Q1. Define the following terms.

a). Design of experiment

b). Covariate

Q2. Answer the following:

a). List down the basic principles of DOE.

b). Write the assumptions of random error term in our DOE models.

c). In a completely randomized design for ANOVA, the number of degrees of freedom for the numerator and denominator are 4 and 25, respectively. The total number of observations must equal:

d). To test the significance of a multiple regression model involving 4 independent variables and 30 observations, the numerator and denominator degrees of freedom (respectively) for $F$ are:

e). A multiple regression equation includes 3 independent variables, and the coefficient of determination is 0.64. What is the percentage of the variation in $y$ that is explained by the regression equation?

f). According to the information given below, what is the value of the $F$ statistic? MST=50, MSE=10
Q3. The effect of three different lubricating oils on fuel economy in diesel truck engines is being studied. Fuel economy is measured using brake-specific fuel consumption after the engine has been running for 15 minutes. Five different truck engines are available for the study, and the experimenters conduct the following randomized complete block design.

<table>
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<th>2</th>
<th>3</th>
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</tbody>
</table>

Analyze the data from this experiment, assuming non-normality at 5% level of significance.

**Treatment Factor:**

**Blocking Factor:**

**Hypotheses:**

**H0:**

**H1:**

**ANOVA Table**

**Conclusions:**