In [ ]:

```
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# Roll No: 11
# Practical no: 05
# Academic year: 2024-25
```

In [1]:

```
import pandas as pd
```

In [3]:

```
import numpy as np
```

In [5]:

```
import matplotlib.pyplot as plt
```

In [11]:

```
df=pd.read_csv("/home/jaihind/Downloads/Social_Network_Ads.csv")
```

In [13]:

```
df
```

Out[13]:

	User ID	Gender	Age	EstimatedSalary	Purchased
0	15624510	Male	19	19000	0
1	15810944	Male	35	20000	0
2	15668575	Female	26	43000	0
3	15603246	Female	27	57000	0
4	15804002	Male	19	76000	0
...	...	...	...	...	...
395	15691863	Female	46	41000	1
396	15706071	Male	51	23000	1
397	15654296	Female	50	20000	1
398	15755018	Male	36	33000	0
399	15594041	Female	49	36000	1

400 rows × 5 columns

In [15]:

```
df.shape
```

Out[15]:

```
(400, 5)
```

In [19]:

```
x=df.iloc[:,2:4]
y=df.iloc[:,4]
```

In [21]:

```
from sklearn.model_selection import train_test_split
xtrain, xtest, ytrain, ytest = train_test_split(x, y, test_size=0.2,
                                                random_state=0)
```

In [47]:

```
from sklearn.preprocessing import StandardScaler
sc_x=StandardScaler()
xtrain=sc_x.fit_transform(xtrain)
xtest=sc_x.transform(xtest)
print(xtrain[:3])
print('-'*15)
print(xtest[:3])
```

```
[[ 1.92295008  2.14601566]
 [ 2.02016082  0.3787193 ]
 [-1.3822153  -0.4324987 ]]
---------------
[[-0.79895082  0.49460758]
 [-0.02126485 -0.57735906]
 [-0.31289709  0.14694273]]
```

In [23]:
```
import sklearn
from sklearn.linear_model import LogisticRegression
```

In [27]:
```
logreg=LogisticRegression()
```

In [51]:
```
logreg.fit(xtrain,ytrain)
y_pred=logreg.predict(xtest)
print(xtest[:10])
print('-'*15)
print(y_pred[:10])
```

```
[[-0.79895082  0.49460758]
 [-0.02126485 -0.57735906]
 [-0.31289709  0.14694273]
 [-0.79895082  0.26283101]
 [-0.31289709 -0.57735906]
 [-1.09058306 -1.44652121]
 [-0.70174008 -1.59138156]
 [-0.21568634  2.14601566]
 [-1.96547978 -0.05586178]
 [ 0.85363187 -0.78016356]]
---------------
[0 0 0 0 0 0 0 1 0 0]
```

In [53]:
```
print(y_pred[:20])
print(ytest[:20])
```

```
[0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0]
132    0
309    0
341    0
196    0
246    0
60     0
155    0
261    1
141    0
214    0
37     0
134    0
113    0
348    0
12     0
59     0
293    0
140    0
206    1
199    0
Name: Purchased, dtype: int64
```

In [99]:
```
from sklearn.metrics import confusion_matrix,ConfusionMatrixDisplay,
classification_report,accuracy_score, precision_score, recall_score, f1_score
cm=confusion_matrix(ytest,y_pred)
print(cm)
```

```
[[57  1]
 [ 5 17]]
```

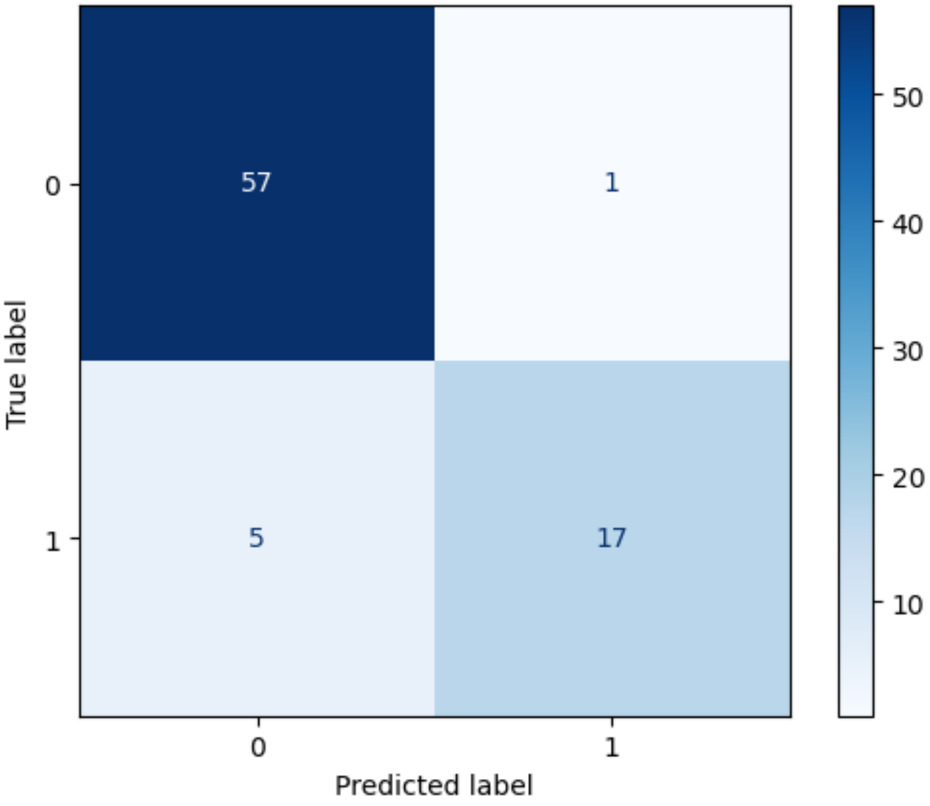
In [101…

```
matrix= confusion_matrix(ytest,y_pred,labels = logreg.classes_)
print(matrix)

tp, fn, fp, tn = confusion_matrix(ytest,y_pred,labels=[1,0]).reshape(-1)
```

```
[[57  1]
 [ 5 17]]
```

In [103…

```
conf_matrix = ConfusionMatrixDisplay(confusion_matrix=matrix,
                                     display_labels=logreg.classes_)
conf_matrix.plot(cmap=plt.cm.Blues)
plt.show()
```



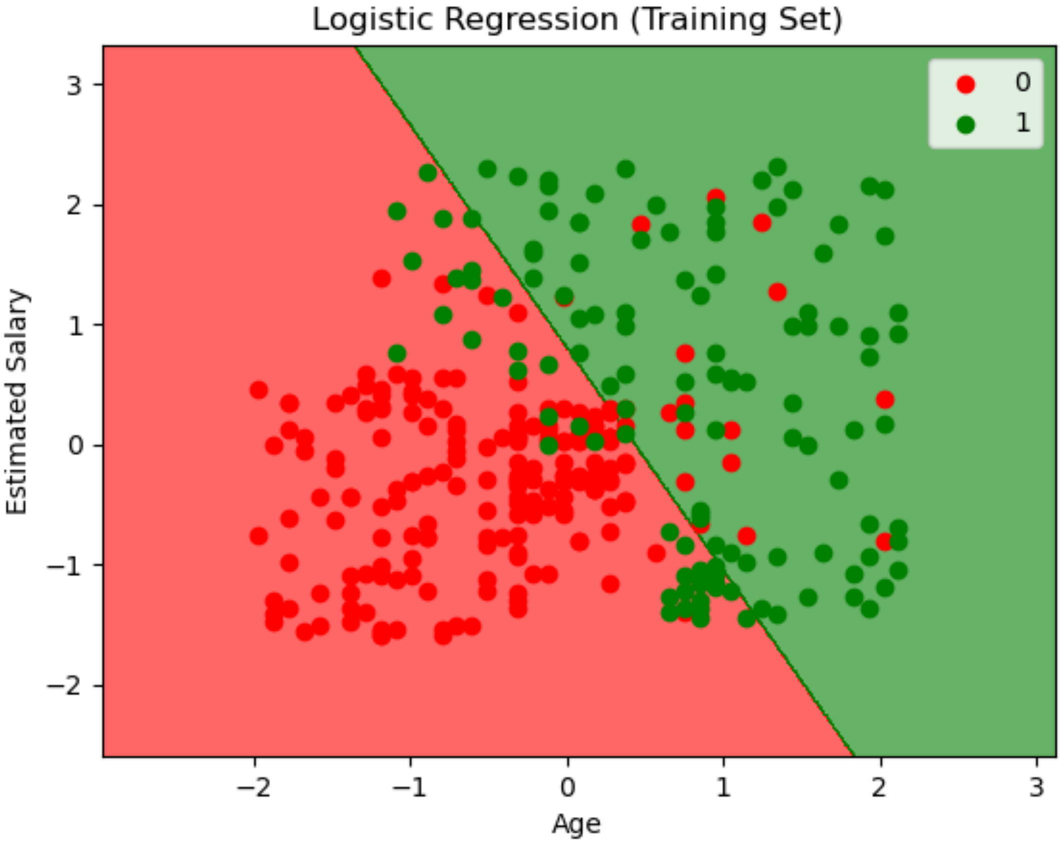
In [ ]:

```
#visualizing the training set results
```

In [81]:

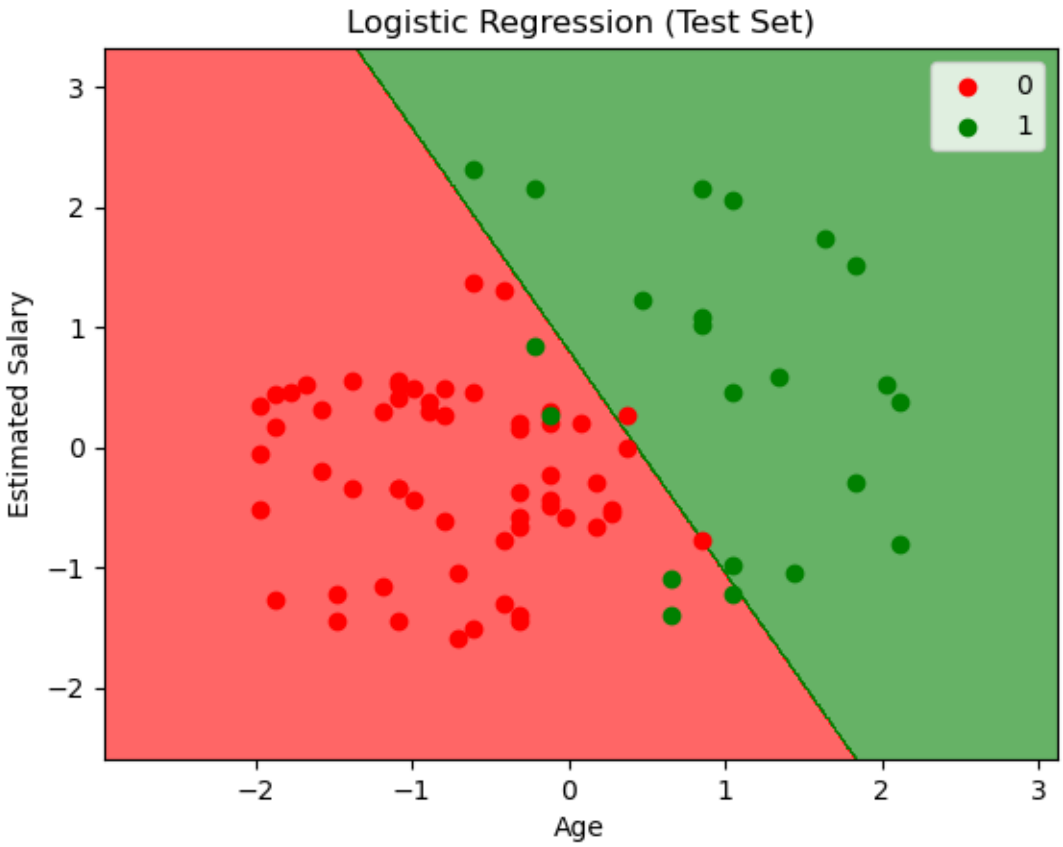
```
from matplotlib.colors import ListedColormap
import numpy as np
import matplotlib.pyplot as plt

xset, yset = xtrain, ytrain

x1, x2 = np.meshgrid(np.arange(start=xset[:, 0].min() - 1,
                               stop=xset[:, 0].max() + 1, step=0.01),
                     np.arange(start=xset[:, 1].min() - 1,
                               stop=xset[:, 1].max() + 1, step=0.01))

plt.contourf(x1, x2, logreg.predict(np.array([x1.ravel(),
                x2.ravel()]).T).reshape(x1.shape), alpha=0.6,
                cmap=ListedColormap(('red', 'green')))
for i, j in enumerate(np.unique(yset)):
    plt.scatter(xset[yset == j, 0], xset[yset == j, 1],
                color=ListedColormap(('red', 'green'))(i), label=j)
plt.title('Logistic Regression (Training Set)')
plt.xlabel('Age')
```

```python
plt.ylabel('Estimated Salary')
plt.legend()

plt.show()
```



In [85]:

```python
from matplotlib.colors import ListedColormap
import numpy as np
import matplotlib.pyplot as plt

xset, yset = xtest, ytest

x1, x2 = np.meshgrid(np.arange(start=xset[:, 0].min() - 1,
                              stop=xset[:, 0].max() + 1, step=0.01),
                     np.arange(start=xset[:, 1].min() - 1,
                              stop=xset[:, 1].max() + 1, step=0.01))

plt.contourf(x1, x2, logreg.predict(np.array([x1.ravel(),
                x2.ravel()]).T).reshape(x1.shape), alpha=0.6,
                cmap=ListedColormap(('red', 'green')))
for i, j in enumerate(np.unique(yset)):
    plt.scatter(xset[yset == j, 0], xset[yset == j, 1],
                color=ListedColormap(('red', 'green'))(i), label=j)
plt.title('Logistic Regression (Test Set)')
plt.xlabel('Age')
plt.ylabel('Estimated Salary')
plt.legend()

plt.show()
```



In [105…

```
print('\nAccuracy: {:.2f}'.format(accuracy_score(ytest,y_pred)))
print('Error Rate: ',(fp+fn)/(tp+tn+fn+fp))
print('Sensitivity (Recall or True positive rate) :',tp/(tp+fn))
print('Specificity (True negative rate) :',tn/(fp+tn))
print('Precision (Positive predictive value) :',tp/(tp+fp))
print('False Positive Rate :',fp/(tn+fp))
```

```
Accuracy: 0.93
Error Rate:  0.075
Sensitivity (Recall or True positive rate) : 0.7727272727272727
Specificity (True negative rate) : 0.9827586206896551
Precision (Positive predictive value) : 0.9444444444444444
False Positive Rate : 0.017241379310344827
```