#Import Libraries

```
import pandas as pd
import numpy as np
```

#Read the dataset

```
df = pd.read_csv("car data.csv")
```

```
df.sample(5)
```

```
                      Car_Name  Year  Selling_Price  Present_Price  \
260                       city  2016           9.15          13.60   
103            Bajaj Dominar 400  2017           1.45           1.60   
116  Royal Enfield Classic 350  2013           1.10           1.47   
167         TVS Apache RTR 160  2014           0.42           0.81   
14                       dzire  2009           2.25           7.21   

     Kms_Driven Fuel_Type Seller_Type Transmission  Owner  
260       29223    Petrol      Dealer       Manual      0  
103        1200    Petrol  Individual       Manual      0  
116       33000    Petrol  Individual       Manual      0  
167       42000    Petrol  Individual       Manual      0  
14        77427    Petrol      Dealer       Manual      0  
```

```
df.shape
```

```
(301, 9)
```

let's first check na value

```
df.isna().values.any()
```

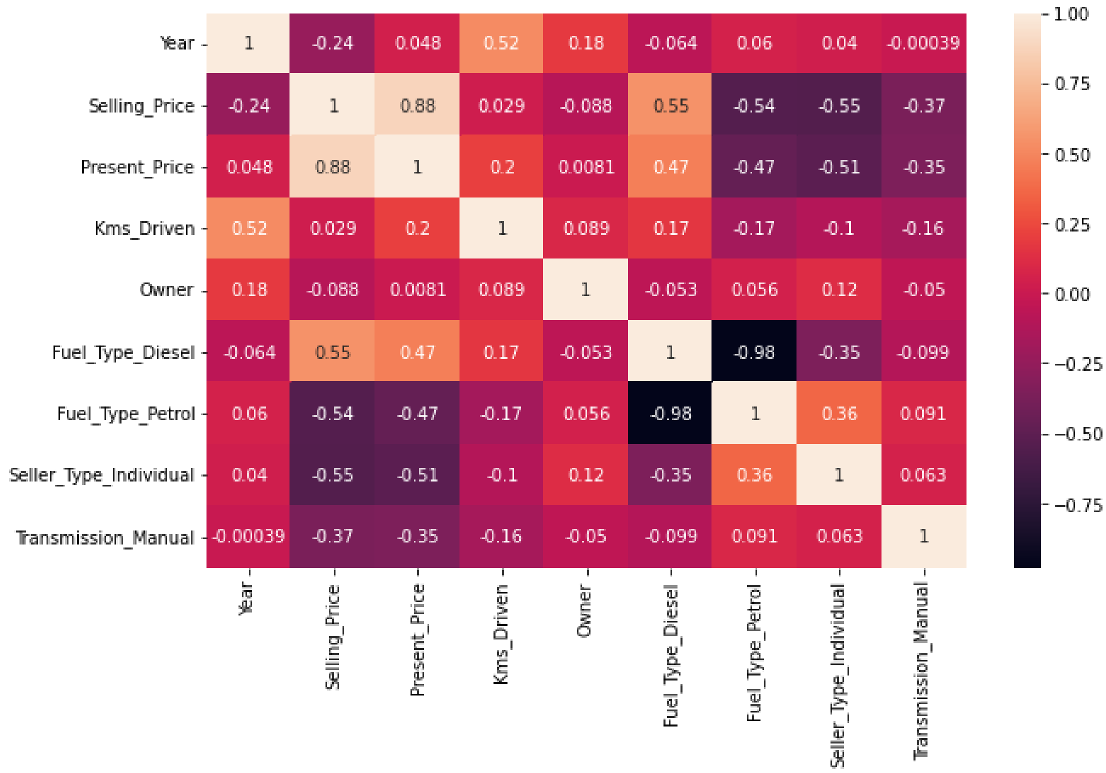
```
False
```

```
print("Fuel Type: ", df.Fuel_Type.unique())
print("Seller Type: ", df.Seller_Type.unique())
print("Transmission: ", df.Transmission.unique())
print("Owner: ", df.Owner.unique())
```

```
Fuel Type:  ['Petrol' 'Diesel' 'CNG']
Seller Type:  ['Dealer' 'Individual']
Transmission:  ['Manual' 'Automatic']
Owner:  [0 1 3]
```

```
# year indicates a purchased year of car, it's basically use for calculating how many years old that car

# for that we need to subtract year from current year

from datetime import datetime
```

```python
df["Current_year"] = datetime.now().year

# now let's subtract Year from Current Year
df["Year"] = df.Current_year - df.Year

# now let's drop current year we don't need it

df.drop(columns="Current_year", axis = 1, inplace = True)

# let's encode text or categorical data using one hot encoding
# let's create  dummy variables for Fuel_Type Seller_Type and
Transmission

dummy = pd.get_dummies(df[["Fuel_Type", "Seller_Type",
"Transmission"]], drop_first = True)
# drop first columns for preventing dummy variable trape
# for Fuel_Type CNG will be Removed, for Seller Type Dealer will be
removed and fo Transmission Automatic remove
df = pd.concat( [df, dummy], axis = 1)
# now we don't need that original text data columns so let's drop it
df.drop(columns = ["Fuel_Type", "Seller_Type", "Transmission"],
inplace = True)

# let's get a corelation of our data

import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline

plt.figure(figsize = (10, 6))
sns.heatmap(df.corr(), annot = True)
plt.show()
```




```python
# let's encode Car_Name text data using one hot encoding

# for this let's convert first Car_Names data into lowercase

df.Car_Name = df.Car_Name.str.lower()

dummy = pd.get_dummies(df.Car_Name, drop_first = True)
# here we dropped first columns which is 800 for prevent dummy
variable trap

df = pd.concat([df, dummy], axis = 1)
# now we don't need Car_Name columns so let's drop it
df.drop("Car_Name", axis = 1, inplace = True)

# now let's create a feature matrix X and target vector y

X = df.drop(columns="Selling_Price")
y = df.Selling_Price

# let's find important feature using ExtraTreesRegressor model

from sklearn.ensemble import ExtraTreesRegressor

etr = ExtraTreesRegressor()
etr.fit(X, y)
important_features = etr.feature_importances_
```

Splitting dependent and independent columns

```
X = df.iloc[: , : -1]
y = df.iloc[ : , -1]
```

```
X.shape
```

```
(301, 105)
```

```
y.shape
```

```
(301,)
```

Splitting the data into train and test

```
# let's divide our data into train and test part
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size =
0.20)
```

#Model Building

```
from sklearn.linear_model import LinearRegression
from sklearn.tree import DecisionTreeRegressor
from sklearn.ensemble import RandomForestRegressor
```

```
# let's create a dict for paramer


algos = {
    "Linear Regression": {
        "model": LinearRegression(),
        "param":{
            "normalize":[True, False]
        }
    },
    "Decision Tree": {
        "model": DecisionTreeRegressor(),
        "param": {
            "criterion": ["mse", "friedman_mse"],
            "splitter": ["best", "random"]
        }
    },
    "Random Forest": {
        "model": RandomForestRegressor(),
        "param": {
            "n_estimators": [int(x) for x in np.linspace(100, 1200,
12)],
            "max_features": ["auto", "sqrt"],
            "max_depth": [int(x) for x in np.linspace(5, 30, 6)],
```

```
            "min_samples_split": [2, 5, 10, 15, 100],
            "min_samples_leaf": [1, 2, 5, 10]
        }
    }
}

# let's find best algotithm with it's best parameter
# here we are going to use Randomize Search cv for hyperparamter
tuninig

from sklearn.model_selection import RandomizedSearchCV

best_models = {}
scores = []
for model_name, values in algos.items():
    model_tunning = RandomizedSearchCV(values["model"],
values["param"], n_iter=10, cv = 5, n_jobs = -1)
    model_tunning.fit(X_train, y_train)

    best_models[model_name] = model_tunning
    scores.append({
        "Model": model_name,
        "Best Parameters": model_tunning.best_params_,
        "Best Score": model_tunning.best_score_
    })

pd.DataFrame(scores)
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/model_selection/
_search.py:296: UserWarning: The total space of parameters 2 is
smaller than n_iter=10. Running 2 iterations. For exhaustive searches,
use GridSearchCV.
  UserWarning,
/usr/local/lib/python3.7/dist-packages/sklearn/linear_model/_base.py:1
55: FutureWarning: 'normalize' was deprecated in version 1.0 and will
be removed in 1.2. Please leave the normalize parameter to its default
value to silence this warning. The default behavior of this estimator
is to not do any normalization. If normalization is needed please use
sklearn.preprocessing.StandardScaler instead.
  FutureWarning,
/usr/local/lib/python3.7/dist-packages/sklearn/model_selection/_search
.py:296: UserWarning: The total space of parameters 4 is smaller than
n_iter=10. Running 4 iterations. For exhaustive searches, use
GridSearchCV.
  UserWarning,
/usr/local/lib/python3.7/dist-packages/sklearn/tree/_classes.py:363:
FutureWarning: Criterion 'mse' was deprecated in v1.0 and will be
removed in version 1.2. Use `criterion='squared_error'` which is
equivalent.
  FutureWarning,
```

```
              Model                                    Best
Parameters  \
0  Linear Regression                              {'normalize':
False}
1      Decision Tree         {'splitter': 'random', 'criterion':
'mse'}
2      Random Forest  {'n_estimators': 100, 'min_samples_split':
5, ...

   Best Score
0    0.644771
1    0.878412
2    0.811137
```

```
# In above we can see that Decision Tree is best algorithm with 92%
accuracy
# but let's test all the algorithm on our test data set

for name, model in best_models.items():
    print(name, " : ", model.score(X_test, y_test))
```

```
Linear Regression  :  0.8179022629603158
Decision Tree  :  0.8434401411337181
Random Forest  :  0.8774852413573476
```

```
# let's take our final model
final_model = best_models["Random Forest"]

# so here we take Random Forest model for our problem

def predict_price(year, present_price, kms, owner, diesel, petrol,
individual, manual, vehicle):
    vehicle_index = np.where(X.columns == vehicle.lower())[0][0]
    X_pred = np.zeros_like(X.columns)

    feature_list = [year, present_price, kms, owner, diesel, petrol,
individual, manual]
    count = 0
    for f in feature_list:
        X_pred[count] = f
        count += 1

    if vehicle_index > 0:
        X_pred[vehicle_index] = 1

    result = final_model.predict([X_pred])

    return result

predict_price(7, 9.54, 43000, 0, 1, 0, 0, 1, "sx4")
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/base.py:451:
UserWarning: X does not have valid feature names, but
RandomForestRegressor was fitted with feature names
  "X does not have valid feature names, but"
```

```
array([7.2354904])
```

```python
# our model is working perfectly fine with around 96% accuracy
# let's save our model as binary file

import pickle

with open("model.pkl", "wb") as f:
    pickle.dump(final_model, f)
```

```python
# let's save json file of our columns, it's use in frontend

import json

column_dict = {"data_columns": X.columns.to_list()}

with open("columns.json", "w") as f:
    json.dump(column_dict, f)
```