In [5]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

import warnings
warnings.filterwarnings('ignore')
```

In [6]:
```
data = pd.read_csv('Social_Network_Ads (2).csv')
```

In [7]:
```
data.head()
```

Out[7]:

	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

In [8]:
```
data.tail()
```

Out[8]:

	User ID	Gender	Age	EstimatedSalary	Purchased
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

In [9]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 400 entries, 0 to 399
Data columns (total 5 columns):
User ID             400 non-null int64
Gender              400 non-null object
Age                 400 non-null int64
EstimatedSalary     400 non-null int64
Purchased           400 non-null int64
dtypes: int64(4), object(1)
memory usage: 14.1+ KB
```

In [11]:
```
round(data.describe(),1)
```

Out[11]:

	User ID	Age	EstimatedSalary	Purchased
count	400.0	400.0	400.0	400.0
mean	15691539.8	37.7	69742.5	0.4
std	71658.3	10.5	34097.0	0.5
min	15566689.0	18.0	15000.0	0.0
25%	15626763.8	29.8	43000.0	0.0
50%	15694341.5	37.0	70000.0	0.0
75%	15750363.0	46.0	88000.0	1.0
max	15815236.0	60.0	150000.0	1.0

In [12]:
```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import accuracy_score,classification_report,confusion_matrix,auc,roc_curve
```

In [14]:
```
data['Gender'].value_counts()
```

Out[14]:
```
Female    204
Male      196
Name: Gender, dtype: int64
```

In [15]:
```
f = {'Female':1,'Male':0}
data['Gender']=data['Gender'].map(f)
```

In [16]:
```
x = data.drop(columns=['Purchased','Gender','User ID']).to_numpy()
y = data['Purchased'].to_numpy()
```

In [17]:
```
x_train,x_test,y_train,y_test = train_test_split(x,y,random_state =0,train_size=0.75,stratify=y)
```

In [18]:
```
scaler = StandardScaler()
X_train = scaler.fit_transform(x_train)
X_test = scaler.transform(x_test)
```

In [23]:
```
print('y_train with 0 :-',len(y_train[y_train==0]))
print('y_train with 1 :-',len(y_train[y_train==1]))
```

```
y_train with 0 :- 193
y_train with 1 :- 107
```

In [24]:
```
from sklearn.naive_bayes import GaussianNB
```

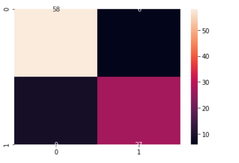
In [43]:
```
classifier = GaussianNB()
classifier.fit(X_train,y_train)
y_pred = classifier.predict(X_test)
print('Accuracy :-',accuracy_score(y_test,y_pred))
```

```
Accuracy :- 0.85
```

In [44]:
```
mat = confusion_matrix(y_test,y_pred)
mat
```

Out[44]:
```
array([[58,  6],
       [ 9, 27]], dtype=int64)
```

In [45]:
```
sns.heatmap(mat,annot=True)
plt.show()
```



In [46]:
```
print(classification_report(y_test,y_pred))
```

```
              precision    recall  f1-score   support

           0       0.87      0.91      0.89        64
           1       0.82      0.75      0.78        36

    accuracy                           0.85       100
   macro avg       0.84      0.83      0.83       100
weighted avg       0.85      0.85      0.85       100
```

In [47]:
```
dataframe = pd.DataFrame({'Actual':y_test,'Predicted':y_pred})
```

In [48]:
```
dataframe.tail()
```

Out[48]:

	Actual	Predicted
95	1	1
96	0	0
97	1	0
98	0	0
99	1	1

In [50]:
```
from sklearn.metrics import mean_squared_error
```

In [51]:
```
sqrt_error = np.sqrt(mean_squared_error(y_test,y_pred))
sqrt_error
```

Out[51]:
```
0.3872983346207417
```

In [52]:
```
np.std(y_test)
```

Out[52]:
```
0.48000000000000004
```

Since Standard Deviation of actual(y_test) is greater than the square root error,that's means our model is good.

In [53]:
```
from sklearn.model_selection import cross_val_score
```

In [54]:
```
print('Accuarcy with train data :-',round(classifier.score(X_train,y_train)*100))
print('Accuarcy with test data :-',round(classifier.score(X_test,y_test)*100,1))
```

```
Accuarcy with train data :- 90.0
Accuarcy with test data :- 85.0
```

In [57]:
```
val_score_mean = cross_val_score(classifier,X_train,y_train,cv=10).mean()*100
val_score_mean
```

Out[57]:
```
89.33333333333333
```

In [58]:
```
val_score_max = cross_val_score(classifier,X_train,y_train,cv=10).max()*100
val_score_max
```

Out[58]:
```
93.33333333333333
```

In [60]:
```
val_score_min = cross_val_score(classifier,X_train,y_train,cv=10).min()*100
val_score_min
```

Out[60]:
```
80.0
```

Due to marginal changes in random_state our model will gives us an accuarcy diffrent diffrent so use k-fold cross validation taken it's mean so that why we can say we had predicted the mean value of the model precition for k=10

- Although the we have calculated max and min of it showing it is varing from 93.33 to 80.0.

In [61]:
```
from plotnine import aes,geom_abline,geom_line,geom_area,ggplot,ggtitle
```

In [66]:
```
probab = classifier.predict_proba(X_test)[:,1]
```

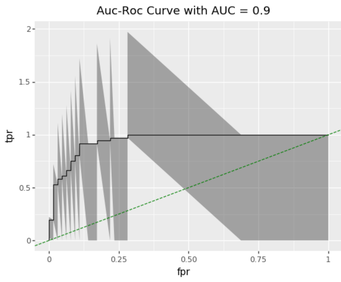
In [67]:
```
fpr,tpr,thresh=roc_curve(y_test,probab)
```

In [68]:
```
roc_data = pd.DataFrame(dict(fpr=fpr,tpr=tpr))
```

In [69]:
```
auc = round(auc(fpr,tpr),1)
auc
```

Out[69]:
```
0.9
```

In [79]:
```
ggplot(roc_data,aes(x='fpr',y='tpr'))+geom_line()+geom_area(alpha=0.4)+geom_abline(linetype='dashed',color='gre
```



Out[79]:
```
<ggplot: (20227655)>
```

Thank you