In [2]:

```
#Name : R AJAY
#Roll no : COTC57
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.preprocessing import LabelEncoder, StandardScaler
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.metrics import accuracy_score, classification_report, confusion_matri
import warnings
warnings.filterwarnings('ignore')
%matplotlib inline
```

In [4]:

```
data = pd.read_csv('Hr.csv')
```

In [6]:

```
data.shape
```

Out[6]:

```
(1200, 28)
```

In [7]:

```
data.columns
```

Out[7]:

```
Index(['EmpNumber', 'Age', 'Gender', 'EducationBackground', 'MaritalStatus',
       'EmpDepartment', 'EmpJobRole', 'BusinessTravelFrequency',
       'DistanceFromHome', 'EmpEducationLevel', 'EmpEnvironmentSatisfaction',
       'EmpHourlyRate', 'EmpJobInvolvement', 'EmpJobLevel',
       'EmpJobSatisfaction', 'NumCompaniesWorked', 'OverTime',
       'EmpLastSalaryHikePercent', 'EmpRelationshipSatisfaction',
       'TotalWorkExperienceInYears', 'TrainingTimesLastYear',
       'EmpWorkLifeBalance', 'ExperienceYearsAtThisCompany',
       'ExperienceYearsInCurrentRole', 'YearsSinceLastPromotion',
       'YearsWithCurrManager', 'Attrition', 'PerformanceRating'],
      dtype='object')
```

```
In [10]:
```

```
data.head()
```

```
Out[10]:
```

	EmpNumber	Age	Gender	EducationBackground	MaritalStatus	EmpDepartment
0	E1001000	32	Male	Marketing	Single	Sales
1	E1001006	47	Male	Marketing	Single	Sales
2	E1001007	40	Male	Life Sciences	Married	Sales
3	E1001009	41	Male	Human Resources	Divorced	Human Resources
4	E1001010	60	Male	Marketing	Single	Sales

5 rows × 28 columns

In [12]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1200 entries, 0 to 1199
Data columns (total 28 columns):
EmpNumber                       1200 non-null object
Age                             1200 non-null int64
Gender                          1200 non-null object
EducationBackground             1200 non-null object
MaritalStatus                   1200 non-null object
EmpDepartment                   1200 non-null object
EmpJobRole                      1200 non-null object
BusinessTravelFrequency         1200 non-null object
DistanceFromHome                1200 non-null int64
EmpEducationLevel               1200 non-null int64
EmpEnvironmentSatisfaction      1200 non-null int64
EmpHourlyRate                   1200 non-null int64
EmpJobInvolvement               1200 non-null int64
EmpJobLevel                     1200 non-null int64
EmpJobSatisfaction              1200 non-null int64
NumCompaniesWorked              1200 non-null int64
OverTime                        1200 non-null object
EmpLastSalaryHikePercent        1200 non-null int64
EmpRelationshipSatisfaction     1200 non-null int64
TotalWorkExperienceInYears      1200 non-null int64
TrainingTimesLastYear           1200 non-null int64
EmpWorkLifeBalance              1200 non-null int64
ExperienceYearsAtThisCompany    1200 non-null int64
ExperienceYearsInCurrentRole    1200 non-null int64
YearsSinceLastPromotion         1200 non-null int64
YearsWithCurrManager            1200 non-null int64
Attrition                       1200 non-null object
PerformanceRating               1200 non-null int64
dtypes: int64(19), object(9)
memory usage: 262.6+ KB
```

In [14]:

```
dept =data.iloc[:,[5,27]].copy()
dept_per= dept.copy()
```

In [17]:

```
dept_per.groupby(by='EmpDepartment')['PerformanceRating'].mean()
```

Out[17]:

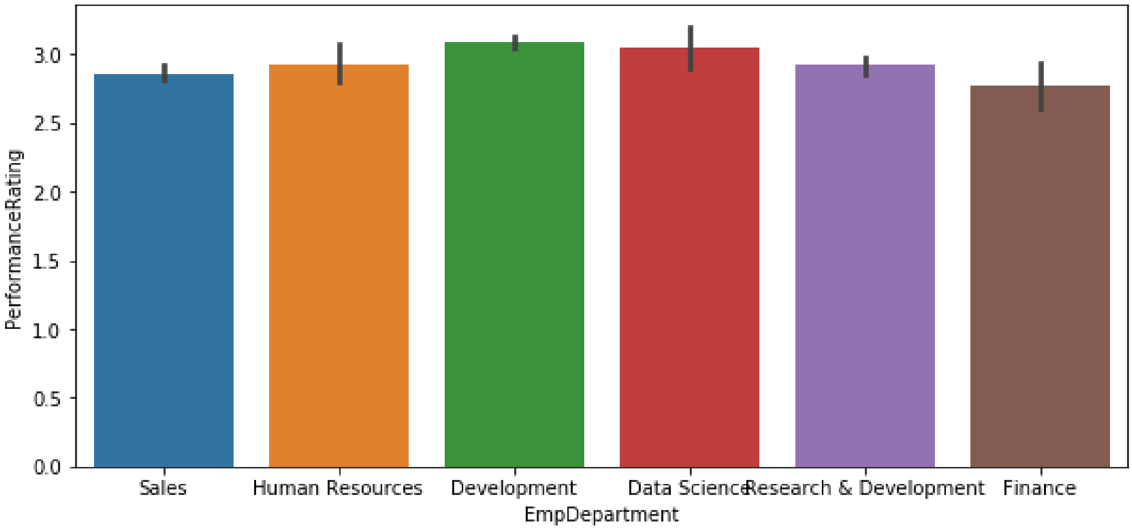
```
EmpDepartment
Data Science              3.050000
Development               3.085873
Finance                   2.775510
Human Resources           2.925926
Research & Development    2.921283
Sales                     2.860590
Name: PerformanceRating, dtype: float64
```

In [18]:

```
plt.figure(figsize=(10,4.5))
sns.barplot(dept_per['EmpDepartment'],dept_per['PerformanceRating'])
```

Out[18]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fde5e021510>
```



In [19]:

```
dept_per.groupby(by='EmpDepartment')['PerformanceRating'].value_counts()
```

Out[19]:

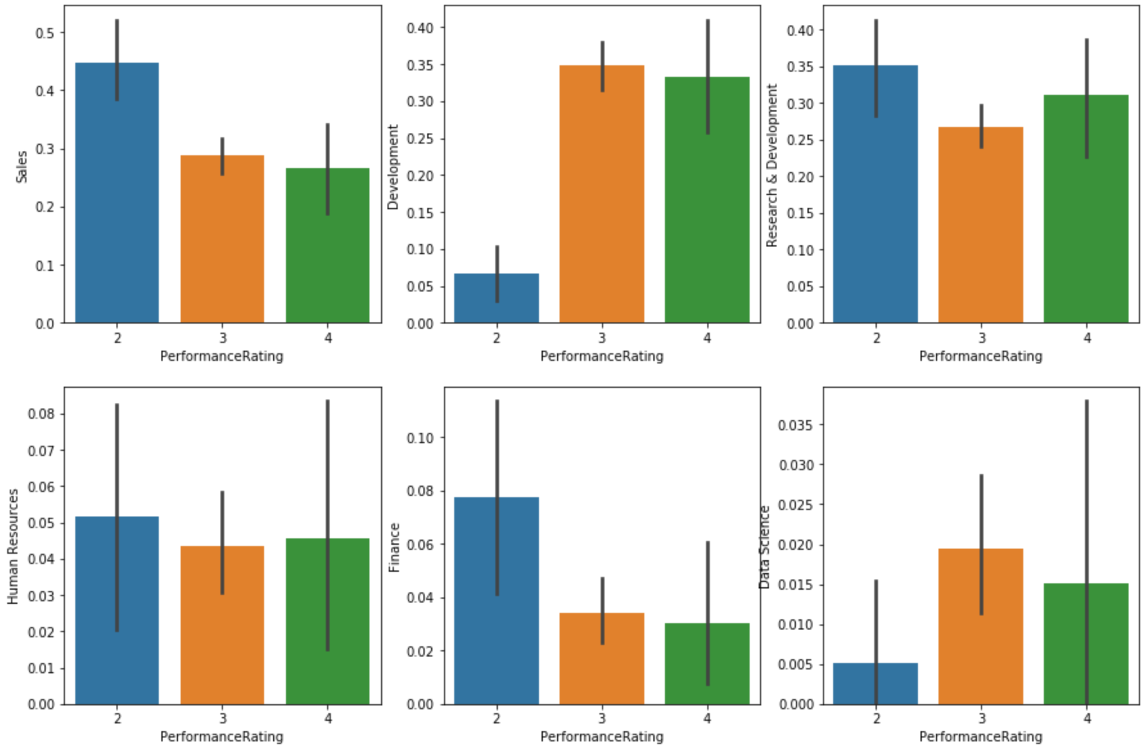
```
EmpDepartment           PerformanceRating
Data Science            3                      17
                        4                       2
                        2                       1
Development             3                     304
                        4                      44
                        2                      13
Finance                 3                      30
                        2                      15
                        4                       4
Human Resources         3                      38
                        2                      10
                        4                       6
Research & Development  3                     234
                        2                      68
                        4                      41
Sales                   3                     251
                        2                      87
                        4                      35
Name: PerformanceRating, dtype: int64
```

In [21]:

```
department=pd.get_dummies(dept_per['EmpDepartment'])
performance=pd.DataFrame(dept_per['PerformanceRating'])
dept_rating=pd.concat([department,performance],axis=1)
```

In [22]:

```
plt.figure(figsize=(15,10))
plt.subplot(2,3,1)
sns.barplot(dept_rating['PerformanceRating'],dept_rating['Sales'])
plt.subplot(2,3,2)
sns.barplot(dept_rating['PerformanceRating'],dept_rating['Development'])
plt.subplot(2,3,3)
sns.barplot(dept_rating['PerformanceRating'],dept_rating['Research & Development'])
plt.subplot(2,3,4)
sns.barplot(dept_rating['PerformanceRating'],dept_rating['Human Resources'])
plt.subplot(2,3,5)
sns.barplot(dept_rating['PerformanceRating'],dept_rating['Finance'])
plt.subplot(2,3,6)
sns.barplot(dept_rating['PerformanceRating'],dept_rating['Data Science'])
plt.show()
```



In [24]:

```
# Encoding all the ordinal columns and creating a dummy variable for them to see if the
r
enc = LabelEncoder()
for i in (2,3,4,5,6,7,16,26):
    data.iloc[:,i] = enc.fit_transform(data.iloc[:,i])
data.head()
```

Out[24]:

	EmpNumber	Age	Gender	EducationBackground	MaritalStatus	EmpDepartment
0	E1001000	32	1	2	2	5
1	E1001006	47	1	2	2	5
2	E1001007	40	1	1	1	5
3	E1001009	41	1	0	0	3
4	E1001010	60	1	2	2	5

5 rows × 28 columns

In [25]:

```
data.corr()
```

Out[25]:

	Age	Gender	EducationBackground	Marital
Age	1.000000	-0.040107	-0.055905	-0.0983
Gender	-0.040107	1.000000	0.009922	-0.0421
EducationBackground	-0.055905	0.009922	1.000000	-0.0010
MaritalStatus	-0.098368	-0.042169	-0.001097	1.0000
EmpDepartment	-0.000104	-0.010925	-0.026874	0.0672
EmpJobRole	-0.037665	0.011332	-0.012325	0.0380
BusinessTravelFrequency	0.040579	-0.043608	0.012382	0.0285
DistanceFromHome	0.020937	-0.001507	-0.013919	-0.0191
EmpEducationLevel	0.207313	-0.022960	-0.047978	0.0267
EmpEnvironmentSatisfaction	0.013814	0.000033	0.045028	-0.0324
EmpHourlyRate	0.062867	0.002218	-0.030234	-0.0135
EmpJobInvolvement	0.027216	0.010949	-0.025505	-0.0433
EmpJobLevel	0.509139	-0.050685	-0.056338	-0.0873
EmpJobSatisfaction	-0.002436	0.024680	-0.030977	0.0445
NumCompaniesWorked	0.284408	-0.036675	-0.032879	-0.0300
OverTime	0.051910	-0.038410	0.007046	-0.0228
EmpLastSalaryHikePercent	-0.006105	-0.005319	-0.009788	0.0101
EmpRelationshipSatisfaction	0.049749	0.030707	0.005652	0.0264
TotalWorkExperienceInYears	0.680886	-0.061055	-0.027929	-0.0935
TrainingTimesLastYear	-0.016053	-0.057654	0.051596	0.0260
EmpWorkLifeBalance	-0.019563	0.015793	0.022890	0.0141
ExperienceYearsAtThisCompany	0.318852	-0.030392	-0.009887	-0.0757
ExperienceYearsInCurrentRole	0.217163	-0.031823	-0.003215	-0.0766
YearsSinceLastPromotion	0.228199	-0.021575	0.014277	-0.0529
YearsWithCurrManager	0.205098	-0.036643	0.002767	-0.0619
Attrition	-0.189317	0.035758	0.027161	0.1629
PerformanceRating	-0.040164	-0.001780	0.005607	0.0241

27 rows × 27 columns

In [26]:

```
data.drop(['EmpNumber'],inplace=True,axis=1)
```

In [27]:

```
data.head()
```

Out[27]:

	Age	Gender	EducationBackground	MaritalStatus	EmpDepartment	EmpJobRole
0	32	1	2	2	5	13
1	47	1	2	2	5	13
2	40	1	1	1	5	13
3	41	1	0	0	3	8
4	60	1	2	2	5	13

5 rows × 27 columns

In [28]:

```
y = data.PerformanceRating
X = data.iloc[:,[4,5,9,16,20,21,22,23,24]]
X.head()
```

Out[28]:

	EmpDepartment	EmpJobRole	EmpEnvironmentSatisfaction	EmpLastSalaryHikePe
0	5	13	4	12
1	5	13	4	12
2	5	13	4	21
3	3	8	2	15
4	5	13	1	14

In [29]:

```
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.3,random_state=10)
```

In [30]:

```
sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)
```

In [31]:

```
X_train.shape
```

Out[31]:

```
(840, 9)
```

In [32]:

```
X_test.shape
```

Out[32]:

```
(360, 9)
```

In [40]:

```
from sklearn.ensemble import RandomForestClassifier

classifier_rfg=RandomForestClassifier(random_state=33,n_estimators=23)
parameters=[{'min_samples_split':[2,3,4,5],'criterion':['gini','entropy'],'min_samples_
leaf':[1,2,3]}]

model_gridrf=GridSearchCV(estimator=classifier_rfg, param_grid=parameters, scoring='acc
uracy')
model_gridrf.fit(X_train,y_train)
```

Out[40]:

```
GridSearchCV(cv=None, error_score='raise',
       estimator=RandomForestClassifier(bootstrap=True, class_weight=None,
criterion='gini',
            max_depth=None, max_features='auto', max_leaf_nodes=None,
            min_impurity_decrease=0.0, min_impurity_split=None,
            min_samples_leaf=1, min_samples_split=2,
            min_weight_fraction_leaf=0.0, n_estimators=23, n_jobs=1,
            oob_score=False, random_state=33, verbose=0, warm_start=Fals
e),
       fit_params=None, iid=True, n_jobs=1,
       param_grid=[{'min_samples_split': [2, 3, 4, 5], 'criterion': ['gin
i', 'entropy'], 'min_samples_leaf': [1, 2, 3]}],
       pre_dispatch='2*n_jobs', refit=True, return_train_score='warn',
       scoring='accuracy', verbose=0)
```

In [41]:

```
model_gridrf.best_params_
```

Out[41]:

```
{'criterion': 'entropy', 'min_samples_leaf': 2, 'min_samples_split': 2}
```

In [46]:

```
y_predict_rf=model_gridrf.predict(X_test)
```

In [47]:

```
print(accuracy_score(y_test,y_predict_rf))
print(classification_report(y_test,y_predict_rf))
```

```
0.930555555556
             precision    recall  f1-score   support

          2       0.92      0.89      0.90        63
          3       0.94      0.97      0.96       264
          4       0.83      0.73      0.77        33

avg / total       0.93      0.93      0.93       360
```

In [48]:

```
confusion_matrix(y_test,y_predict_rf)
```

Out[48]:

```
array([[ 56,   7,   0],
       [  4, 255,   5],
       [  1,   8,  24]])
```