Dummy variables

Import the relevant libraries

In [3]:
```python
import numpy as np
import pandas as pd
import statsmodels.api as sm
import matplotlib.pyplot as plt
import seaborn as sns

sns.set()
```

Load the data

In [4]:
```python
# Load the data from a .csv in the same folder.
raw_data = pd.read_csv('Dummies.csv')
```

In [5]:
```python
# what's inside this data frame
raw_data
```

Out[5]:

	SAT	GPA	Attendance
0	1714	2.40	No
1	1664	2.52	No
2	1760	2.54	No
3	1685	2.74	No
4	1693	2.83	No
...	...	...	...
79	1936	3.71	Yes
80	1810	3.71	Yes
81	1987	3.73	No
82	1962	3.76	Yes
83	2050	3.81	Yes

84 rows × 3 columns

Map the data

In [6]:
```python
# Map all 'No' entries with 0, and all 'Yes' entries with 1. Put that in a new variable called 'data'

data = raw_data.copy()
data['Attendance'] = data['Attendance'].map({'Yes': 1, 'No': 0})

# what's inside
data
```

Out[6]:

	SAT	GPA	Attendance
0	1714	2.40	0
1	1664	2.52	0
2	1760	2.54	0
3	1685	2.74	0
4	1693	2.83	0
...	...	...	...
79	1936	3.71	1
80	1810	3.71	1
81	1987	3.73	0
82	1962	3.76	1
83	2050	3.81	1

84 rows × 3 columns

In [7]:
```python
# descriptive statistics
data.describe()
```

Out[7]:

	SAT	GPA	Attendance
count	84.000000	84.000000	84.000000
mean	1845.273810	3.330238	0.464286
std	104.530661	0.271617	0.501718
min	1634.000000	2.400000	0.000000
25%	1772.000000	3.190000	0.000000
50%	1846.000000	3.380000	0.000000
75%	1934.000000	3.502500	1.000000
max	2050.000000	3.810000	1.000000

Regression

In [8]:
```python
# Following the regression equation, our dependent variable (y) is the GPA
y = data ['GPA']
# Similarly, our independent variable (x) is the SAT score
x1 = data [['SAT','Attendance']]
```

In [9]:
```python
# Add a constant
x = sm.add_constant(x1)
# Fit the model, according to the OLS  method with a dependent variable y and an idependent x
results = sm.OLS(y,x).fit()
# Print a nice summary of the regression.
results.summary()
```

Out[9]:

OLS Regression Results

Dep. Variable:	GPA	**R-squared:**	0.565
Model:	OLS	**Adj. R-squared:**	0.555
Method:	Least Squares	**F-statistic:**	52.70
Date:	Tue, 04 Oct 2022	**Prob (F-statistic):**	2.19e-15
Time:	14:40:25	**Log-Likelihood:**	25.798
No. Observations:	84	**AIC:**	-45.60
Df Residuals:	81	**BIC:**	-38.30
Df Model:	2		
Covariance Type:	nonrobust		

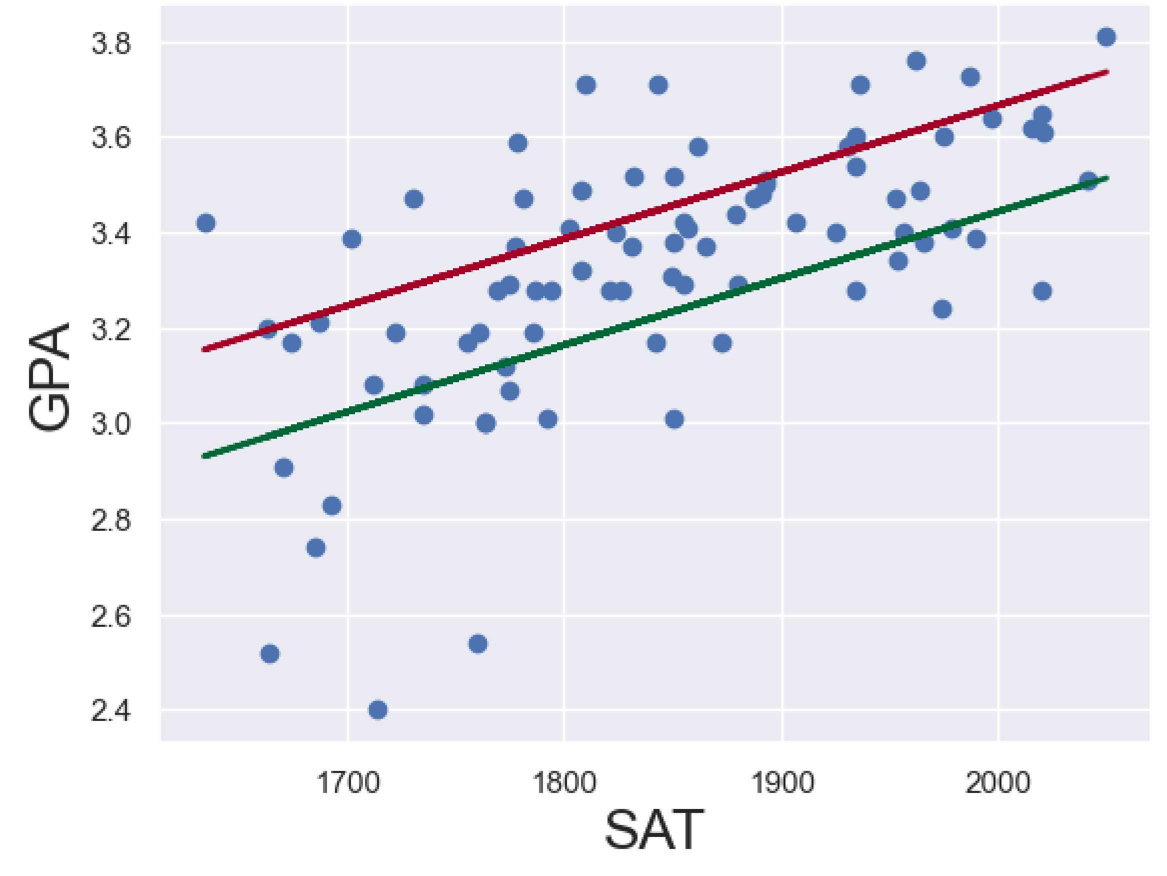
	coef	std err	t	P>|t|	[0.025	0.975]
const	0.6439	0.358	1.797	0.076	-0.069	1.357
SAT	0.0014	0.000	7.141	0.000	0.001	0.002
Attendance	0.2226	0.041	5.451	0.000	0.141	0.304

Omnibus:	19.560	**Durbin-Watson:**	1.009
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	27.189
Skew:	-1.028	**Prob(JB):**	1.25e-06
Kurtosis:	4.881	**Cond. No.**	3.35e+04

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 3.35e+04. This might indicate that there are
strong multicollinearity or other numerical problems.

Plot the regression line(s) on the scatter plot

In [10]:
```python
# Create a scatter plot of SAT and GPA
plt.scatter(data['SAT'],y)
# Define the two regression equations, depending on whether they attended (yes), or didn't (no)
yhat_no = 0.6439 + 0.0014*data['SAT']
yhat_yes = 0.8665 + 0.0014*data['SAT']
# Plot the two regression lines
fig = plt.plot(data['SAT'],yhat_no, lw=2, c='#006837')
fig = plt.plot(data['SAT'],yhat_yes, lw=2, c='#a50026')
# Name axes
plt.xlabel('SAT', fontsize = 20)
plt.ylabel('GPA', fontsize = 20)
plt.show()
```



Plot the regression line(s) on the scatter plot and color the data points

In [11]:
```python
plt.scatter(data['SAT'],data['GPA'], c=data['Attendance'],cmap='RdYlGn_r')

# Define the two regression equations (one with a dummy = 1, the other with dummy = 0)

yhat_no = 0.6439 + 0.0014*data['SAT']
yhat_yes = 0.8665 + 0.0014*data['SAT']

# Plot the two regression lines
fig = plt.plot(data['SAT'],yhat_no, lw=2, c='#006837')
fig = plt.plot(data['SAT'],yhat_yes, lw=2, c='#a50026')
plt.xlabel('SAT', fontsize = 20)
plt.ylabel('GPA', fontsize = 20)
plt.show()
```

Add the original regression line

In [12]:
```python
# Same as above, this time we are including the regression line WITHOUT the dummies.

plt.scatter(data['SAT'],data['GPA'], c=data['Attendance'],cmap='RdYlGn_r')

# Define the two regression equations (one with a dummy = 1, the other with dummy = 0)
# We have those above already, but for the sake of consistency, we will also include them here
yhat_no = 0.6439 + 0.0014*data['SAT']
yhat_yes = 0.8665 + 0.0014*data['SAT']
# Original regression line
yhat = 0.0017*data['SAT'] + 0.275

# Plot the two regression lines
fig = plt.plot(data['SAT'],yhat_no, lw=2, c='#006837', label ='regression line1')
fig = plt.plot(data['SAT'],yhat_yes, lw=2, c='#a50026', label ='regression line2')
# Plot the original regression line
fig = plt.plot(data['SAT'],yhat, lw=3, c='#4C72B0', label ='regression line')

plt.xlabel('SAT', fontsize = 20)
plt.ylabel('GPA', fontsize = 20)
plt.show()
```