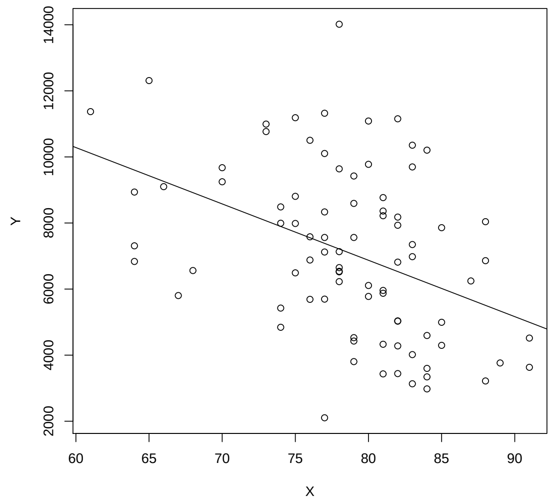

Figure 2: Crime rate

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	20517.60	3277.64	6.26	0.0000
X	-170.58	41.57	-4.10	0.0001

Table 3: Parameter Estimates from regression model

8.1 Slope

The slope of the line passing through the two points is given by the forumula

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}.$$

Plugging in our two points, we find the slope of the line between them is

$$m = \frac{1 - 16}{3 - (-1)} = -\frac{15}{4}. \tag{2}$$

8.2 Intercept

To find the y-intercept of the line, we start with the point-slope form of the line of slope m through the point (x_0, y_0):

$$y - y_0 = m(x - x_0).$$

We plug in the point $(x_0, y_0) = (-1, 16)$ and the slope we found previously (**??**) to obtain the equation

$$y - 16 = -\frac{15}{4}(x + 1).$$

Solving for y, we find the slope-intercept form of the line:

$$\begin{aligned} y &= -\frac{15}{4}x - \frac{15}{4} + 16 \\ &= -\frac{15}{4}x + \frac{49}{4}. \end{aligned}$$

Table 4: Data for Problem 2.42

$i:$	1	2	3	$\cdots$	13	14	15
Y_{i1}	13.9	16.0	10.3	$\cdots$	14.9	12.9	15.8
Y_{i2}	28.6	34.7	21.0	$\cdots$	35.1	30.0	36.2

Therefore, the y-intercept is $b = 49/4$, and the equation $y = -\frac{15}{4}x + \frac{49}{4}$ describes the line through the two points.

9 Exponential Fit

Let us consider the exponential function $y = Ae^{kx}$. For this function to pass through both points, we must find constants A and k that satisfy both equations $16 = Ae^{-k}$ and $1 = Ae^{3k}$. To solve these two simultaneous equations, we first take the ratio of the two equations, which gives us a single equation involving only k:

$$16 = \frac{Ae^{-k}}{Ae^{3k}} = e^{-4k}.$$

We can take the natural logarithm of this equation to solve for k:

$$-4k = \ln(16) = 4\ln(2),$$

which means $k = -\ln(2)$.

We can then use this value of k, along with either of the two points to solve for A. Let us consider the point $(-1, 16)$:

$$16 = Ae^{(-\ln(2))(-1)} = Ae^{\ln 2} = 2A.$$

Solving for A, we find $A = 8$, and the exponential equation through both points is

$$y = 8e^{-\ln(2)x} = 82^{-x} = 8\left(\frac{1}{2}\right)^x.$$