```
!pip install pandas
!pip install matplotlib
!pip install seaborn
!pip install scikit-learn
```

```
Requirement already satisfied: pandas in /usr/local/lib/python3.10/dist-packages (2.0.3)
Requirement already satisfied: python-dateutil>=2.8.2 in /usr/local/lib/python3.10/dist-packages (from pandas) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas) (2023.4)
Requirement already satisfied: tzdata>=2022.1 in /usr/local/lib/python3.10/dist-packages (from pandas) (2024.1)
Requirement already satisfied: numpy>=1.21.0 in /usr/local/lib/python3.10/dist-packages (from pandas) (1.25.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.8.2->pandas) (1.16.0)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.10/dist-packages (3.7.1)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (1.2.1)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (4.53.0)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (1.4.5)
Requirement already satisfied: numpy>=1.20 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (1.25.2)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (24.1)
Requirement already satisfied: pillow>=6.2.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (9.4.0)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (3.1.2)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (2.8.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.7->matplotlib) (1.16.0)
Requirement already satisfied: seaborn in /usr/local/lib/python3.10/dist-packages (0.13.1)
Requirement already satisfied: numpy!=1.24.0,>=1.20 in /usr/local/lib/python3.10/dist-packages (from seaborn) (1.25.2)
Requirement already satisfied: pandas>=1.2 in /usr/local/lib/python3.10/dist-packages (from seaborn) (2.0.3)
Requirement already satisfied: matplotlib!=3.6.1,>=3.4 in /usr/local/lib/python3.10/dist-packages (from seaborn) (3.7.1)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib!=3.6.1,>=3.4->seaborn) (1.2.
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib!=3.6.1,>=3.4->seaborn) (0.12.1)
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Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib!=3.6.1,>=3.4->seaborn) (3.1.
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.10/dist-packages (from matplotlib!=3.6.1,>=3.4->seaborn) (
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.2->seaborn) (2023.4)
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Requirement already satisfied: scikit-learn in /usr/local/lib/python3.10/dist-packages (1.2.2)
Requirement already satisfied: numpy>=1.17.3 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (1.25.2)
Requirement already satisfied: scipy>=1.3.2 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (1.11.4)
Requirement already satisfied: joblib>=1.1.1 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (1.4.2)
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (3.5.0)
```

```
import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns
import sklearn
```

```
dataset = pd.read_csv('internship.csv')
```

```
dataset.head()
```

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

```
dataset.tail()
```

	R&D Spend	Administration	Marketing Spend	Profit
45	1000.23	124153.04	1903.93	64926.08
46	1315.46	115816.21	297114.46	49490.75
47	0.00	135426.92	0.00	42559.73
48	542.05	51743.15	0.00	35673.41
49	0.00	116983.80	45173.06	14681.40

```
dataset.describe()
```

	R&D Spend	Administration	Marketing Spend	Profit
count	50.000000	50.000000	50.000000	50.000000
mean	73721.615600	121344.639600	211025.097800	112012.639200
std	45902.256482	28017.802755	122290.310726	40306.180338
min	0.000000	51283.140000	0.000000	14681.400000
25%	39936.370000	103730.875000	129300.132500	90138.902500
50%	73051.080000	122699.795000	212716.240000	107978.190000
75%	101602.800000	144842.180000	299469.085000	139765.977500
max	165349.200000	182645.560000	471784.100000	192261.830000

```
print('There are', dataset.shape[0], 'rows and', dataset.shape[1], 'columns in the dataset')
```

```
There are 50 rows and 4 columns in the dataset
```

```
print('There are',dataset.duplicated().sum(),'duplicate values in the dataset')
```

```
There are 0 duplicate values in the dataset
```

```
dataset.isnull().sum()
```

```
R&D Spend          0
Administration     0
Marketing Spend    0
Profit             0
dtype: int64
```

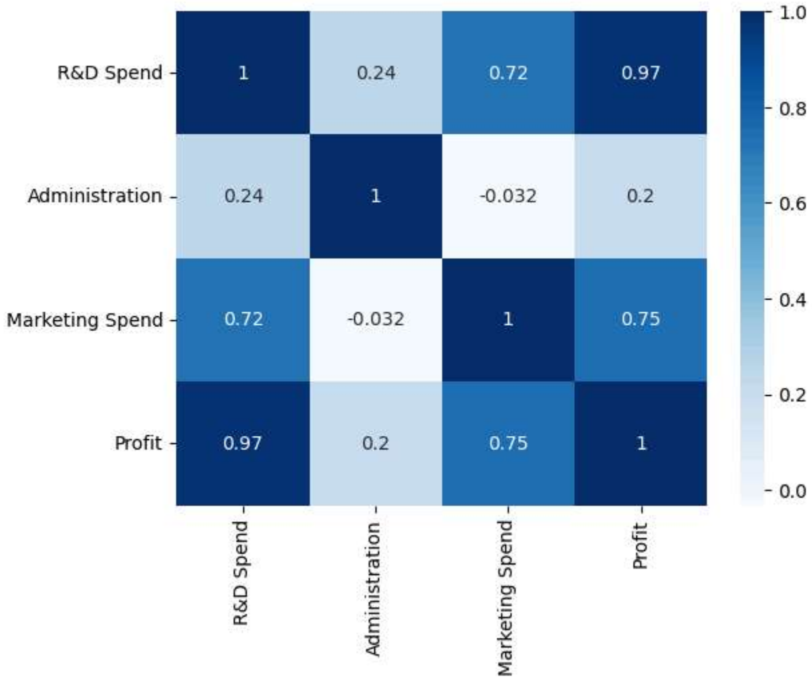
```
dataset.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50 entries, 0 to 49
Data columns (total 4 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   R&D Spend        50 non-null     float64
 1   Administration   50 non-null     float64
 2   Marketing Spend  50 non-null     float64
 3   Profit           50 non-null     float64
dtypes: float64(4)
memory usage: 1.7 KB
```

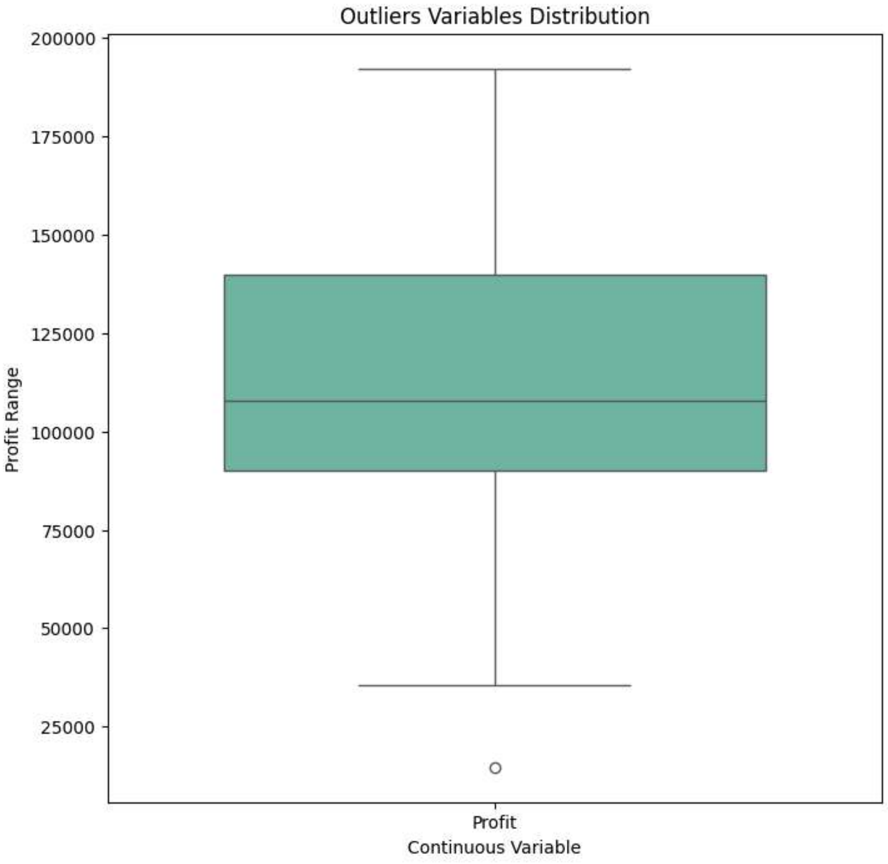
```
c=dataset.corr()
c
```

	R&D Spend	Administration	Marketing Spend	Profit
R&D Spend	1.000000	0.241955	0.724248	0.972900
Administration	0.241955	1.000000	-0.032154	0.200717
Marketing Spend	0.724248	-0.032154	1.000000	0.747766
Profit	0.972900	0.200717	0.747766	1.000000

```
sns.heatmap(c,annot=True,cmap='Blues')
plt.show()
```

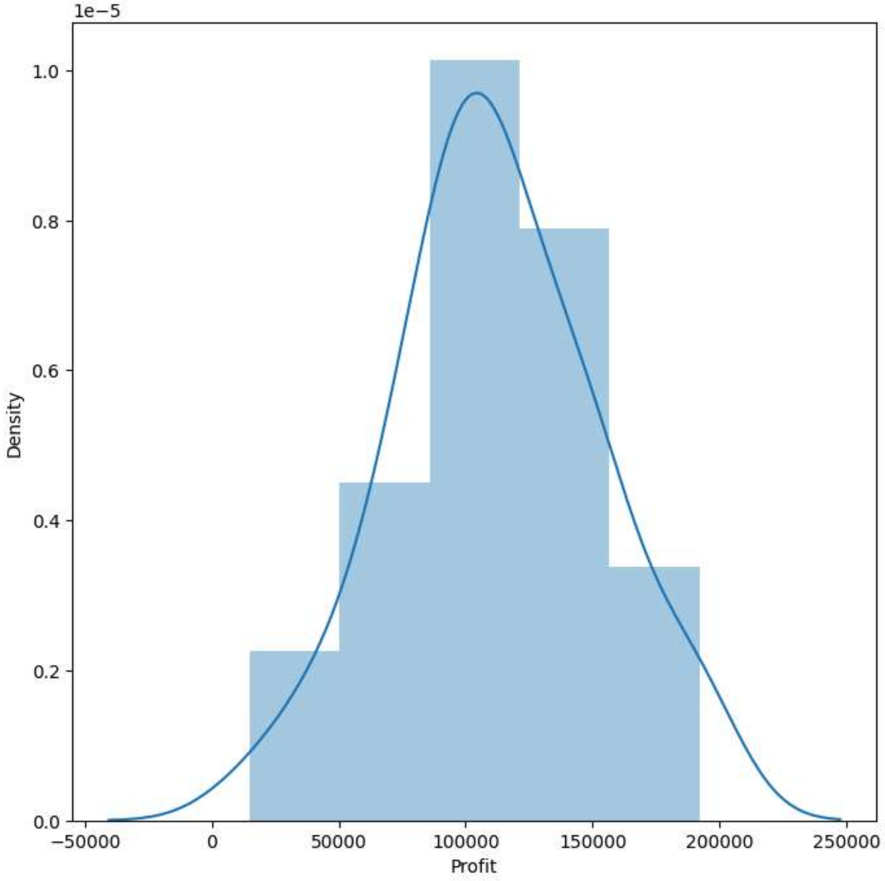


```
outliers = ['Profit']
plt.rcParams['figure.figsize'] = [8, 8]
sns.boxplot(data=dataset[outliers], orient='v', palette='Set2', width=0.7)
plt.title('Outliers Variables Distribution')
plt.ylabel('Profit Range')
plt.xlabel('Continuous Variable')
plt.show()
```

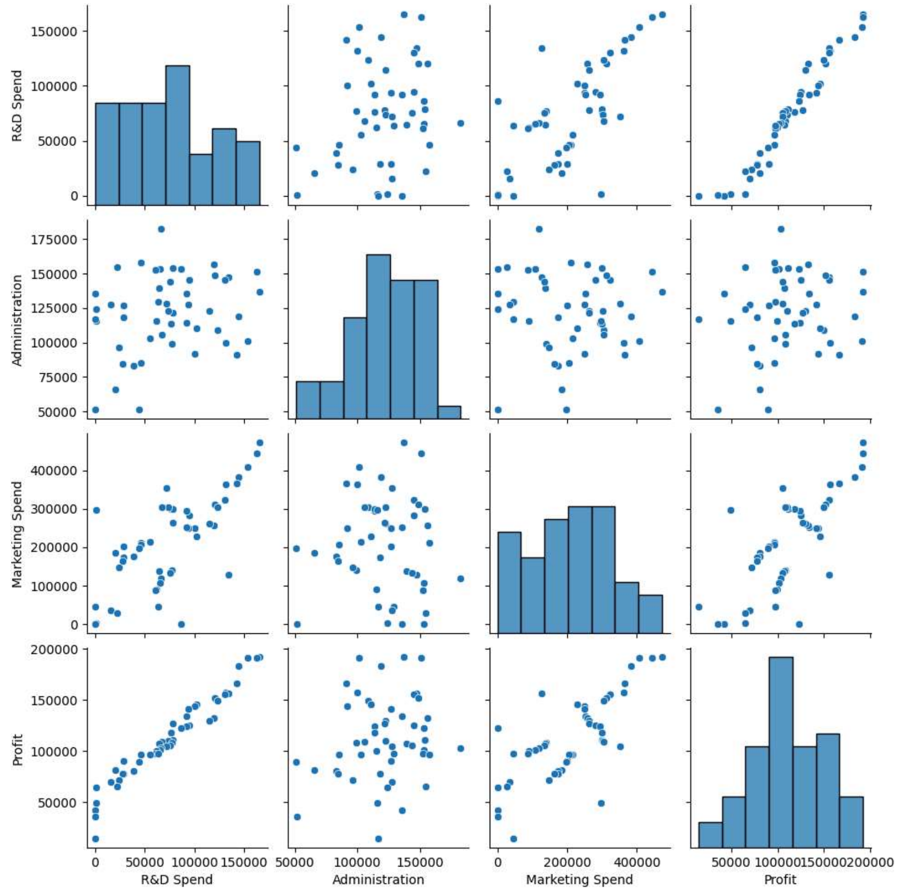


```
sns.distplot(dataset['Profit'], bins=5, kde=True)
plt.show()
```

```
<ipython-input-15-0b0e85318e1c>:1: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(dataset['Profit'], bins=5, kde=True)
```



```
sns.pairplot(dataset)
plt.show()
```



```
x = dataset.iloc[:,:-1].values
y = dataset.iloc[:,3].values
```

```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test = train_test_split(x,y,train_size=0.7,random_state=0)
x_train
```

```
array([[130298.13, 145530.06, 323876.68],
       [119943.24, 156547.42, 256512.92],
       [  1000.23, 124153.04,   1903.93],
       [   542.05,  51743.15,      0.  ],
       [ 65605.48, 153032.06, 107138.38],
       [114523.61, 122616.84, 261776.23],
       [ 61994.48, 115641.28,  91131.24],
       [ 63408.86, 129219.61,  46085.25],
       [ 78013.11, 121597.55, 264346.06],
       [ 23640.93,  96189.63, 148001.11],
       [ 76253.86, 113867.3 , 298664.47],
       [ 15505.73, 127382.3 ,  35534.17],
       [120542.52, 148718.95, 311613.29],
       [ 91992.39, 135495.07, 252664.93],
       [ 64664.71, 139553.16, 137962.62],
       [131876.9 ,  99814.71, 362861.36],
       [ 94657.16, 145077.58, 282574.31],
            [ 28754.33, 118546.05, 172795.67],
            [     0.  , 116983.8 ,  45173.06],
            [162597.7 , 151377.59, 443898.53],
            [ 93863.75, 127320.38, 249839.44],
            [ 44069.95,  51283.14, 197029.42],
            [ 77044.01,  99281.34, 140574.81],
            [134615.46, 147198.87, 127716.82],
            [ 67532.53, 105751.03, 304768.73],
            [ 28663.76, 127056.21, 201126.82],
            [ 78389.47, 153773.43, 299737.29],
            [ 86419.7 , 153514.11,      0.  ],
            [123334.88, 108679.17, 304981.62],
            [ 38558.51,  82982.09, 174999.3 ],
            [  1315.46, 115816.21, 297114.46],
            [144372.41, 118671.85, 383199.62],
            [165349.2 , 136897.8 , 471784.1 ],
            [     0.  , 135426.92,      0.  ],
            [ 22177.74, 154806.14,  28334.72]])
```

```
from sklearn.linear_model import LinearRegression
model = LinearRegression()
model.fit(x_train,y_train)
('Model has been trained successfully')
```

```
'Model has been trained successfully'
```

```
y_pred = model.predict(x_test)
y_pred
```

```
array([104054.44293869, 132719.3459701 , 133640.26830949,  72294.76911458,
       179685.62227843, 114508.97572031,  66305.23069863,  98297.69326565,
       114277.91894933, 169112.36095691,  96257.40152149,  87916.97242208,
       110687.33942598,  90670.8337806 , 127780.63539583])
```

```
testing_data_model_score = model.score(x_test,y_test)
testing_data_model_score
```

```
0.9355188337118219
```

```
df = pd.DataFrame(data={'Predicted value':y_pred.flatten(),'Actual value':y_test.flatten()})
df
```

	Predicted value	Actual value
0	104054.442939	103282.38
1	132719.345970	144259.40
2	133640.268309	146121.95
3	72294.769115	77798.83
4	179685.622278	191050.39
5	114508.975720	105008.31
6	66305.230699	81229.06
7	98297.693266	97483.56
8	114277.918949	110352.25
9	169112.360957	166187.94
10	96257.401521	96778.92
11	87916.972422	96479.51
12	110687.339426	105733.54
13	90670.833781	96712.80
14	127780.635396	124266.90

```
from sklearn.metrics import r2_score
r2_score = r2_score(y_pred,y_test)
print('R2 score of the Model is',r2_score)
```

```
R2 score of the Model is 0.9341560653448715
```

```
from sklearn.metrics import mean_squared_error
mse = mean_squared_error(y_pred,y_test)
print('Mean squared error of the Model is',mse)
```