Objective:-

- To predict the profit made by a startup on the basis of expenses incurred and the state where they operate

Tasks:-

- Validate all the assumptions
- Compute all the regression evaluation metrics
- Comment on the best evaluation metrics for this problem

```
# Importing the libraries
import numpy as np
import pandas as pd
from numpy import math

from sklearn.preprocessing import MinMaxScaler
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import r2_score
from sklearn.metrics import mean_squared_error

import matplotlib.pyplot as plt


from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```
# Importing the dataset
dataset = pd.read_csv('/content/drive/MyDrive/AlmaBetter/Cohort Aravali/Module 3/Week 1/Day 3/data/50_Startups.csv')
```

```
len(dataset)
```

```
50
```

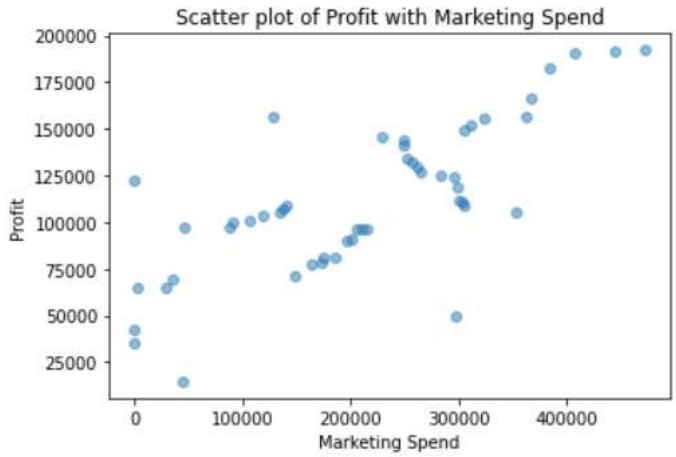
```
dataset.head()
```

	R&D Spend	Administration	Marketing Spend	State	Profit
0	165349.20	136897.80	471784.10	New York	192261.83
1	162597.70	151377.59	443898.53	California	191792.06
2	153441.51	101145.55	407934.54	Florida	191050.39
3	144372.41	118671.85	383199.62	New York	182901.99
4	142107.34	91391.77	366168.42	Florida	166187.94

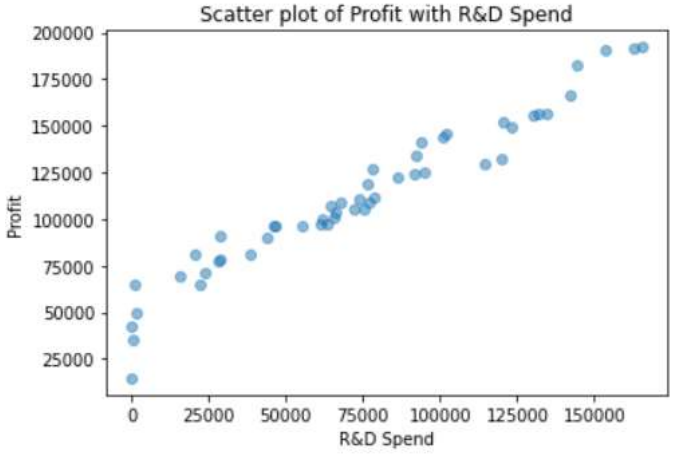
```
dataset.shape
```

```
(50, 5)
```

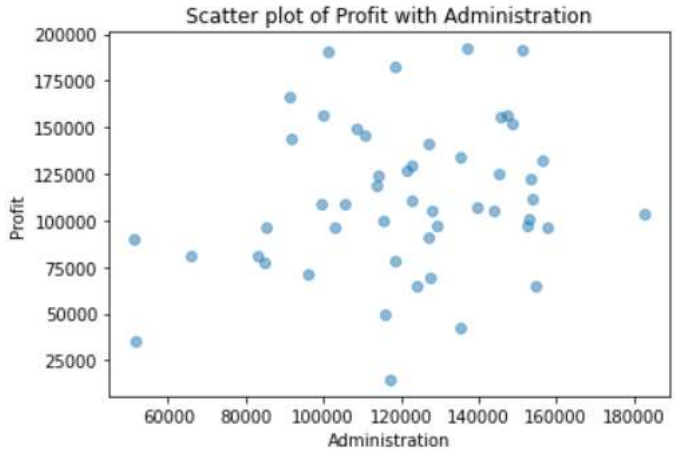
```
plt.scatter(dataset['Marketing Spend'], dataset['Profit'], alpha=0.5)
plt.title('Scatter plot of Profit with Marketing Spend')
plt.xlabel('Marketing Spend')
plt.ylabel('Profit')
plt.show()
```




```
plt.scatter(dataset['R&D Spend'], dataset['Profit'], alpha=0.5)
plt.title('Scatter plot of Profit with R&D Spend')
plt.xlabel('R&D Spend')
plt.ylabel('Profit')
plt.show()
```




```
plt.scatter(dataset['Administration'], dataset['Profit'], alpha=0.5)
plt.title('Scatter plot of Profit with Administration')
plt.xlabel('Administration')
plt.ylabel('Profit')
plt.show()
```

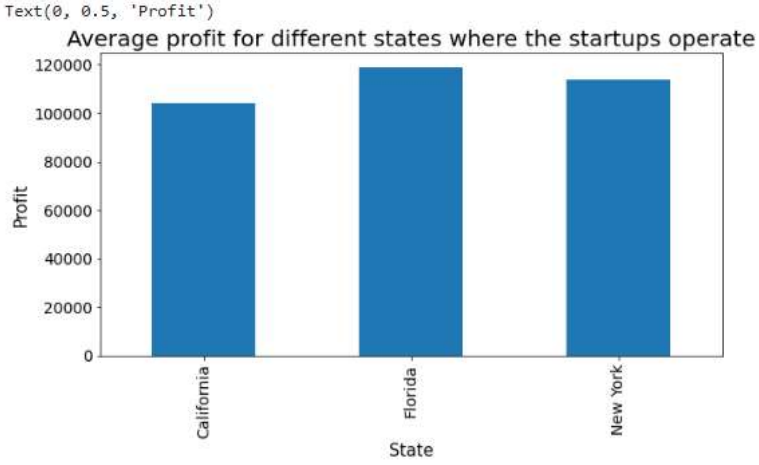


```
# Create the figure object
ax = dataset.groupby(['State'])['Profit'].mean().plot.bar(
    figsize = (10,5),
    fontsize = 14
)

# Set the title
ax.set_title("Average profit for different states where the startups operate", fontsize = 20)

# Set x and y-labels
ax.set_xlabel("State", fontsize = 15)
ax.set_ylabel("Profit", fontsize = 15)
```

```
Text(0, 0.5, 'Profit')
```




```
dataset.State.value_counts()
```

New York 17

California 17

Florida 16

Name: State, dtype: int64

```
# Create dummy variables for the catgeorical variable State
dataset['NewYork_State'] = np.where(dataset['State']=='New York', 1, 0)
dataset['California_State'] = np.where(dataset['State']=='California', 1, 0)
dataset['Florida_State'] = np.where(dataset['State']=='Florida', 1, 0)

# Drop the original column State from the dataframe
dataset.drop(columns=['State'],axis=1,inplace=True)
```

```
dataset.head()
```

	R&D Spend	Administration	Marketing Spend	Profit	NewYork_State	California_State	Florida_State
0	165349.20	136897.80	471784.10	192261.83	1	0	0
1	162597.70	151377.59	443898.53	191792.06	0	1	0
2	153441.51	101145.55	407934.54	191050.39	0	0	1
3	144372.41	118671.85	383199.62	182901.99	1	0	0
4	142107.34	91391.77	366168.42	166187.94	0	0	1

```
dependent_variable = 'Profit'
```

```
# Create a list of independent variables
independent_variables = list(set(dataset.columns.tolist()) - {dependent_variable})
independent_variables
```

```
['Administration',
 'Marketing Spend'
```

```
# Create the data of independent variables
X = dataset[independent_variables].values

# Create the dependent variable data
y = dataset[dependent_variable].values


# Splitting the dataset into the Training set and Test set
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 0)


# Transforming data
scaler = MinMaxScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)


X_train[0:10]
```

```
array([[0.48655174, 0.45494286, 0.        , 1.        , 0.        ,
        0.33561668],
       [0.3173015 , 0.43561799, 0.        , 0.        , 1.        ,
        0.2782839 ],
       [0.87258866, 0.28413435, 0.        , 1.        , 0.        ,
        0.45557444],
       [1.        , 0.44680961, 1.        , 0.        , 0.        ,
        0.2807759 ],
       [0.59103645, 0.62511553, 0.        , 1.        , 0.        ,
        0.55488118],
       [0.88568959, 0.68649342, 0.        , 1.        , 0.        ,
        0.7880179 ],
       [0.98922572, 0.54370828, 0.        , 1.        , 0.        ,
        0.72539353],
       [0.6847981 , 0.0040356 , 0.        , 0.        , 1.        ,
        0.0060492 ],
       [0.00432296, 0.        , 0.        , 0.        , 1.        ,
        0.00327821],
       [0.95618996, 0.22709197, 0.        , 0.        , 1.        ,
        0.39676926]])
```

```
# Fitting Multiple Linear Regression to the Training set
regressor = LinearRegression()
regressor.fit(X_train, y_train)
```

LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)

```
# Predicting the Test set results
y_pred = regressor.predict(X_test)
```

```
math.sqrt(mean_squared_error(y_test, y_pred))
```

9137.990152794966

```
r2_score(y_test, y_pred)
```

0.9347068473282422

Start coding or generate with AI.