Skill Assessment 2

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In [1]:

```
import pandas as pd                                    #importing all necesary libraries
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

In [2]:

```
df = pd.read_csv("ToyotaCorolla.csv")              #loading Toyota_data
```

In [4]:

```
df.head()
```

Out[4]:

	Id	Model	Price	Age_08_04	Mfg_Month	Mfg_Year	KM	Fuel_Type	HP	Met_Color
0	1	TOYOTA Corolla 2.0 D4D HATCHB TERRA 2/3-Doors	13500	23	10	2002	46986	Diesel	90	1
1	2	TOYOTA Corolla 2.0 D4D HATCHB TERRA 2/3-Doors	13750	23	10	2002	72937	Diesel	90	1
2	3	? TOYOTA Corolla 2.0 D4D HATCHB TERRA 2/3-Doors	13950	24	9	2002	41711	Diesel	90	1
3	4	TOYOTA Corolla 2.0 D4D HATCHB TERRA 2/3-Doors	14950	26	7	2002	48000	Diesel	90	0
4	5	TOYOTA Corolla 2.0 D4D HATCHB SOL 2/3-Doors	13750	30	3	2002	38500	Diesel	90	0

5 rows × 37 columns

In [5]:

```
df.isnull().sum()
```

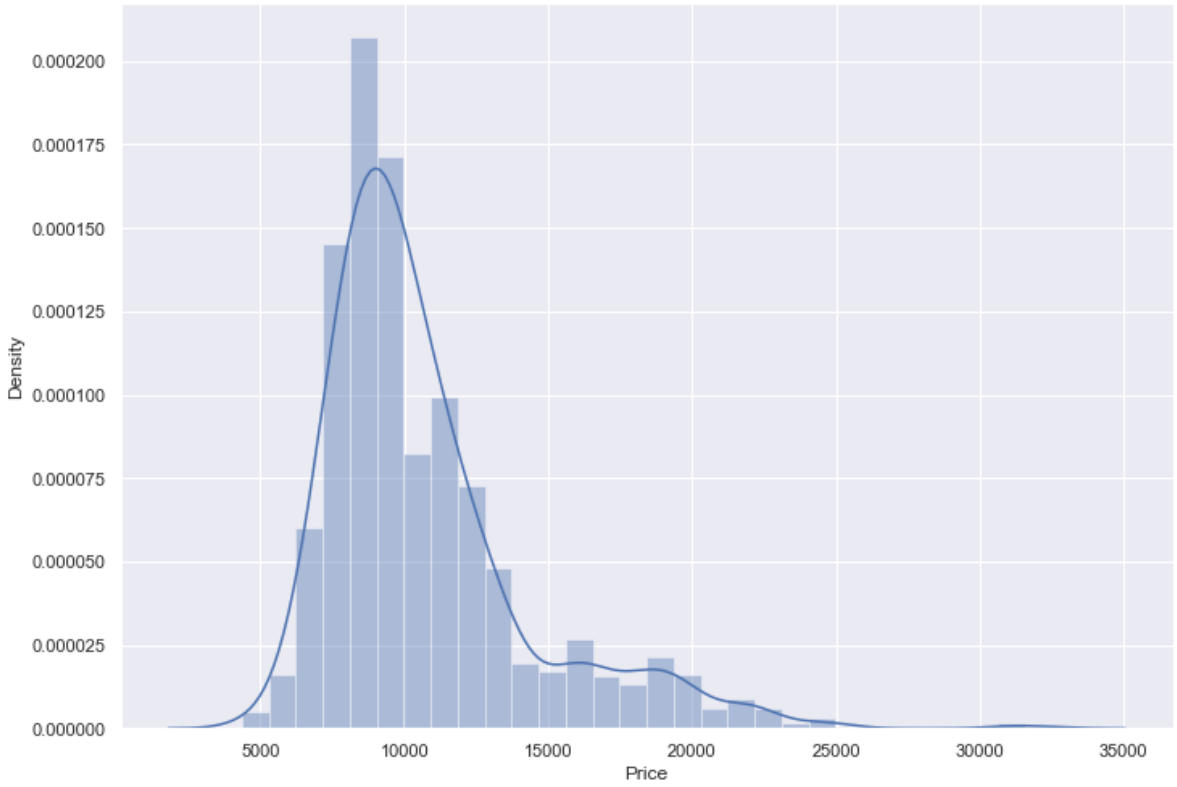
Out[5]:

```
Id                  0
Model               0
Price               0
Age_08_04           0
Mfg_Month           0
Mfg_Year            0
KM                  0
Fuel_Type           0
HP                  0
Met_Color           0
Automatic           0
cc                  0
Doors               0
Cylinders           0
Gears               0
Quarterly_Tax       0
Weight              0
Mfr_Guarantee       0
BOVAG_Guarantee     0
Guarantee_Period    0
ABS                 0
Airbag_1            0
Airbag_2            0
Airco               0
Automatic_airco     0
Boardcomputer       0
CD_Player           0
Central_Lock        0
Powered_Windows     0
Power_Steering      0
Radio               0
Mistlamps           0
Sport_Model         0
Backseat_Divider    0
Metallic_Rim        0
Radio_cassette      0
Tow_Bar             0
dtype: int64
```

In [7]:

```
sns.set(rc={'figure.figsize':(11.7,8.27)})
sns.distplot(df['Price'], bins=30)
plt.show()
```

```
C:\Users\Admin\anaconda3\lib\site-packages\seaborn\distributions.py:2619: Fu
tureWarning: `distplot` is a deprecated function and will be removed in a fu
ture version. Please adapt your code to use either `displot` (a figure-level
function with similar flexibility) or `histplot` (an axes-level function for
histograms).
  warnings.warn(msg, FutureWarning)
```

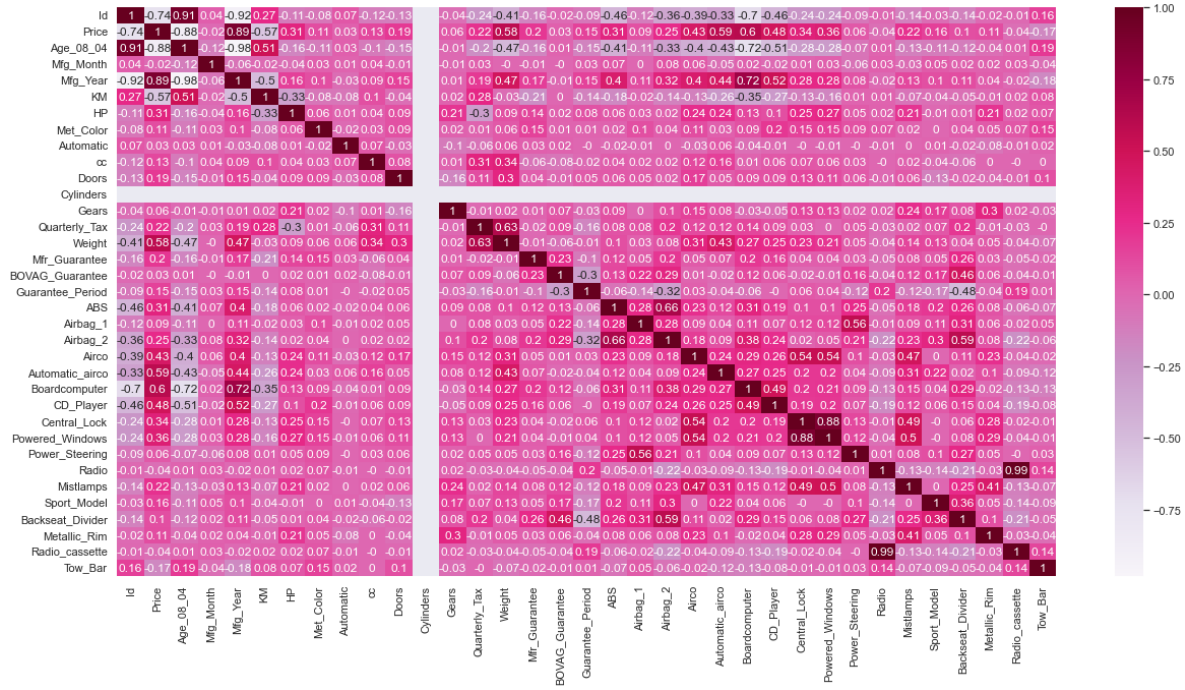


In [10]:

```
sns.set(rc={'figure.figsize':(20.7,10.27)})
correlation_matrix = df.corr().round(2)                    # annot = True to prin
sns.heatmap(data=correlation_matrix, annot=True,cmap="PuRd")
```

Out[10]:

```
<AxesSubplot:>
```



The correlation bet mfg_year and price is o.89

In [11]:

```
from sklearn import linear_model
```

In [12]:

```
df.columns
```

Out[12]:

```
Index(['Id', 'Model', 'Price', 'Age_08_04', 'Mfg_Month', 'Mfg_Year', 'KM',
       'Fuel_Type', 'HP', 'Met_Color', 'Automatic', 'cc', 'Doors', 'Cylinder
s',
       'Gears', 'Quarterly_Tax', 'Weight', 'Mfr_Guarantee', 'BOVAG_Guarante
e',
       'Guarantee_Period', 'ABS', 'Airbag_1', 'Airbag_2', 'Airco',
       'Automatic_airco', 'Boardcomputer', 'CD_Player', 'Central_Lock',
       'Powered_Windows', 'Power_Steering', 'Radio', 'Mistlamps',
       'Sport_Model', 'Backseat_Divider', 'Metallic_Rim', 'Radio_cassette',
       'Tow_Bar'],
      dtype='object')
```

In [ ]:

```

```

In [18]:

```
X = df[['Age_08_04', 'KM'
       , 'HP', 'cc', 'Doors',
       'Gears', 'Quarterly_Tax', 'Weight']]
y = df['Price']
```

In [19]:

```
regr = linear_model.LinearRegression()
regr.fit(X, y)
```

Out[19]:

```
LinearRegression()
```

In [20]:

```
predictedPrice = regr.predict([[26,50125,92,1794,5,6,1,4128]])
```

In [21]:

```
predictedPrice
```

Out[21]:

```
array([66484.72371824])
```

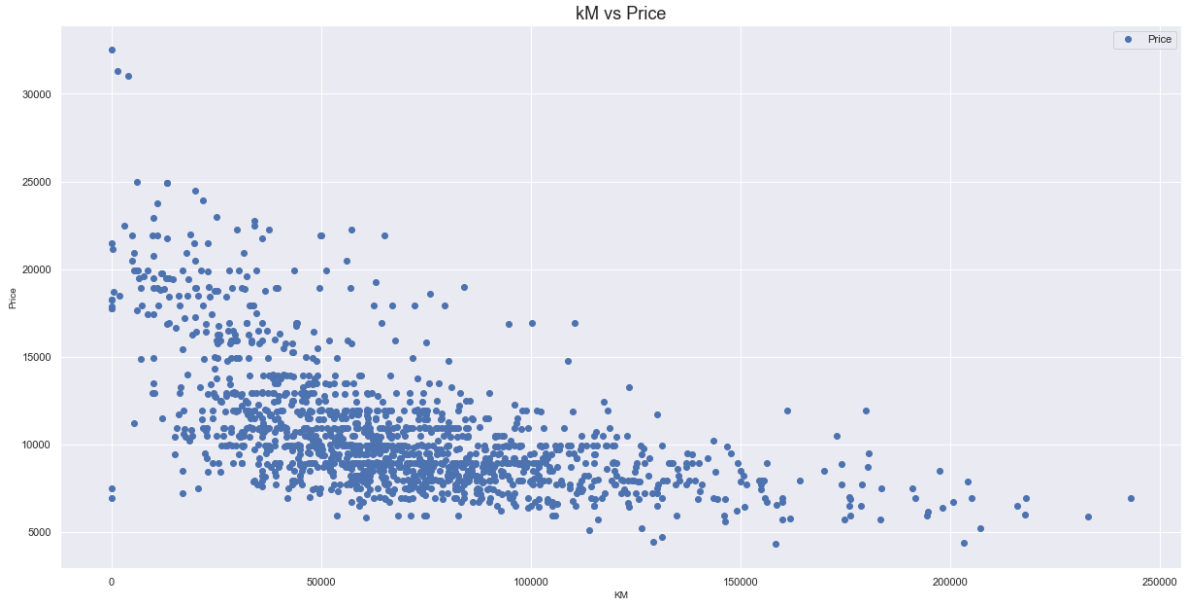
In [22]:

```
print(regr.coef_)
```

```
[-1.21658402e+02 -2.08171292e-02  3.16809058e+01 -1.21100301e-01
 -1.61664095e+00  5.94319936e+02  3.94908076e+00  1.69586318e+01]
```

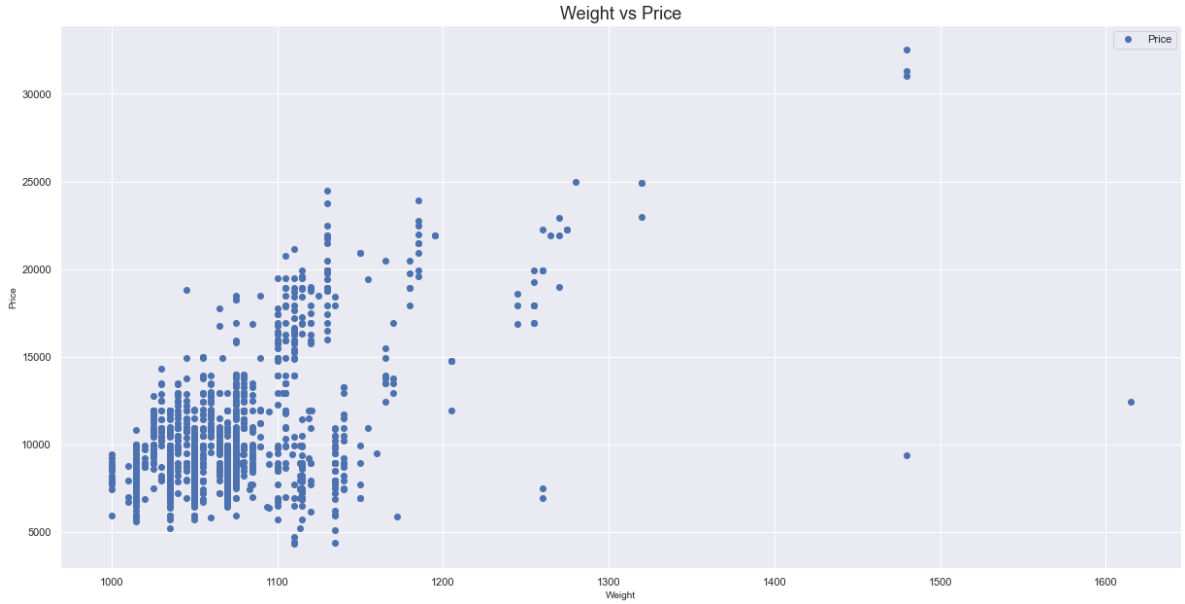
In [27]:

```
df.plot(x='KM', y='Price', style='o')
plt.title('kM vs Price', fontsize= 18)
plt.xlabel('KM',fontsize = 10)
plt.ylabel('Price',fontsize = 10)
plt.show()
```



In [31]:

```
df.plot(x='Weight', y='Price', style='o')
plt.title('Weight vs Price', fontsize= 18)
plt.xlabel('Weight',fontsize = 10)
plt.ylabel('Price',fontsize = 10)
plt.show()
```



In [32]:

```
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state=5)
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(1148, 8)
(288, 8)
(1148,)
(288,)
```

In [33]:

```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error

lin_model = LinearRegression()
lin_model.fit(X_train, y_train)
```

Out[33]:

```
LinearRegression()
```

In [34]:

```
from sklearn import metrics                                    # model evaluation for training se
y_train_predict = lin_model.predict(X_train)
rmse = (np.sqrt(mean_squared_error(y_train, y_train_predict)))
r2 = metrics.r2_score(y_train, y_train_predict)
rmse
```

Out[34]:

```
1339.599824209788
```

In [35]:

```
r2
```

Out[35]:

```
0.8713182346005559
```

In [36]:

```
y_test_predict = lin_model.predict(X_test)                     # model evaluation for test
rmse = (np.sqrt(mean_squared_error(y_test, y_test_predict)))
r2 = metrics.r2_score(y_test, y_test_predict)
rmse
```

Out[36]:

```
1338.43791848782
```

In [37]:

```
r2
```

Out[37]:

```
0.8183270798925493
```

In [38]:

```
features=['Age_08_04', 'KM'
       , 'HP', 'cc', 'Doors',
       'Gears', 'Quarterly_Tax', 'Weight']
```

In [39]:

```
coef2 = pd.Series(lin_model.coef_,features).sort_values()
coef2
```

Out[39]:

```
Age_08_04       -123.072736
cc                -0.078158
KM                -0.021051
Quarterly_Tax      4.284885
Doors             10.492803
Weight            16.731301
HP                33.951177
Gears            594.917126
dtype: float64
```

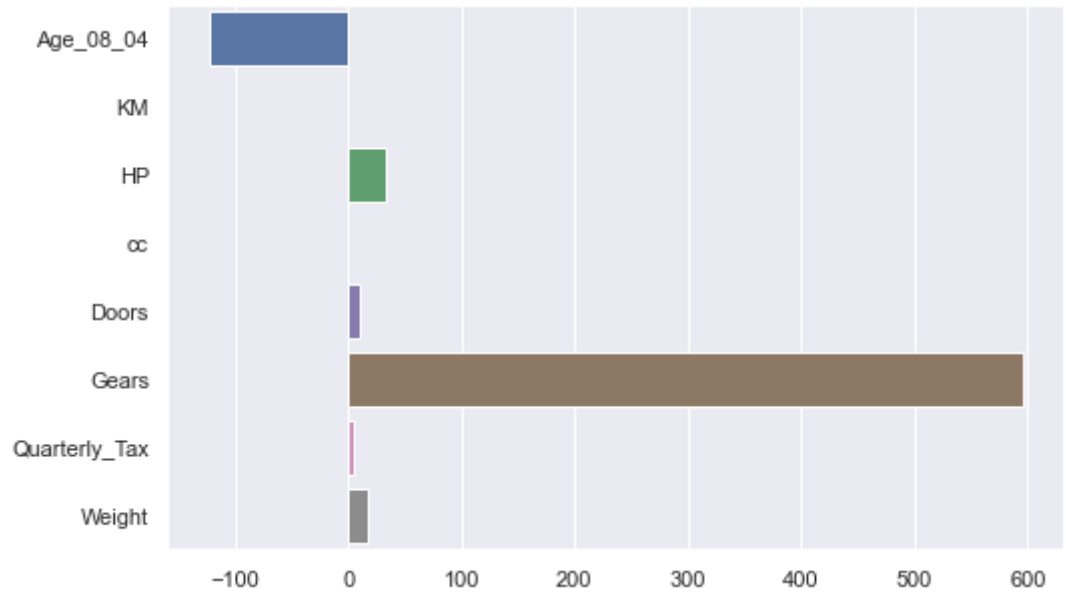
In [40]:

```
plt.figure(figsize=(8,5))
sns.barplot(lin_model.coef_,features)
```

```
C:\Users\Admin\anaconda3\lib\site-packages\seaborn\_decorators.py:36: Future
Warning: Pass the following variables as keyword args: x, y. From version 0.
12, the only valid positional argument will be `data`, and passing other arg
uments without an explicit keyword will result in an error or misinterpretat
ion.
  warnings.warn(
```

Out[40]:

```
<AxesSubplot:>
```



Evaluation Metrics

In [41]:

```
from sklearn.metrics import r2_score
R2 = r2_score(y_test,y_test_predict)
R2
```

Out[41]:

```
0.8183270798925493
```

In [46]:

```
n=489
k=3                                    #k=No. of independent variables
adj_R2_score = 1 - ((1-R2)*(n-1)/(n-k-1))
print(adj_R2_score)
```

```
0.8172033298712661
```

In [42]:

```
MAE= metrics.mean_absolute_error(y_test,y_test_predict)
MSE= metrics.mean_squared_error(y_test,y_test_predict)
print("mean absolute error:",MAE)
print("mean squared error:",MSE)
```

```
mean absolute error: 1011.1742342298401
mean squared error: 1791416.0616460086
```

In [43]:

```
from math import sqrt
rmse = sqrt(MSE)
print("Root Mean Squared Error:",rmse)
```

```
Root Mean Squared Error: 1338.43791848782
```

In [44]:

```
RMSLE = np.log(np.sqrt(mean_squared_error(y_test,y_test_predict)))
print("RMSLE",np.log(np.sqrt(mean_squared_error(y_test,y_test_predict))))
```

```
RMSLE 7.19925848047857
```

In [47]:

```
print("R2 value:",R2)
print("Adjusted R2 value:",adj_R2_score)
```

```
R2 value: 0.8183270798925493
Adjusted R2 value: 0.8172033298712661
```

In [48]:

```
print("mean absolute error:",MAE)
print("mean squared error:",MSE)
print("Root Mean Squared Error:",rmse)
print("Root Mean Squared Log Error:", RMSLE)
```

```
mean absolute error: 1011.1742342298401
mean squared error: 1791416.0616460086
Root Mean Squared Error: 1338.43791848782
Root Mean Squared Log Error: 7.19925848047857
```

In [ ]:

In [ ]:

In [ ]: