STAT 350

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1. $b_1 = \frac{\sum[(x_i-\bar{x})(y_i-\bar{y})]}{\sum(x_i-\bar{x})^2} = \sum a_i y_i$

$= \frac{\sum[(x_i-\bar{x})\cdot y_i]}{\sum(x_i-\bar{x})^2} - \frac{\sum[(x_i-\bar{x})\cdot\bar{y}]}{\sum(x_i-\bar{x})^2} = \frac{\sum[(x_i-\bar{x})\cdot y_i]}{\sum(x_i-\bar{x})^2}$ ($\sum[(x_i-\bar{x})\cdot\bar{y}] \to 0$)

$\therefore a_i = \frac{\sum[(x_i-\bar{x})\cdot y_i]}{\sum(x_i-\bar{x})^2}$

$\therefore \sqrt{\sum a_i^2} = \frac{1}{\sqrt{S_{xx}}} = \sqrt{\frac{\sum(x_i-\bar{x})^2}{(\sum(x_i-\bar{x})^2)^2}}$

$= \frac{1}{\sum(x_i-\bar{x})^2} = \frac{1}{S_{xx}}$

2. $b_1 = \frac{S_{xy}}{S_{xx}} = 92.69$

$b_0 = \bar{y} - b_1\bar{x} = 823.3 - (92.69)\cdot 4.887 = 370.3$

a). Explanatory Variable = x. the age in years

Response Variable = y. the cost.

b). $\hat{y} = 370.3 + 96.29x$

c). $SSR = b_1 S_{xy} = 92.69(7686) = 712415.34$

$SST = S_{yy} = 3848000$

$SSE = SST - SSR = 3135584.66$

$df_r = 1$

$df_e = n-2 = 13$ $\quad df_t = n-1 = 15-1 = 14$

$$MSE = \frac{SSE}{dfe} = 241198.82$$

$$F = \frac{MSR}{MSE} = \frac{712415.34}{MSE} = 2.95$$

$$b_1 \pm t_{0.025,13}\sqrt{\frac{MSE}{S_{xx}}} = 92.69 \pm 2.1604\sqrt{\frac{MSE}{S_{xx}}} \Rightarrow$$

We are 95% confident that the population slope is between -23.85 and 209.23.

d) Step. H_0 : No significant linear Relationship

H_a : Significant linear Relationship

Step : $T = \frac{b_1 - 0}{\sqrt{\frac{MSE}{S_{xx}}}} = \frac{92.69}{\sqrt{\frac{MSE}{S_{xx}}}} = 1.718$ $df = 13$ $0.1 > p\text{-value} > 0.05$

Step 4: Fail to reject H_0 since p-value > 0.05.

The data does not support ($p = 0.1064$) to claim that there is a significant relationship between the age of the car & the cost of repairs.

e) $r = \frac{S_{xy}}{\sqrt{S_{xx} S_{yy}}} = \frac{7696}{\sqrt{82.96 \quad 3848000}} = 0.4304$

f) No, the r is moderatly strong.
test & hypothesis & Confidence interval shows slope can be 0 which means no significant linear relationship between the cost & the age.

3. a). Step. H_0: There is no Linear relationship.

H_a: There is a significant Linear Relationship

step: $F = \frac{MSR}{MSE} = \frac{108.34}{13.01} = 8.327744$

df1 = 1 df2 = 6. P-value = 0.027848 < 0.05

Step: Reject H_0 since 0.027 < 0.05

The data provides sufficient support (p=0.027) to claim that there is significant Linear Relationship between

b) $r = \frac{Sxy}{\sqrt{Sxx \cdot Syy}} = -\sqrt{\frac{SSR}{SST}} = -\sqrt{\frac{108.34}{186.6}} = -0.7627$

c) Yes, from hypothesis test and r we can see there is moderately association between temperature & depth.

4. a). Don't know

b). Linear prediction.

c) Don't know.