Handout on Simple Linear Regression 2

Philip Bachas-Daunert

2023-08-31

Questions

1. A sample of 10 billionaires is selected, and the person's age and net worth (in billions) are compared. The data are given here: X (age): 56, 39, 42, 60, 84, 37, 68, 66, 73, 55 | Y (net worth in Billions USD): 18, 14, 12, 14, 11, 10, 10, 7, 7, 5

1. (a & b) Find $\hat{y}$ for each x & find a residual for each x.

```
age = c(56, 39, 42, 60, 84, 37, 68, 66, 73, 55)
netB = c(18, 14, 12, 14, 11, 10, 10, 7, 7, 5)

df = data.frame(age , netB)

model = lm(netB~age, data = df)

data.frame(df, y_hat = fitted(model), e = residuals(model))
```

```
##    age netB     y_hat          e
## 1   56   18 10.934579  7.0654206
## 2   39   14 12.078505  1.9214953
## 3   42   12 11.876636  0.1233645
## 4   60   14 10.665421  3.3345794
## 5   84   11  9.050467  1.9495327
## 6   37   10 12.213084 -2.2130841
## 7   68   10 10.127103 -0.1271028
## 8   66    7 10.261682 -3.2616822
## 9   73    7  9.790654 -2.7906542
## 10  55    5 11.001869 -6.0018692
```

1. (c) Calculate the sum of squares total (SST).

```
SST = sum()
```

1. (d) Calculate the sum of squares regression (SSR).

1. (e) Calculate the sum of squares due to error (SSE).

1. (f) Calculate the coefficient of determination (R^2).

1. (g) Calculate the mean square error (MSE).

1. (h) Calculate the root mean square error (RMSE).

1. (i) Calculate the standard error of the slope estimate (b_1).

1. (j) Calculate the t-value for the slope estimate (b_1).

1. (k) Calculate the standard error of the intercept estimate (b_0).

1. (l) Calculate the t-value for the intercept estimate (b_0).

1. (m) Calculate the t-value for the intercept estimate (b_0).

2. The data on price ($) and the overall score for six stereo headphones tested by *Consumer Reports* were as follows (*Consumer Reports* website, March 5, 2012): Brand: Bose , Skullcandy , Koss , Phillips/O'Neill, Denon , JVC | Price (USD): 180 , 150 , 95 , 70 , 70 , 35 | Score: 76 , 71 , 61 , 56 , 40 , 26

2. (a) Find the linear regression equation that predicts the Score based on Price. State the parameter estimates to 2 places past the decimal.

2. (b) Calculate the SST, SSR, and SSE.

2. (c) Compute the coefficient of determination (R^2).

2. (d) Compute the root mean square error (RMSE).

2. (e) Calculate the standard error of the slope estimate (b_1).

2. (f) Perform a t-test.

2. (g) Does the t test indicate a significant relationship between price and the overall score? What is your conclusion?

type answer here

2. (g) Test for a significant relationship using the F-test. What is your conclusion?

type answer here