### This tutorial is modified from: https://www.dataquest.io/blog/jupyter-notebook-tutorial/ (https://www.dataquest.io/blog/jupyter-notebook-tutorial/)

In [1]:

```
print('Hello World!')
```

```
Hello World!
```

In [2]:

```
import time
time.sleep(5)
```

In [3]:

```
def say_hello(recipient):
    return 'Hello, {}!'.format(recipient)
say_hello('EE4211 Students')
```

Out[3]:

```
'Hello, EE4211 Students!'
```

# Intro to Markdown (This is a level 1 heading)

## This is a level 2 heading

This is some plain text that forms a paragraph. Add emphasis via **bold** and **bold**, or italic and italic. Paragraphs must be separated by an empty line.

- Sometimes we want to include lists.
  - Which can be indented.

1. Lists can also be numbered.
2. It is possible to include hyperlinks (https://www.ece.nus.edu.sg/stfpage/motani/)
3. You can add images too:


In [4]:

```
import numpy as np
def square(x):
    return x * x
```

In [5]:

```
x = np.random.randint(1, 10)
y = square(x)
print('%d squared is %d' % (x, y))
```

```
4 squared is 16
```

Let get some data from Fortune 500 (http://archive.fortune.com/magazines/fortune/fortune500_archive/full/2005/) companies spanning over 50 years since the list's first publication in 1955, put together from Fortune's public archive. You can get a CSV of the data at this link (https://s3.amazonaws.com/dq-blog-files/fortune500.csv).

In [6]:

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
sns.set(style="darkgrid")
```

In [7]:

```
df = pd.read_csv('fortune500.csv')
```

In [8]:

```
df.head()
```

Out[8]:

| | Year | Rank | Company | Revenue (in millions) | Profit (in millions) |
|---|---|---|---|---|---|
| **0** | 1955 | 1 | General Motors | 9823.5 | 806 |
| **1** | 1955 | 2 | Exxon Mobil | 5661.4 | 584.8 |
| **2** | 1955 | 3 | U.S. Steel | 3250.4 | 195.4 |
| **3** | 1955 | 4 | General Electric | 2959.1 | 212.6 |
| **4** | 1955 | 5 | Esmark | 2510.8 | 19.1 |

In [9]:

```
df.tail()
```

Out[9]:

| | Year | Rank | Company | Revenue (in millions) | Profit (in millions) |
|---|---|---|---|---|---|
| **25495** | 2005 | 496 | Wm. Wrigley Jr. | 3648.6 | 493 |
| **25496** | 2005 | 497 | Peabody Energy | 3631.6 | 175.4 |
| **25497** | 2005 | 498 | Wendy's International | 3630.4 | 57.8 |
| **25498** | 2005 | 499 | Kindred Healthcare | 3616.6 | 70.6 |
| **25499** | 2005 | 500 | Cincinnati Financial | 3614.0 | 584 |

In [10]:

```
#Let's rename those columns so we can refer to them later.
df.columns = ['year', 'rank', 'company', 'revenue', 'profit']
```

In [11]:

```
len(df)
```

Out[11]:

```
25500
```

In [12]:

```
df.dtypes
```

Out[12]:

```
year          int64
rank          int64
company      object
revenue     float64
profit       object
dtype: object
```

In [13]:

```
non_numberic_profits = df.profit.str.contains('[^0-9.-]')
df.loc[non_numberic_profits].head()
```

Out[13]:

| | year | rank | company | revenue | profit |
|---|---|---|---|---|---|
| **228** | 1955 | 229 | Norton | 135.0 | N.A. |
| **290** | 1955 | 291 | Schlitz Brewing | 100.0 | N.A. |
| **294** | 1955 | 295 | Pacific Vegetable Oil | 97.9 | N.A. |
| **296** | 1955 | 297 | Liebmann Breweries | 96.0 | N.A. |
| **352** | 1955 | 353 | Minneapolis-Moline | 77.4 | N.A. |

In [14]:

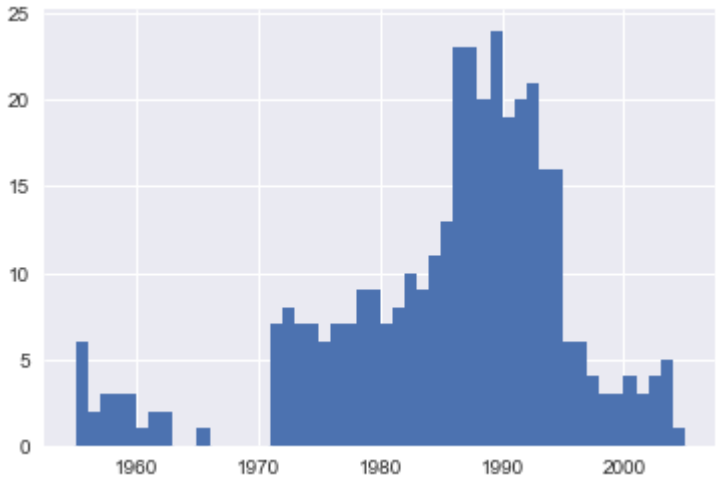
```
# How much bad data do we have?
round(100*len(df.profit[non_numberic_profits])/len(df),2)
```

Out[14]:

```
1.45
```

In [15]:

```
bin_sizes, _, _ = plt.hist(df.year[non_numberic_profits], bins=range(1955, 2006
))
```




In [16]:

```
#Let's remove the bad rows
df = df.loc[~non_numberic_profits]
df.profit = df.profit.apply(pd.to_numeric)
```

In [17]:

```
len(df)
```

Out[17]:

```
25131
```

In [18]:

```
df.dtypes
```

Out[18]:

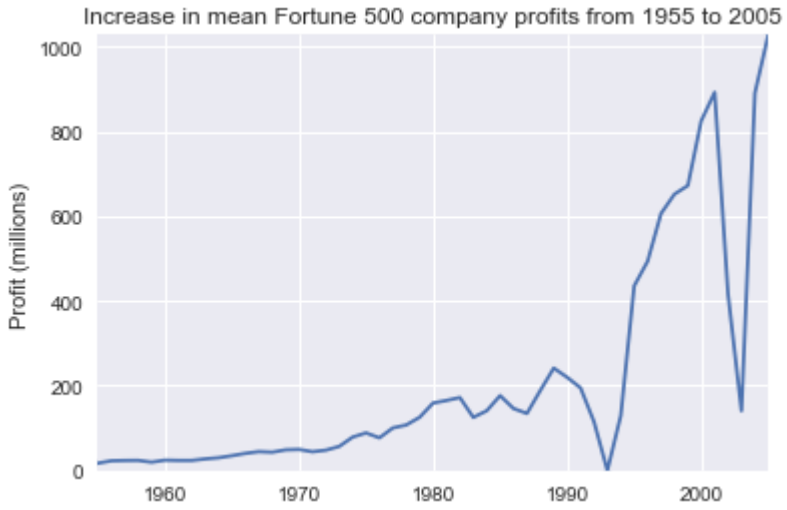
```
year          int64
rank          int64
company      object
revenue     float64
profit      float64
dtype: object
```

In [19]:

```
group_by_year = df.loc[:, ['year', 'revenue', 'profit']].groupby('year')
avgs = group_by_year.mean()
x = avgs.index
def plot(x, y, ax, title, y_label):
    ax.set_title(title)
    ax.set_ylabel(y_label)
    ax.plot(x, y)
    ax.margins(x=0, y=0)
```

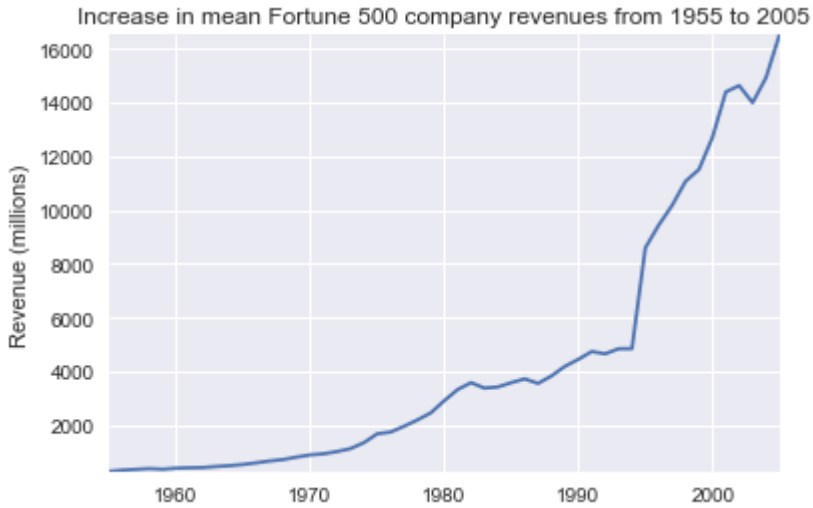
In [20]:

```
# Let's plot profits
y1 = avgs.profit
fig, ax = plt.subplots()
plot(x, y1, ax, 'Increase in mean Fortune 500 company profits from 1955 to 2005'
, 'Profit (millions)')
```




In [21]:

```
# Let's plot revenues
y2 = avgs.revenue
fig, ax = plt.subplots()
plot(x, y2, ax, 'Increase in mean Fortune 500 company revenues from 1955 to 200
5', 'Revenue (millions)')
```



In [22]:

```
# A more complex plot, code taken from StackOverflow: https://stackoverflow.com/
a/47582329/604687
def plot_with_std(x, y, stds, ax, title, y_label):
    ax.fill_between(x, y - stds, y + stds, alpha=0.2)
    plot(x, y, ax, title, y_label)

fig, (ax1, ax2) = plt.subplots(ncols=2)
title = 'Increase in mean and std Fortune 500 company %s from 1955 to 2005'
stds1 = group_by_year.std().profit.values
stds2 = group_by_year.std().revenue.values
plot_with_std(x, y1.values, stds1, ax1, title % 'profits', 'Profit (millions)')
plot_with_std(x, y2.values, stds2, ax2, title % 'revenues', 'Revenue (millions)'
)
fig.set_size_inches(14, 4)
fig.tight_layout()
```