1. A multiple regression model is fitted with the response variable being *Fuel* and the predictors being *Tax*, *Dlic*, *Income*, and *logMiles*. The results of the fitted model is as follows, and please answer the following questions: (25 分):

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Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 154.1928   194.9062   0.791 0.432938
Tax          -4.2280     2.0301  -2.083 0.042873
Dlic          0.4719     0.1285   3.672 0.000626
Income       -6.1353     2.1936  -2.797 0.007508
logMiles     18.5453     6.4722   2.865 0.006259

Residual standard error: 64.89 on 46 degrees of freedom
Multiple R-Squared: 0.5105
F-statistic: 11.99 on 4 and 46 DF,  p-value: 9.33e-07
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   a. What is the sample size? (5 分)
   b. What is the value of Sum of Squares of Error (SSE)? (5 分)
   c. What is the value of Sum of Squares of Regression (SSR)? (5 分)
   d. What is the value of Sum of Square Total? ? (5 分)
   e. What does the results of F-test tell us about the fitted model? (5 分)

2. for a simple linear regression model $y = \beta_0 + \beta_1 x + \varepsilon$, prove the estimated slope equation is

$$\hat{\beta}_1 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$$ using Normal equation approach. (25 分)

3. The following question is about standard error (25 分):
   a. Write down the equation for standard error. (5 分)
   b. Define standard error. (5 分)
   c. What are the properties/behavior of standard error? (5 分)
   d. Why is standard error important? (5 分)
   e. Describe the procedure to calculate standard error of estimated variance. (5 分)

4. Assuming that there is a square empty land of 200 × 200 m. Two researchers want to establish a spacing experiment. A spacing experiment is which trees are planted in different distances to test their growth responses. The two researchers decide spacing as the treatment factor with five treatment levels: 1 × 1 m, 2 × 2 m, 3 × 3 m, 4 × 4 m, and 5 × 5 m. For example, the 1 × 1 m treatment level means that trees are all planted at 1 m apart. The two researchers decide that each experimental unit is a square plot of 40 × 40 m. Thus, there are 5 experimental units for each treatment level. Researcher A wants to carry out a Completely Randomized Design (CRD), but Researcher B wants to carry out Latin Square Design (LaSD). Please answer the following questions (25 分):
   a. Write down the procedure of a Completely Randomized Design (CRD). (10 分)
   b. Draw an example of a CRD for the spacing experiment. (2 分)
   c. Write down the procedure of a Latin Square Design (LaSD). (10 分)
   d. Draw an example of a LaSD for the above spacing experiment. (3 分)

試題隨卷繳回