Assignment 2

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January 2022

Q57 Suppose $r_{1.23}$ and $r_{1.234}$ are sample multiple correlation coefficients of X_1 on X_2, X_3 and X_1 on X_2, X_3, X_4 respectively. Which of the following is possible?

1. $r_{1.23} = -0.3$ and $r_{1.234} = 0.7$
2. $r_{1.23} = 0.7$ and $r_{1.234} = 0.3$
3. $r_{1.23} = 0.3$ and $r_{1.234} = 0.7$
4. $r_{1.23} = 0.7$ and $r_{1.234} = -0.3$

Coefficient Of Multiple Correlation: The coefficient of multiple correlation, denoted R, is a scalar that is defined as the Pearson correlation coefficient between the predicted and the actual values of the dependent variable in a linear regression model that includes an intercept.

The coefficient of multiple correlation(R) is known as the square root of the coefficient of determination(R^2)

for any multi-linear regression model R^2 can be calculated using the formula given bellow

$$R^2 = 1 - \frac{sumsquaredregression(SSR)}{totalsumofsquares(SST)} \tag{1}$$

$$R^2 = 1 - \frac{\sum(y_i - \hat{y_i})}{\sum(y_i - \bar{y})} \tag{2}$$

where,

y_i is actual value,
$\hat{y_i}$ is predicted value,
and $\bar{y}$ is mean of y values.

Solution From equation 2 we can see that value of coefficient of multiple correlation can't be negative, also if we introduce more variables, the R^2 will always increase, it can never decrease. This follows mathematically from the

observation that,

$$(y - \beta_0 - \beta_1 x_1 - \cdots - \beta_p x_p - \beta_{p+1} x_{p+1})^2 \leq (y - \beta_0 - \beta_1 x_1 - \cdots - \beta_p x_p)^2 \quad (3)$$

Hence by looking at options we can say that option 3($r_{1.23} = 0.3$ and $r_{1.234} = 0.7$) is the correct answer