**CRD with Fixed Effects (by hand)**

**Do problem by hand, submit picture/scan of your handwritten work. You may use R only as a “calculator” to only support your calculations or to look up critical values from the F-table, do not use built in AOV() or ANOVA() commands**

A rental car company wants to investigate whether the type of car rented affects the length of the rental period. An experiment is run for one week at a particular location until 10 rental contracts for each car type have been observed. The results are shown in the following table.

| **Type of Car** | **Observations (rental period in days)** | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Subcompact | 3 | 5 | 3 | 7 | 6 | 5 | 3 | 2 | 1 | 6 |  |
| Compact | 1 | 3 | 4 | 7 | 5 | 6 | 3 | 2 | 1 | 7 |  |
| Midsize | 4 | 1 | 3 | 5 | 7 | 1 | 2 | 4 | 2 | 7 |  |
| Full size | 3 | 5 | 7 | 5 | 10 | 3 | 4 | 7 | 2 | 7 |  |

1. Does this experiment represent a CRD? Why or why not?
2. Do you feel that the type of car is a fixed or random effect?
3. Write the linear effects equation
4. Write the hypothesis you are testing
5. Estimate the grand mean of rental length
6. Estimate the mean of rental length by each type of car
7. Estimate the variance by the Mean Square Error (MSE)
8. Compute the Mean Square of Treatments (MSTr)
9. Comment on an eyeball comparison of the MSTr to the MSE. Do you believe that the type of car has an impact on the true mean rental length?
10. What is the F-statistic corresponding to the hypothesis in part d)?
11. Test hypothesis that the type of car affects the mean length of the rental period with an α=0.05 level of significance (critical value in R: qf(p, df1, df2)).