In [1]:

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

importing Dataset

In [3]:

```python
dataset = pd.read_csv('50_Startups.csv')
```

In [5]:

```python
dataset.head(),dataset.tail()
```

Out[5]:

```
(   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,
     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)
```

In [7]:

```python
print('rows :',dataset.shape[0])
print('columns :',dataset.shape[1])
```

```
rows : 50
columns : 4
```

In [8]:

```python
#checking for repeated values in dataset
dataset.duplicated().sum()
```

Out[8]:

```
0
```

In [9]:

```python
#checking for null values in dataset
dataset.isnull().sum()
```

Out[9]:

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

In [10]:

```python
#dataset schema
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)
```

In [12]:

```python
#corr function
#corr() is used to find the pairwise correlation of all columns in the dataframe.
c = dataset.corr()
```

In [13]:

```python
c
```

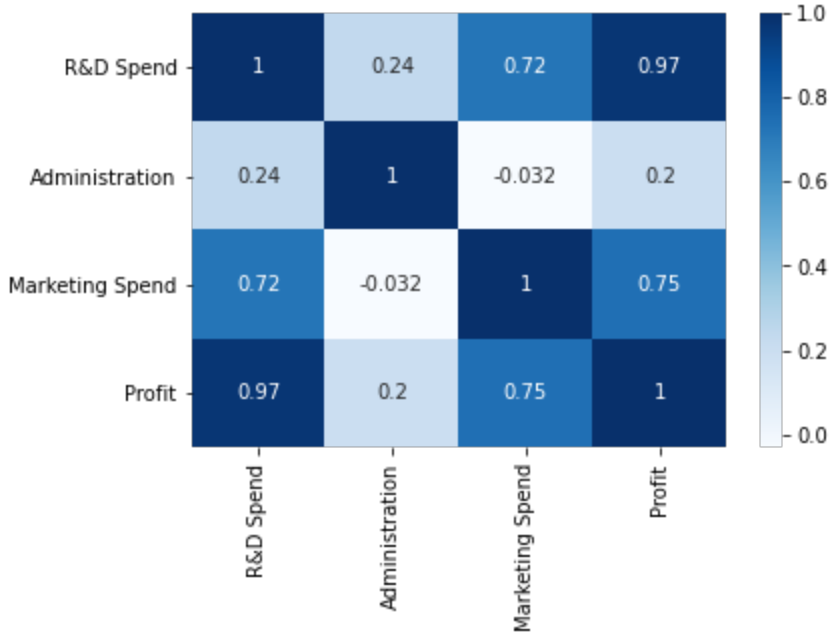
Out[13]:

	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

correlation matrix

In [14]:

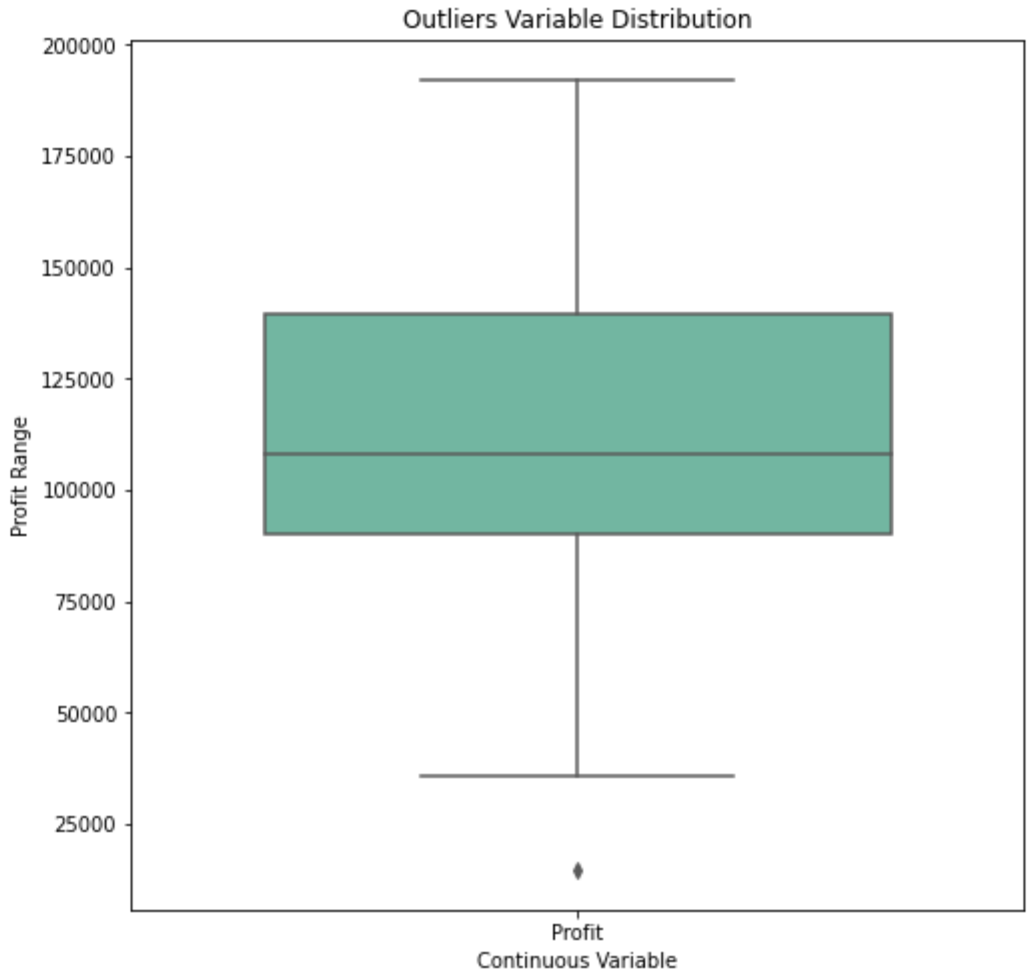
```python
sns.heatmap(c,annot=True,cmap='Blues')
plt.show()
```



Outliers detection in the target variable

In [15]:

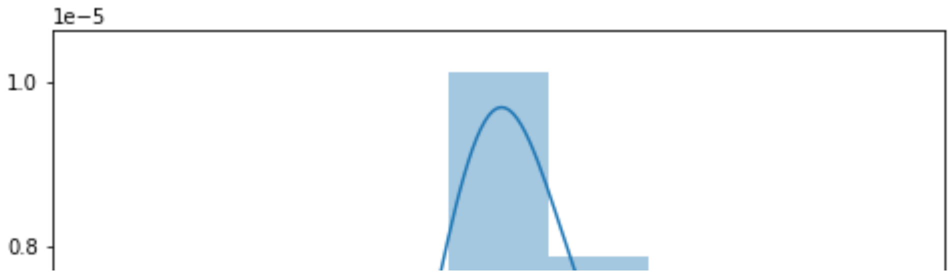
```python
outliers = ['Profit']
plt.rcParams['figure.figsize'] = [8,8]
sns.boxplot(data=dataset[outliers], orient="v", palette="Set2" , width=0.7) # orie
                                                                              # orie

plt.title("Outliers Variable Distribution")
plt.ylabel("Profit Range")
plt.xlabel("Continuous Variable")

plt.show()
```



In [18]:

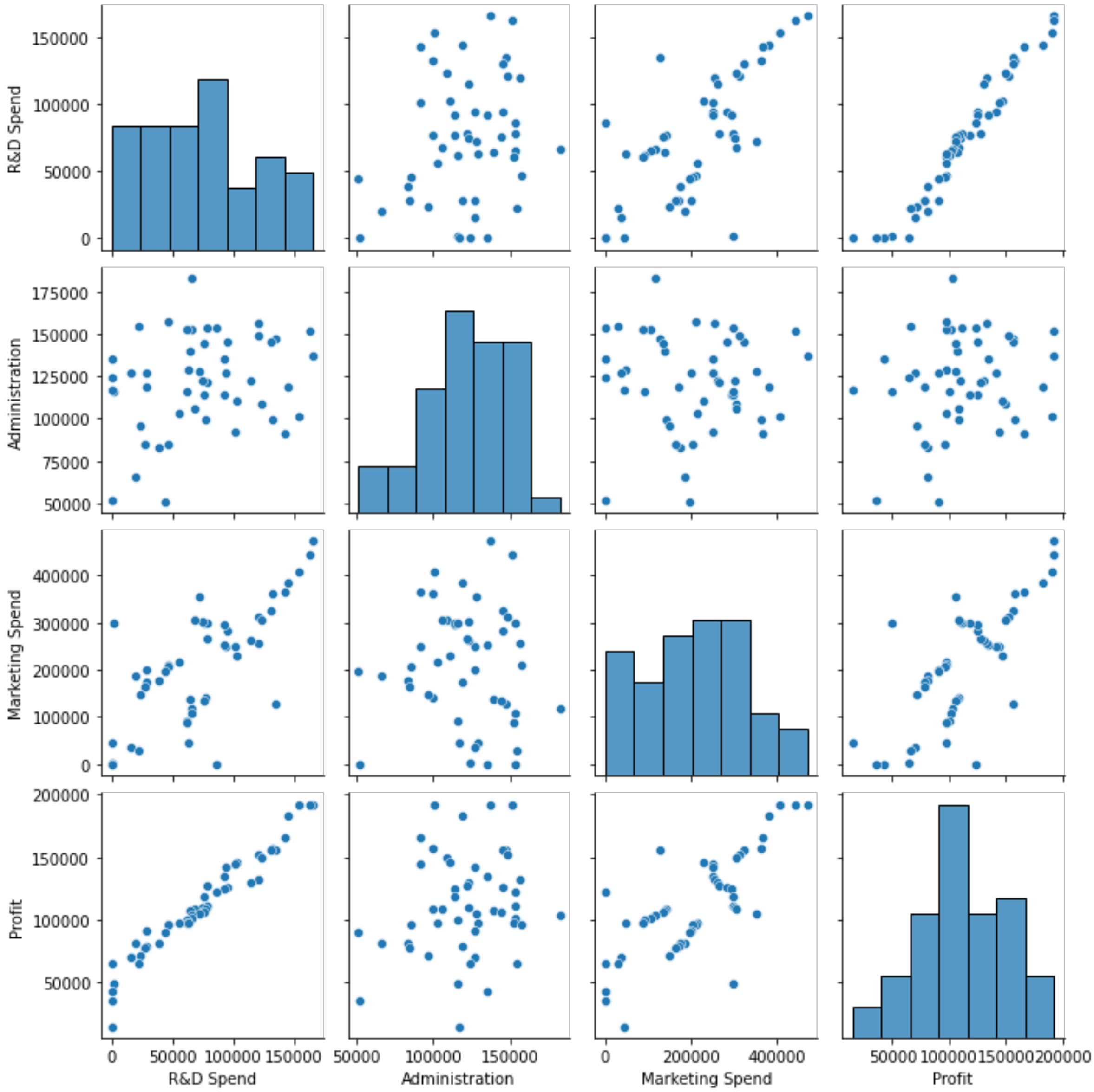
```
sns.distplot(dataset['Profit'],bins=5,kde=True)
plt.show()
```

```
c:\users\91755\appdata\local\programs\python\python39\lib\site-packages\seaborn\di
stributions.py:2557: FutureWarning: `distplot` is a deprecated function and will b
e removed in a future version. Please adapt your code to use either `displot` (a f
igure-level function with similar flexibility) or `histplot` (an axes-level functi
on for histograms).
  warnings.warn(msg, FutureWarning)
```



In [19]:

```
sns.pairplot(dataset)
plt.figure(figsize=(5,5))
plt.show()
```




```
<Figure size 360x360 with 0 Axes>
```

model preparation

In [21]:

```
# spliting Dataset in Dependent & Independent Variables
X = dataset.iloc[:, :-1].values
y = dataset.iloc[:, 3].values
```

In [24]:
```
from sklearn.preprocessing import LabelEncoder
```

In [26]:
```
#Label Encoder : Encode labels with value between 0 and n_classes-1.
labelencoder = LabelEncoder()
X[:, 2] = labelencoder.fit_transform(X[:, 2])
X1 = pd.DataFrame(X)
X1.head()
```

Out[26]:

	0	1	2
0	165349.20	136897.80	47.0
1	162597.70	151377.59	46.0
2	153441.51	101145.55	45.0
3	144372.41	118671.85	44.0
4	142107.34	91391.77	43.0

split the data into training and testing data

In [27]:
```
split the data into training and testing data
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=(
x_train
```

Out[27]:
```
array([[1.3029813e+05, 1.4553006e+05, 4.0000000e+01],
       [1.1994324e+05, 1.5654742e+05, 2.8000000e+01],
       [1.0002300e+03, 1.2415304e+05, 1.0000000e+00],
       [5.4205000e+02, 5.1743150e+04, 0.0000000e+00],
       [6.5605480e+04, 1.5303206e+05, 8.0000000e+00],
       [1.1452361e+05, 1.2261684e+05, 2.9000000e+01],
       [6.1994480e+04, 1.1564128e+05, 7.0000000e+00],
       [6.3408860e+04, 1.2921961e+05, 5.0000000e+00],
       [7.8013110e+04, 1.2159755e+05, 3.0000000e+01],
       [2.3640930e+04, 9.6189630e+04, 1.4000000e+01],
       [7.6253860e+04, 1.1386730e+05, 3.4000000e+01],
       [1.5505730e+04, 1.2738230e+05, 3.0000000e+00],
       [1.2054252e+05, 1.4871895e+05, 3.9000000e+01],
       [9.1992390e+04, 1.3549507e+05, 2.7000000e+01],
       [6.4664710e+04, 1.3955316e+05, 1.2000000e+01],
       [1.3187690e+05, 9.9814710e+04, 4.2000000e+01],
       [9.4657160e+04, 1.4507758e+05, 3.1000000e+01],
       [2.8754330e+04, 1.1854605e+05, 1.6000000e+01],
       [0.0000000e+00, 1.1698380e+05, 4.0000000e+00],
       [1.6259770e+05, 1.5137759e+05, 4.6000000e+01],
       [9.3863750e+04, 1.2732038e+05, 2.6000000e+01],
       [4.4069950e+04, 5.1283140e+04, 1.9000000e+01],
       [7.7044010e+04, 9.9281340e+04, 1.3000000e+01],
       [1.3461546e+05, 1.4719887e+05, 1.0000000e+01],
       [6.7532530e+04, 1.0575103e+05, 3.7000000e+01],
       [2.8663760e+04, 1.2705621e+05, 2.0000000e+01],
       [7.8389470e+04, 1.5377343e+05, 3.5000000e+01],
       [8.6419700e+04, 1.5351411e+05, 0.0000000e+00],
       [1.2333488e+05, 1.0867917e+05, 3.8000000e+01],
       [3.8558510e+04, 8.2982090e+04, 1.7000000e+01],
       [1.3154600e+03, 1.1581621e+05, 3.3000000e+01],
```

```
       [1.4437241e+05, 1.1867185e+05, 4.4000000e+01],
       [1.6534920e+05, 1.3689780e+05, 4.7000000e+01],
       [0.0000000e+00, 1.3542692e+05, 0.0000000e+00],
```

In [30]:

```
# Feature Scaling -- Useful when Features have different units

"""from sklearn.preprocessing import StandardScaler
sc_X = StandardScaler()
X_train = sc_X.fit_transform(X_train)
X_test = sc_X.transform(X_test)
sc_y = StandardScaler()
y_train = sc_y.fit_transform(y_train)
y_test = sc_y.fit_transform(y_test)"""
```

Out[30]:

```
'from sklearn.preprocessing import StandardScaler\nsc_X = StandardScaler()\nX_trai
n = sc_X.fit_transform(X_train)\nX_test = sc_X.transform(X_test)\nsc_y = StandardS
caler()\ny_train = sc_y.fit_transform(y_train)\ny_test = sc_y.fit_transform(y_tes
t)'
```

In [31]:

```
from sklearn.linear_model import LinearRegression

model = LinearRegression()
model.fit(x_train,y_train)
print('Model has been trained successfully')
```

```
Model has been trained successfully
```

In [32]:

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

Out[32]:

```
array([103365.65430448, 132409.63159464, 133669.58924177,  71596.33493623,
       179574.8809234 , 114195.96899299,  65656.85292429,  97938.81018901,
       114412.29898539, 169772.36831918,  96050.9051499 ,  87515.25731045,
       110242.6075272 ,  90000.89195708, 127479.23515393])
```

In [33]:

```
testing_data_model_score = model.score(x_test, y_test)
print("Model Score/Performance on Testing data",testing_data_model_score)

training_data_model_score = model.score(x_train, y_train)
print("Model Score/Performance on Training data",training_data_model_score)
```

```
Model Score/Performance on Testing data 0.9324057207634493
Model Score/Performance on Training data 0.9506671824404848
```

In [34]:

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

Out[34]:

	Predicted value	Actual Value
0	103365.654304	103282.38
1	132409.631595	144259.40
2	133669.589242	146121.95
3	71596.334936	77798.83
4	179574.880923	191050.39
5	114195.968993	105008.31

	Predicted value	Actual Value
6	65656.852924	81229.06
7	97938.810189	97483.56
8	114412.298985	110352.25
9	169772.368319	166187.94
10	96050.905150	96778.92
11	87515.257310	96479.51
12	110242.607527	105733.54
13	90000.891957	96712.80

regression metrics

R2 score

In [35]:

```
from sklearn.metrics import r2_score
r2Score = r2_score(y_pred, y_test)
print("R2 score of model is :" ,r2Score*100)
```

```
R2 score of model is : 93.21346390789374
```

mean squared error

In [36]:

```
from sklearn.metrics import mean_squared_error
mse = mean_squared_error(y_pred, y_test)
print("Mean Squarred Error is :" ,mse*100)
```

```
Mean Squarred Error is : 6524519362.317416
```

root Mean squared Error

In [37]:

```
rmse = np.sqrt(mean_squared_error(y_pred, y_test))
print("Root Mean Squarred Error is : ",rmse*100)
```

```
Root Mean Squarred Error is :  807744.9697966195
```

Mean absolute Error

In [38]:

```
from sklearn.metrics import mean_absolute_error

mae = mean_absolute_error(y_pred,y_test)
print("Mean Absolute Error is :" ,mae)
```

```
Mean Absolute Error is : 6603.238628961085
```

In [ ]: