Assignment # 1

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1.

a.) $\hat{\beta}_1 = \bar{Y} - \hat{\beta}_2 \bar{X} = 21.03 - (-0.1585)\,12.20 = 22.9637$

$$\hat{\beta}_2 = \frac{\Sigma(X_i - \bar{X})(Y_i - \bar{Y})}{\Sigma(X_i - \bar{X})^2} = \frac{-174.20}{1098.8} = -0.1585$$

$$\boxed{\hat{Y} = 22.9637 - 0.1585 X_i}$$ Regression Model

For the meaning of $\hat{B}_1$ is when x equal to 0, Y will be 22.9637 and if X increase 1 unit, Y will decrease by 0.1585 units which refer to the description of $\hat{B}_2$

b.) $$r^2 = \frac{ESS}{TSS} = 1 - \frac{RSS}{TSS} = 1 - \frac{\Sigma \hat{u}_i^2}{\Sigma y_i^2}$$

$$r^2 = 1 - \frac{RSS}{TSS} = 1 - \frac{873.14}{882.97} = 0.0111$$

$\therefore$ Total variation in Y explained by regression Model 1.11 %

Note :

TSS : $\Sigma y_i^2 = \Sigma(Y_i - \bar{Y})^2$

ESS : $\Sigma \hat{y}_i^2 = \Sigma(\hat{Y}_i - \bar{Y})^2$

RSS : $(Y_i - \hat{Y})^2 = \Sigma \hat{u}_i^2$

TSS : ESS + RSS

c.) $E(\hat{Y} \mid X = 5)$

$\hat{Y} = 22.9637 - 0.1585\,(5) = 22.1712$

$\therefore$ To assumed that given $X_i = 5$ then the result of $\hat{Y}$ will be expected approximate 22.1712.

d.) $$Var(\hat{\mu}_i) = \hat{\sigma}^2 = \frac{\Sigma \hat{\mu}_i^2}{n-2} = \frac{873.14}{30-2} = 31.1836$$

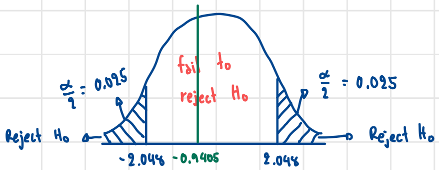
$$Var(\hat{B}_1) = \frac{\Sigma x_i^2}{n(\Sigma x_i - \bar{x})^2} \cdot \hat{\sigma}^2 = \frac{5{,}564}{30(1098.8)} \cdot 31.1836 = 5.2635$$

$$Var(\hat{B}_2) = \frac{\hat{\sigma}^2}{\Sigma(x_i - \bar{x})^2} = \frac{31.1836}{1098.8} = 0.0284$$

e.) $H_0 : B_2 = 0$

$H_1 : B_2 \neq 0$

$\alpha = 0.05$



$t_{28, 0.025} = 2.048 = \text{critical}$

$$t_{cal} = \frac{\hat{B}_2 - B_2}{Se\,\hat{B}_2} = \frac{\hat{B}_2 - B_2}{\sqrt{Var(\hat{B}_2)}} = \frac{-0.1585 - 0}{\sqrt{0.0284}} = -0.9405$$

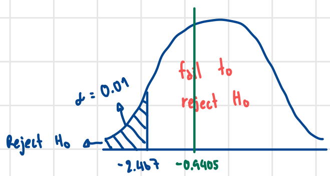
$\therefore |t_{cal}| < |t_{cri}| = (0.9405 < 2.048)$

fall in fail to reject Ho region, we believe $B_2 = 0$ (not difference from zero) which can refer that X no any effect to Y at 95% confidence level.

f.) $H_0 : B_2 \geq 0$

$H_1 : B_2 < 0$

$\alpha = 0.01$



$t_{28, 0.01} = -2.467$

$$t_{cal} = \frac{\hat{B}_2 - B_2}{Se\,\hat{B}_2} = \frac{\hat{B}_2 - B_2}{\sqrt{Var(\hat{B}_2)}} = \frac{-0.1585 - 0}{\sqrt{0.0284}}$$

$$= -0.9405$$

$\therefore |t_{cal}| < |t_{cri}| = (0.9405 < 2.467)$

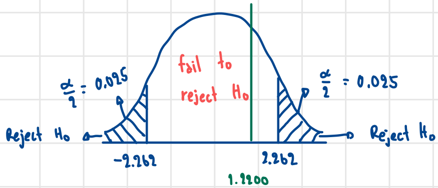
fall in fail to reject Ho region, we believe B_2 not less than 0 which means x no effect to Y at 99% confidence level.

2.

a.) $H_0 : B_2 = 0$

$H_1 : B_2 \neq 0$

$\alpha = 0.05$



$t_{9,0.025} = 2.262 = \text{critical}$

$$t_{cal} = \frac{\hat{B}_2 - B_2}{Se\,\hat{B}_2} = \frac{\hat{B}_2 - B_2}{\sqrt{Var(\hat{B}_2)}} = \frac{-502.4 - 0}{411.8} = 1.2200$$

$\therefore |t_{cal}| < |t_{cri}| = (1.2200 < 2.262)$

fail to reject H_0 region, we believe $\hat{B}_2 = 0$ (not difference from zero) which means x no effect to Y at 95% confidence level and this result is not make economic sense.

b.) $$\boxed{\hat{Y}_0 - \left(t_{\frac{\alpha}{2}} \cdot \sigma_{\hat{Y}_0}\right) \leq Y_0 \leq \hat{Y}_0 + \left(t_{\frac{\alpha}{2}} \cdot \sigma_{\hat{Y}_0}\right)}$$

- $Var(\hat{Y}_0) = \sigma^2 \left[\frac{1}{n} + \frac{(x_0 - \bar{x})^2}{\Sigma(x_i - \bar{x})^2}\right] = 212,877 \left[\frac{1}{11} + \frac{(5 - 7.45)^2}{78.73}\right] = 35,582.5345$

- $x_i = 5 \rightarrow \hat{Y}_0 = 7,836 - 502.4(5) = 5324$
- $\sigma_{\hat{Y}_0} = \sqrt{35,582.5345} = 188.6333$
- $t_{\frac{0.05}{2}} = t_{0.025,9} = 2.262$

$5,324 - (2.262 \cdot 188.6333) \leq Y_0 \leq 5,324 + (2.262 \cdot 188.633)$

$4,897.3115 \leq Y_0 \leq 5750.6885$

Assumed his car will be averagely priced at when his car is 5 years old, we estimate price in (4,897.3115, 5750.6885) at 95% confidence level.

c.) Due to the given that when multiply all the X with 10, the new SRF with the Standard error resulted will be change by mutiply by 10 to all variable of X.
In contrast, if plus or minus to all variable of X, X will not change.

d.) $$e_p = \frac{d\,{}^{Q}\!/_{Q}}{d\,{}^{P}\!/_{P}} = \frac{dQ}{dp} \times \frac{P}{Q}$$

- A : $\frac{dP}{dA} \times \frac{A}{P} = -5,024 \times \frac{10}{2,812} = -1.7866$

$\therefore |-1.7866| = 1.7866 > 1$ refer to elasticity