*In this problem set you will get some practice performing One-Way Analysis of Variance.* ***Enjoy!***

Listed below are measured amounts of greenhouse gas emissions from cars in three different categories. The data are taken from the Car Measurements data set that can be found in the statdisk datasets for our textbook. The measurements are in tons per year, expressed as CO2 equivalents. The goal of the study is to determine whether the number of cylinders appears to be related to the average amount of greenhouse gas emissions by using a 5% significance level to test the claim that the different car categories have different mean amounts of greenhouse gas emissions.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Four Cylinder** | 7.2 | 7.9 | 6.8 | 7.4 | 6.5 | 6.6 | 6.7 | 6.5 | 6.5 | 7.1 | 6.7 | 5.5 | 7.3 |
| **Six Cylinder** | 8.7 | 7.7 | 7.7 | 8.7 | 8.2 | 9.0 | 9.3 | 7.4 | 7.0 | 7.2 | 7.2 | 8.2 |  |
| **Eight Cylinder** | 9.3 | 9.3 | 9.3 | 8.6 | 8.7 | 9.3 | 9.3 |  |  |  |  |  |  |

1. What are the independent variable and the dependent variable for this study? Why?
2. What are the null and alternate hypotheses for this test? Why?

Null hypothesis: each of the three groups of cars has the same mean emission level

Alternative hypothesis: at least one of the groups of cars has a different mean emission level

1. Enter the data into statdisk using three columns with one column for each of the car categories. Use the One-Way Analysis of Variance task in the Analysis menu to fill in the table below using a 5% significance level.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | SS | MS | F Test Stat. | Critical F | P-value |
| Between Groups | 2 | 25.08585165 | 12.54292582 | 32.32095735 | 3.327654 | 4.15386E-08 |
| Within Groups | 29 | 11.25414835 | 0.388074081 |  |  |  |
| Total | 31 | 36.34 |  |  |  |  |

1. Use the results in the table above to demonstrate the formula   
   DF Total = DF Treatment + DF Error.

31= 2+29

1. Use the results in the table above to demonstrate the formula   
   MS Treatment = SS Treatment / DF Treatment.

12.54292583= 25.08585165/2

1. Use the results in the table above to demonstrate the formula   
   MS Error = SS Error / DF Error.

0.388074081=11.25414835/29

1. Use the results in the table above to demonstrate the formula  
   F Test Statistic = MS Treatment / MS Error.

32.32095735=12.54292582/0.388074081

1. Use the plot button to create a graph of the F-distribution for this study. Paste a copy of the graph below, and resize it to fit nicely.
2. What is the reported critical value for this hypothesis test using a 5% significance level?
3. What is the reported p-value for this hypothesis test using a 5% significance level?
4. State the decision for this test. Explain the reason for this decision using a comparison of the critical value to the computed test statistic, a comparison of the p-value to the 5% significance level, and the graph displayed above.
5. Do the different car categories appear to have different mean amounts of greenhouse gas emissions? Explain this using the results above.
6. Does the number of cylinders appear to be related to the average amount of greenhouse gas emissions? Explain this using the results above.