In [2]:
```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns
```

Load Dataframe

In [3]:
```
df = pd.read_csv('Social_Network_Ads.csv')
```

In [4]:
```
print("----------------Dataframe Info-----------------")
print(df.info())
print("\n")
```

```
----------------Dataframe Info-----------------
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 400 entries, 0 to 399
Data columns (total 5 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   User ID          400 non-null    int64  
 1   Gender           400 non-null    object 
 2   Age              400 non-null    float64
 3   EstimatedSalary  400 non-null    float64
 4   Purchased        400 non-null    int64  
dtypes: float64(2), int64(2), object(1)
memory usage: 15.8+ KB
None
```

In [5]:
```
print("---------------Dataframe Descibe----------------")
print(df.describe())
print("\n")
```

```
---------------Dataframe Descibe----------------
            User ID         Age  EstimatedSalary   Purchased
count  4.000000e+02  400.000000       400.000000  400.000000
mean   1.569154e+07   37.655000     69742.500000    0.357500
std    7.165832e+04   10.482877     34096.960282    0.479864
min    1.556669e+07   18.000000     15000.000000    0.000000
25%    1.562676e+07   29.750000     43000.000000    0.000000
50%    1.569434e+07   37.000000     70000.000000    0.000000
75%    1.575036e+07   46.000000     88000.000000    1.000000
max    1.581524e+07   60.000000    150000.000000    1.000000
```

In [6]:
```
print("---------------First 5 rows of Dataframe----------------")
print(df.head())
print("\n")
```

```
---------------First 5 rows of Dataframe----------------
    User ID  Gender   Age  EstimatedSalary  Purchased
0  15624510    Male  19.0          19000.0          0
1  15810944    Male  35.0          20000.0          0
2  15668575  Female  26.0          43000.0          0
3  15603246  Female  27.0          57000.0          0
4  15804002    Male  19.0          76000.0          0
```

In [7]:
```
print("---------------Train Dataset-------------")
X = df[['Age', 'EstimatedSalary']]
Y = df['Purchased']
```

```
---------------Train Dataset-------------
```

In [8]:
```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
```

In [9]:
```
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size = 0.25,
sc_X = StandardScaler()
X_train = sc_X.fit_transform(X_train)
X_test = sc_X.transform(X_test)
print(f'Train Dataset Size - X: {X_train.shape}, Y: {Y_train.shape}')
print(f'Test  Dataset Size - X: {X_test.shape}, Y: {Y_test.shape}')
```

```
Train Dataset Size - X: (300, 2), Y: (300,)
Test  Dataset Size - X: (100, 2), Y: (100,)
```

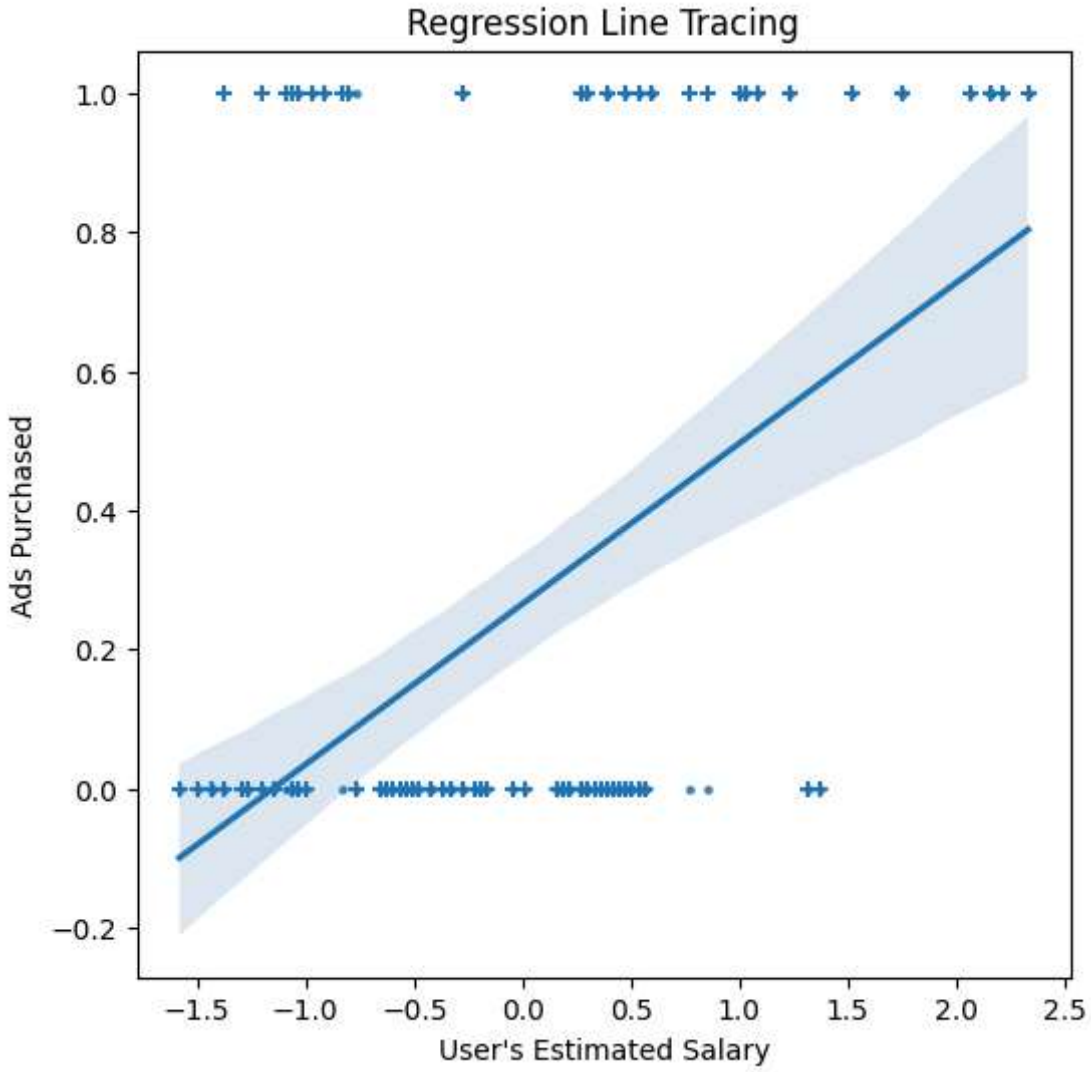
Linner Regression

This code fits a logistic regression model on the training data, makes predictions on the test data, and plots the regression line along with the actual test data to visualize the accuracy of the model.

In [10]:
```
print("----------------Linner Regression-------------------")
from sklearn.linear_model import LogisticRegression
```

```
----------------Linner Regression-------------------
```

In [11]:
```
lm = LogisticRegression(random_state=0, solver='lbfgs')
lm.fit(X_train, Y_train)
predictions = lm.predict(X_test)
plt.figure(figsize=(6, 6))
sns.regplot(x = X_test[:, 1], y = predictions, scatter_kws={'s':5})
plt.scatter(X_test[:, 1], Y_test, marker = '+')
plt.xlabel("User's Estimated Salary")
plt.ylabel('Ads Purchased')
plt.title('Regression Line Tracing')
plt.show()
```




In [12]:
```
print("-------------Confusion Matrix---------------")
from sklearn.metrics import confusion_matrix
from sklearn.metrics import classification_report
```

```
-------------Confusion Matrix---------------
```

In [13]:
```
cm = confusion_matrix(Y_test, predictions)
print(f'''Confusion matrix :\n
               | Positive Prediction\t| Negative Prediction
---------------+-----------------------+---------------------
Positive Class | True Positive (TP) {cm[0, 0]}\t| False Negative (FN) {cm[0
---------------+-----------------------+---------------------
Negative Class | False Positive (FP) {cm[1, 0]}\t| True Negative (TN) {cm[1
```

```
Confusion matrix :

               | Positive Prediction    | Negative Prediction
---------------+------------------------+---------------------
Positive Class | True Positive (TP) 65  | False Negative (FN) 3
---------------+------------------------+---------------------
Negative Class | False Positive (FP) 8  | True Negative (TN) 24
```

In [14]:
```
cm = classification_report(Y_test, predictions)
print('Classification report : \n', cm)
```

```
Classification report :
               precision    recall  f1-score   support

           0       0.89      0.96      0.92        68
           1       0.89      0.75      0.81        32

    accuracy                           0.89       100
   macro avg       0.89      0.85      0.87       100
weighted avg       0.89      0.89      0.89       100
```

Visualizing Training set result

This code visualizes the training set results for the logistic regression model.
It creates a meshgrid of points, makes predictions on those points using the trained model, and plots the decision boundary.
It also scatters the actual training data points, coloring them based on their true class.
This allows us to see how well the logistic regression model fits the training data.

In [15]:
```
print("-----------------Visualizing Training set result----------------")
from matplotlib.colors import ListedColormap
X_set, y_set = X_train, Y_train
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 1, stop = X_set[
                     np.arange(start = X_set[:, 1].min() - 1, stop = X_set[
```

```
-----------------Visualizing Training set result----------------
```

In [16]:
```
plt.figure(figsize=(9, 7.5))
plt.contourf(X1, X2, lm.predict(np.array([X1.ravel(), X2.ravel()]).T).resha
             alpha = 0.6, cmap = ListedColormap(('red', 'green')));
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1],
                color = ListedColormap(('red', 'green'))(i), label = j)
plt.title('Logistic Regression (Training set)')
plt.xlabel('Age')
plt.ylabel('Estimated Salary')
plt.legend()
plt.show()
print("\n")
```


Visualizing Test set result

This code is visualizing the test set results after training the logistic regression model.
It creates meshgrid of points, makes predictions on those points using the trained model, and plots the decision boundary. It also scatters the actual test set data points on top.
This allows us to visualize how well the model is able to separate the two classes on the test data.
The various plot settings like colors, alpha, labels etc help interpret the results better.

In [17]:
```
print("-----------------Visualizing Test set result----------------")
from matplotlib.colors import ListedColormap
X_set, y_set = X_test, Y_test
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 1, stop = X_set[
                     np.arange(start = X_set[:, 1].min() - 1, stop = X_set[
```

```
-----------------Visualizing Test set result----------------
```

In [18]:
```
plt.figure(figsize=(9, 7.5))
plt.contourf(X1, X2, lm.predict(np.array([X1.ravel(), X2.ravel()]).T).resha
             alpha = 0.6, cmap = ListedColormap(('red', 'green')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == 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()
print("\n")
```