Department of Mathematics and Statistics KFUPM
STAT 319-05 Quiz#5, Time: 20 mins

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A rocket motor is manufactured by bonding together two types of propellants, an igniter and a sustainer. The shear strength of the bond (y) is thought to be a linear function of the age of the propellant (x) when the motor is cast. Twenty observations are taken and their summary is given as:

$$\sum y = 42648.15, \quad \sum x = 266.75, \quad \sum y^2 = 92642655.86, \quad \sum x^2 = 4672.4375, \quad \sum xy = 527619.89$$

   a. Estimate the regression line of shear strength of the bond (y) on age of the propellant (x).

   b. Interpret both the regression coefficients i.e. $\hat{\beta}_0$ and $\hat{\beta}_1$.

    c. Estimate the standard errors of $\hat{\beta}_0$ and $\hat{\beta}_1$.

    d. Test the significance of slope coefficient.

$$S_{xx} = \sum x^2 - \frac{1}{n}(\sum x)^2, \quad S_{yy} = \sum y^2 - \frac{1}{n}(\sum y)^2, \quad S_{xy} = \sum xy - \frac{1}{n}(\sum y)(\sum x)$$

$$Y = \beta_0 + \beta_1 X + \epsilon, \quad \hat{Y} = \hat{\beta}_0 + \hat{\beta}_1 X, \quad e = Y - \hat{Y}, \quad \hat{\beta}_1 = \frac{S_{xy}}{S_{xx}}, \quad \hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}$$

$\hat{\beta}_0 \pm t_{\frac{\alpha}{2}, n-2}\sqrt{\hat{\sigma}^2\left[\frac{1}{n} + \frac{\bar{x}^2}{S_{xx}}\right]}$	$T = \dfrac{\hat{\beta}_0 - \beta_0}{\sqrt{\hat{\sigma}^2\left[\frac{1}{n} + \frac{\bar{x}^2}{S_{xx}}\right]}}$
$\hat{\beta}_1 \pm t_{\frac{\alpha}{2}, n-2}\sqrt{\frac{\hat{\sigma}^2}{S_{xx}}}$	$T = \dfrac{\hat{\beta}_1 - \beta_1}{\sqrt{\frac{\hat{\sigma}^2}{S_{xx}}}}$