Data Exploration and Visualization

Conducted by: Dr. Abhishek Agarwal

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Home Work 4 (Amir Ali)

1. Calculate the sum of squares between groups
2. Calculate the sum of squares within groups
3. Fill in the ANOVA table
4. How much of the variance in height is explained by the treatment group?
5. Plot the results

In [15]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import statsmodels.api as sm
from statsmodels.formula.api import ols
```

In [3]:

```
df=pd.read_csv('treatment.csv',sep=';')
```

In [4]:

```
df.head(2)
```

Out[4]:

	treatment1	treatment2	treatment3	treatment4
0	60	50	48	47
1	67	52	49	67

In [5]:

```
print(df.shape)
```

```
(10, 4)
```

Question 1

In [6]:

```
#sum of square between groups groups
mean_total = df.to_numpy().reshape(-1).mean()
sum_of_square_between_groups = ((df.mean()-mean_total)**2).sum()*len(df.index)
print(sum_of_square_between_groups)
```

```
196.5000000000001
```

Question 2

In [7]:

```
#sum of square within groups
sum_of_square_within_groups = ((df-df.mean())**2).sum().sum()
print(sum_of_square_within_groups)
```

```
2060.6
```

Question 3

In [8]:

```
import scipy.stats as stats
# stats f_oneway functions takes the groups as input and returns ANOVA F and p value
fvalue, pvalue = stats.f_oneway(df['treatment1'], df['treatment2'], df['treatment3'], df['treatment4'])
print(fvalue, pvalue)
```

```
1.1443268950791026 0.3443595629359094
```

In [9]:

```
df_melt = pd.melt(df.reset_index(),
                  id_vars=['index'],
                  value_vars=['treatment1', 'treatment2', 'treatment3', 'treatment4'])
```

In [10]:

```
df_melt.columns = ['index', 'treatments', 'value']
```

In [11]:

```
df_melt.head()
```

Out[11]:

	index	treatments	value
0	0	treatment1	60
1	1	treatment1	67
2	2	treatment1	42
3	3	treatment1	67
4	4	treatment1	56

In [16]:

```
# Ordinary Least Squares (OLS) model
model = ols('value ~ C(treatments)', data=df_melt).fit()
anova_table = sm.stats.anova_lm(model, typ=2)
anova_table
```

Out[16]:

	sum_sq	df	F	PR(>F)
C(treatments)	196.5	3.0	1.144327	0.34436
Residual	2060.6	36.0	NaN	NaN

Question 4

In [13]:

```
variance = np.var(df_melt)
print(variance)
```

```
index     8.2500
value    56.4275
dtype: float64
```

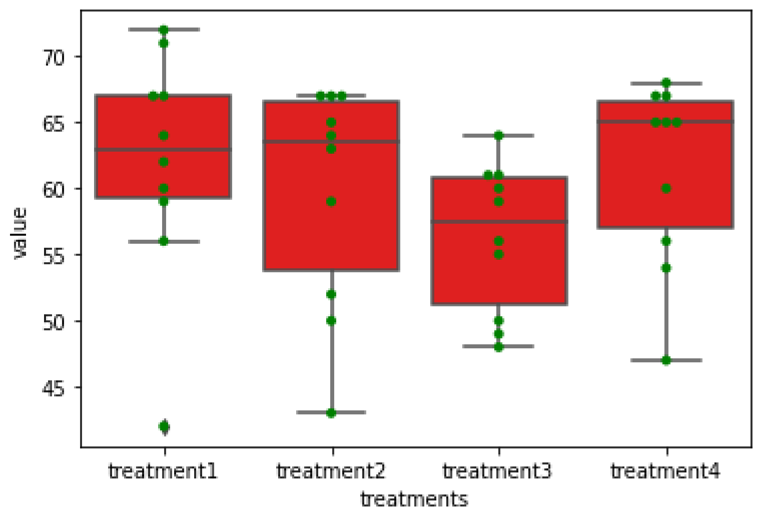
In [ ]:

```
# more than half of the variance is explained by the treatment groups.
```

Question 5

In [14]:

```
# generate a boxplot to see the data distribution by treatments. Using boxplot, we can
# easily detect the differences between different treatments
import seaborn as sns
ax = sns.boxplot(x='treatments', y='value', data=df_melt, color='Red')
ax = sns.swarmplot(x="treatments", y="value", data=df_melt, color='Green')
plt.show()
```



In [ ]: