TASK 1 : PREDICTION USING SUPERVISED LEARNING

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GRIP : THE SPARKS FOUNDATION

DATA SCIENCE AND BUSINESS ANALYTICS INTERN

In [1]:
```
#IMPORT LIBRARIES
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import scipy.stats as stats
import statsmodels.formula.api as smf
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
```

In [2]:
```
# IMPORT DATA SET USING PANDAS READ_CSV
df = pd.read_csv('https://raw.githubusercontent.com/AdiPersonalWorks/Random/master/student_scores%20-%20student_scores.csv')
```

In [3]:
```
df.head()
```

Out[3]:

	Hours	Scores
0	2.5	21
1	5.1	47
2	3.2	27
3	8.5	75
4	3.5	30

EXPLORATORY DATA ANALYSIS

In [4]:
```
df.columns
```

Out[4]:
```
Index(['Hours', 'Scores'], dtype='object')
```

In [5]:
```
df.dtypes
```

Out[5]:
```
Hours     float64
Scores      int64
dtype: object
```

In [6]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 25 entries, 0 to 24
Data columns (total 2 columns):
 #   Column  Non-Null Count  Dtype  
---  ------  --------------  -----  
 0   Hours   25 non-null     float64
 1   Scores  25 non-null     int64  
dtypes: float64(1), int64(1)
memory usage: 528.0 bytes
```

In [7]:
```
df.isnull().sum()
```

Out[7]:
```
Hours     0
Scores    0
dtype: int64
```

In [8]:
```
df.describe()
```

Out[8]:

	Hours	Scores
count	25.000000	25.000000
mean	5.012000	51.480000
std	2.525094	25.286887
min	1.100000	17.000000
25%	2.700000	30.000000
50%	4.800000	47.000000
75%	7.400000	75.000000
max	9.200000	95.000000

In [9]:
```
df.corr()
```

Out[9]:

	Hours	Scores
Hours	1.000000	0.976191
Scores	0.976191	1.000000

Remove Outliers

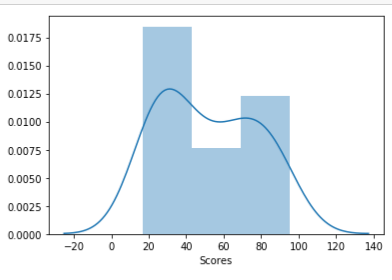
In [10]:
```
def outlier_detection(df):
    ### Written by: Sujay Rittikar
    # Detecting the Null or NaN values and remo ving them first
    # to ensure that the numerical columns can be detected correctly.
    r = []
    for col in df.columns:
        for i in df.index:
            if df.loc[i, col]=='Null' or df.loc[i, col] == np.nan:
                r.append(i)
    df = df.drop(list(set(r)))
    df = df.reset_index()
    df = df.drop('index', axis=1)

    # Finding out the columns having numerical values.
    num_cols = []
    for col in df.columns:
        if df[col].dtype == 'object':
            try:
                df[col] = pd.to_numeric(df[col])
                num_cols.append(col)
            except ValueError:
                pass

    # Removing the rows having values which can be called outliers
    # on the basis of their z-scores of >3 or <-3
    count = 0
    t = []
    for i in num_cols:
        z = np.abs(stats.zscore(df[i]))
        for j in range(len(z)):
            if z[j]>3 or z[j]<-3:
                t.append(j)
                count+=1
    df = df.drop(list(set(t)))
    df = df.reset_index()
    df = df.drop('index', axis=1)
    print(count)
    return df
```

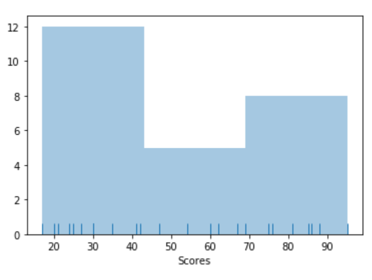
In [11]:
```
df = outlier_detection(df)
```

```
0
```

Distribution

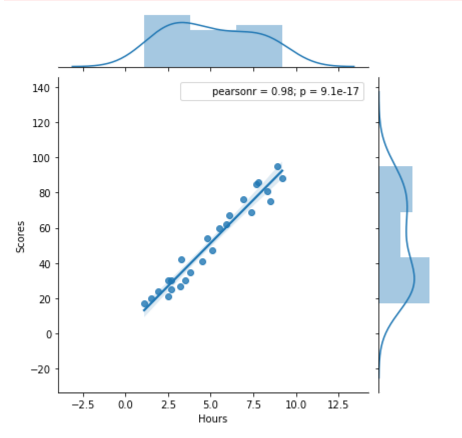
In [12]:
```
sns.distplot(df["Scores"])
plt.show()

sns.distplot(df["Scores"], kde=False, rug=True)
plt.show()
```





In [13]:
```
sns.jointplot(df['Hours'], df['Scores'], kind = "reg").annotate(stats.pearsonr)
plt.show()
```

```
C:\Users\Tejaswi\anaconda3\lib\site-packages\seaborn\axisgrid.py:1848: UserWarning: JointGrid annotation is deprecated and will be removed in a future release.
  warnings.warn(UserWarning(msg))
```



Performing Simple Linear Regression

In [14]:
```
mean_x = np.mean(df['Hours'])
mean_y = np.mean(df['Scores'])
num = 0
den = 0
x = list(df['Hours'])
y = list(df['Scores'])
for i in range(len(df)):
    num += (x[i]-mean_x)*(y[i]-mean_y)
    den += (x[i]-mean_x)**2
B1 = num/den
```

In [15]:
```
B1
```

Out[15]:
```
9.775803390787475
```

In [16]:
```
B0 = mean_y - B1*mean_x
```

In [17]:
```
B0
```

Out[17]:
```
2.4836734053731746
```

Making Predictions

In [18]:
```
df['predicted_Scores'] = B0 + B1*df['Hours']
```

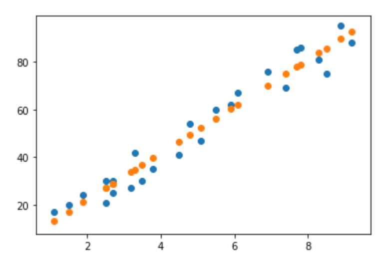
In [19]:
```
df.head()
```

Out[19]:

	Hours	Scores	predicted_Scores
0	2.5	21	26.923182
1	5.1	47	52.340271
2	3.2	27	33.766244
3	8.5	75	85.578002
4	3.5	30	36.698985

In [20]:
```
plt.scatter(df['Hours'], df['Scores'])
plt.scatter(df['Hours'], df['predicted_Scores'])
plt.plot()
```

Out[20]:
```
[]
```



Prediction of given value: 9.25

In [21]:
```
B0 + B1*9.25
```

Out[21]:
```
92.90985477015732
```

In [22]:
```
y = list(df['Scores'].values)
y_pred = list(df['predicted_Scores'].values)
```

RMSE

In [25]:
```
s = sum([(y_pred[i] - y[i])**2 for i in range(len(df))])
rmse = (np.sqrt(s/len(df)))/mean_y
```

In [26]:
```
rmse
```

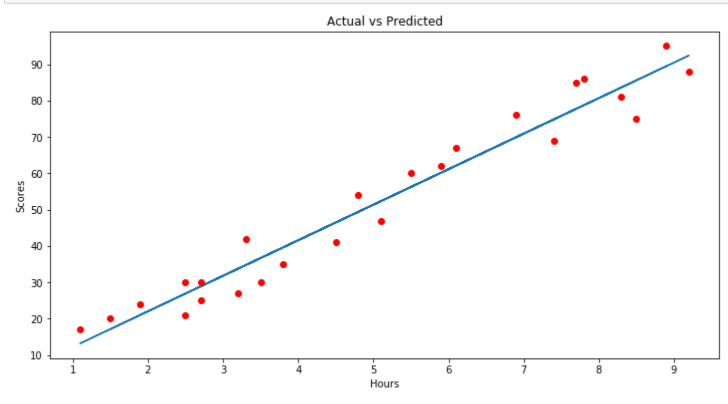
Out[26]:
```
0.10439521325937494
```

OLS Model

In [27]:
```
model = smf.ols('Scores ~ Hours', data = df)
model = model.fit()
```

In [28]:
```
df['pred_ols'] = model.predict(df['Hours'])
```

In [29]:
```
plt.figure(figsize=(12, 6))
plt.plot(df['Hours'], df['pred_ols'])     # regression line
plt.plot(df['Hours'], df['Scores'], 'ro')   # scatter plot showing actual data
plt.title('Actual vs Predicted')
plt.xlabel('Hours')
plt.ylabel('Scores')

plt.show()
```



We can observe that the predicted value for 9.25 hours is around 92

Additional conclusions: Categorical Prediction

In [30]:
```
# Consider a threshold to come to a conclusion whether the student passed or not!
# Let's consider here 40 as the cut-off to pass.

cut_off = 40
```

In [31]:
```
df['Result'] = df['Scores']>=40
```

In [32]:
```
df.head()
```

Out[32]:

	Hours	Scores	predicted_Scores	pred_ols	Result
0	2.5	21	26.923182	26.923182	False
1	5.1	47	52.340271	52.340271	True
2	3.2	27	33.766244	33.766244	False
3	8.5	75	85.578002	85.578002	True
4	3.5	30	36.698985	36.698985	False

In [33]:
```
feature = df['Hours'].values.reshape(-1, 1)
target = df['Result'].values
```

In [34]:
```
X_train, X_test, y_train, y_test = train_test_split(feature, target, random_state=0)
```

In [35]:
```
knn = KNeighborsClassifier(n_neighbors=5)
knn.fit(X_train, y_train)
```

Out[35]:
```
KNeighborsClassifier(algorithm='auto', leaf_size=30, metric='minkowski',
                     metric_params=None, n_jobs=None, n_neighbors=5, p=2,
                     weights='uniform')
```

ACCURACY

In [36]:
```
knn.score(X_train, y_train)
```

Out[36]:
```
0.9444444444444444
```

In [37]:
```
knn.score(X_test, y_test)
```

Out[37]:
```
0.8571428571428571
```

Predicting the outcomes

In [38]:
```
get_results = [[9.25]]
```

In [39]:
```
knn.predict(get_results)
```

Out[39]:
```
array([ True])
```

In [40]:
```
knn.predict([[14]])
```

Out[40]:
```
array([ True])
```

In [41]:
```
knn.predict([[3]])
```

Out[41]:
```
array([False])
```

In [ ]: