In [1]:
```
import pandas as pd
import numpy as np
```

In [2]:
```
df=pd.read_excel('survey_data3.xlsx')
df.head()
```

Out[2]:

	Person	Age	Gender	State	Children	Salary	Opinion	Agree or Not	Strongly Agree or Not	Neutral or Not	Disagree or Not
0	1	Middle-aged	2	Texas	2	63017	Strongly agree	1	1	0	0
1	2	Middle-aged	2	Virginia	3	100302	Strongly disagree	0	0	0	1
2	3	Middle-aged	2	California	0	144043	Strongly agree	1	1	0	0
3	4	Young	2	California	0	36025	Agree	1	0	0	0
4	5	Middle-aged	1	Texas	0	97543	Neutral	0	0	1	0

In [3]:
```
df=df[['Age','Gender', 'State', 'Children','Salary', 'Neutral or Not']]
df.head()
```

Out[3]:

	Age	Gender	State	Children	Salary	Neutral or Not
0	Middle-aged	2	Texas	2	63017	0
1	Middle-aged	2	Virginia	3	100302	0
2	Middle-aged	2	California	0	144043	0
3	Young	2	California	0	36025	0
4	Middle-aged	1	Texas	0	97543	1

In [4]:
```
df = pd.concat([df,pd.get_dummies(df['Age'], prefix='_', drop_first=True)],axis=1)
df.drop(['Age'],axis=1, inplace=True)
df = pd.concat([df,pd.get_dummies(df['State'], prefix='State', drop_first=True)],axis=1
df.drop(['State'],axis=1, inplace=True)
df['Gender']=df['Gender']-1
df.head()
```

Out[4]:

	Gender	Children	Salary	Neutral or Not	_Middle-aged	_Young	State_California	State_Florida	State_Illinois
0	1	2	63017	0	1	0	0	0	0
1	1	3	100302	0	1	0	0	0	0
2	1	0	144043	0	1	0	1	0	0

	Gender	Children	Salary	Neutral or Not	_Middle-aged	_Young	State_California	State_Florida	State_Illinois
3	1	0	36025	0	0	1	1	0	0
4	0	0	97543	1	1	0	0	0	0

In [5]:
```
df1=df.copy()
```

In [6]:
```
df1['Gend_child']=df1['Gender']*df1['Children']
df1['log_Salary']=np.log(df1['Salary'])
df1['Salary_Sq'] = df1['Salary']**2
df1.head()
```

Out[6]:

	Gender	Children	Salary	Neutral or Not	_Middle-aged	_Young	State_California	State_Florida	State_Illinois
0	1	2	63017	0	1	0	0	0	0
1	1	3	100302	0	1	0	0	0	0
2	1	0	144043	0	1	0	1	0	0
3	1	0	36025	0	0	1	1	0	0
4	0	0	97543	1	1	0	0	0	0

In [7]:
```
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import classification_report, confusion_matrix
```

In [9]:
```
df_copy = df.copy()
train_set = df_copy.sample(frac=0.80, random_state=0)
test_set = df_copy.drop(train_set.index)
train_set.head()
```

Out[9]:

	Gender	Children	Salary	Neutral or Not	_Middle-aged	_Young	State_California	State_Florida	State_Illinois
132	0	0	97814	0	1	0	0	0	0
309	0	2	69817	0	0	0	0	0	0
334	0	1	48225	1	0	1	0	0	0
196	0	0	37929	0	0	1	0	0	0
246	1	2	100062	0	1	0	0	0	0

In [10]:
```
test_set.head()
```

Out[10]:

	Gender	Children	Salary	Neutral or Not	_Middle-aged	_Young	State_California	State_Florida	State_Illinois
9	0	3	87457	0	1	0	0	0	1
25	1	2	148075	0	1	0	0	0	0
28	1	2	37963	0	0	1	1	0	0
31	1	2	49505	0	0	1	0	0	0
32	0	3	49723	0	0	1	1	0	0

In [11]:
```
test_set_labels = test_set.pop('Neutral or Not')
train_set_labels = train_set.pop('Neutral or Not')
```

In [12]:
```
model = LogisticRegression(solver = 'liblinear', random_state=0).fit(train_set,train_se
```

In [13]:
```
model.predict_proba(train_set)
```

Out[13]:
```
array([[0.86219691, 0.13780309],
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```

In [14]:

```
model.predict(train_set)
```

Out[14]:

```
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```

In [15]:

```
model.predict_proba(test_set)
```

Out[15]:

```
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       [0.76189216, 0.23810784],
       [0.83588659, 0.16411341],
       [0.85755787, 0.14244213],
       [0.69596147, 0.30403853],
       [0.80923766, 0.19076234],
       [0.70741852, 0.29258148],
       [0.73042915, 0.26957085],
       [0.88290782, 0.11709218],
       [0.78646297, 0.21353703],
       [0.66572453, 0.33427547],
       [0.80727079, 0.19272921],
       [0.81212912, 0.18787088],
       [0.69930684, 0.30069316],
       [0.90876304, 0.09123696],
       [0.80671894, 0.19328106],
       [0.82965814, 0.17034186],
       [0.80201098, 0.19798902],
       [0.74978909, 0.25021091],
       [0.8321812 , 0.1678188 ],
       [0.6956877 , 0.3043123 ],
       [0.69436052, 0.30563948],
       [0.81195745, 0.18804255],
       [0.84675205, 0.15324795],
       [0.79070401, 0.20929599],
       [0.89807904, 0.10192096],
       [0.85772495, 0.14227505],
       [0.72610732, 0.27389268],
       [0.85506449, 0.14493551],
       [0.83341849, 0.16658151],
       [0.8138364 , 0.1861636 ],
       [0.92321128, 0.07678872],
       [0.83238269, 0.16761731],
       [0.78317051, 0.21682949],
       [0.82884059, 0.17115941],
       [0.8384776 , 0.1615224 ],
       [0.74123962, 0.25876038],
       [0.83694847, 0.16305153],
       [0.81824603, 0.18175397],
       [0.83078379, 0.16921621]])
```

In [16]:
```
model.predict(test_set)
```

Out[16]:
```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0], dtype=int64)
```

In [17]:
```
model.score(train_set,train_set_labels)
```

Out[17]:
```
0.8244514106583072
```

In [18]:
```
model.score(test_set,test_set_labels)
```

Out[18]:
```
0.85
```

In [19]:
```
confusion_matrix(train_set_labels,model.predict(train_set))
```

Out[19]:
```
array([[263,   0],
       [ 56,   0]], dtype=int64)
```

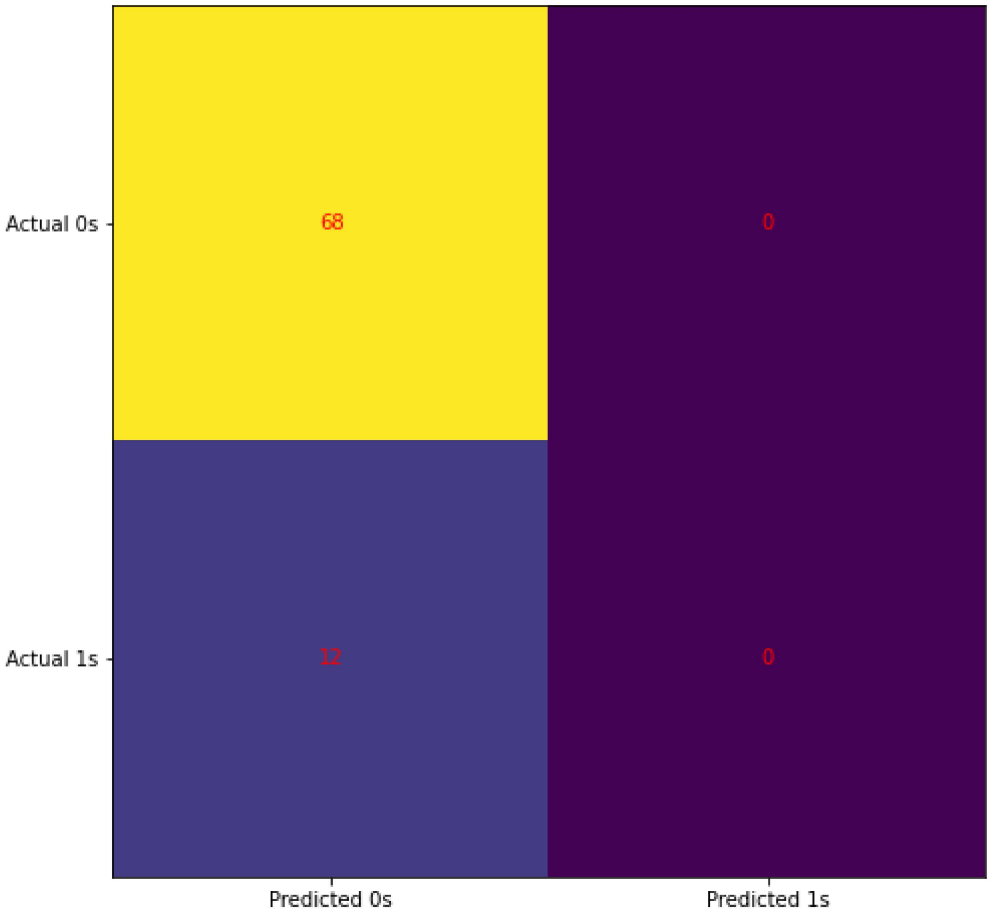
In [20]:
```
confusion_matrix(test_set_labels,model.predict(test_set))
```

Out[20]:
```
array([[68,  0],
       [12,  0]], dtype=int64)
```

In [21]:
```
import matplotlib.pyplot as plt
```

In [22]:
```
cm = confusion_matrix(test_set_labels, model.predict(test_set))

fig, ax = plt.subplots(figsize=(8, 8))
ax.imshow(cm)
ax.grid(False)
ax.xaxis.set(ticks=(0, 1), ticklabels=('Predicted 0s', 'Predicted 1s'))
ax.yaxis.set(ticks=(0, 1), ticklabels=('Actual 0s', 'Actual 1s'))
ax.set_ylim(1.5, -0.5)
for i in range(2):
    for j in range(2):
        ax.text(j, i, cm[i, j], ha='center', va='center', color='red')
plt.show()
```



In [23]:
```
model = LogisticRegression(C=10.0, solver = 'liblinear', random_state=0).fit(train_set,
```

In [24]:
```
model.score(train_set,train_set_labels)
```

Out[24]:
```
0.8244514106583072
```

In [25]:
```
prob1 = model.predict_proba(train_set)
predicted=[0 if i>0.84 else 1 for i in prob1[:,0]]
predicted
```

Out[25]:
```
[0,
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```

In [26]:
```
sum(abs(train_set_labels-predicted))
```

Out[26]: 180

In [27]:
```
len(train_set_labels)
```

Out[27]: 319

In [28]:
```
error_percent =sum(abs(train_set_labels-predicted))/319
1-error_percent
```

Out[28]: 0.4357366771159875

In [29]:
```
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler
```

In [30]:
```
scaler = StandardScaler()
```

In [31]:
```
scaled_features = scaler.fit_transform(train_set)
```

In [32]:
```
kmeans = KMeans(init="random", n_clusters=5, n_init=10, max_iter=300, random_state=42)
kmeans.fit(scaled_features)
```

Out[32]:
```
KMeans(init='random', n_clusters=5, random_state=42)
```

In [33]:
```
kmeans.inertia_
```

Out[33]:
```
2982.105883164649
```

In [34]:
```
kmeans.cluster_centers_
```

Out[34]:
```
array([[-0.04971743,  0.01781439,  0.33015189,  0.3133736 , -0.52049624,
         0.25232533,  0.26227165, -0.32218974, -0.37864122, -0.29160592,
         0.34644297,  0.32731074, -0.38938997,  0.15103416],
       [ 0.20089178, -0.12825991,  0.34720311,  0.20571739, -0.52049624,
        -0.28522961, -0.33391355, -0.32218974,  1.02486446, -0.29160592,
        -0.33968311, -0.35666298,  1.19350246, -0.31622777],
       [-0.11496944, -0.07072974,  0.03824646,  0.02921187, -0.0321483 ,
        -0.28522961, -0.33391355, -0.32218974, -0.37864122,  3.42928564,
        -0.33968311, -0.35666298, -0.38938997, -0.31622777],
       [-0.29038454,  0.15619483,  0.10758022,  0.24343225, -0.19493094,
        -0.28522961, -0.33391355,  3.10376116, -0.37864122, -0.29160592,
        -0.33968311, -0.35666298, -0.38938997, -0.31622777],
       [ 0.06753546,  0.06443599, -1.23856512, -1.09544512,  1.92124347,
         0.03605657,  0.1174357 , -0.32218974, -0.02037603, -0.29160592,
        -0.06141164,  0.01830333, -0.18888085,  0.33230714]])
```

In [35]:
```
kmeans.n_iter_
```

Out[35]:
```
19
```

In [36]:
```
kmeans.labels_[:]
```

Out[36]:
```
array([0, 2, 4, 4, 0, 1, 4, 0, 2, 1, 0, 0, 1, 1, 2, 0, 0, 0, 4, 0, 0, 1,
       1, 4, 2, 0, 0, 1, 1, 3, 1, 4, 0, 1, 4, 0, 1, 0, 4, 3, 4, 1, 1, 0,
       0, 0, 4, 0, 4, 0, 3, 0, 4, 0, 1, 0, 1, 0, 0, 0, 4, 1, 1, 4, 0, 0,
       0, 0, 2, 0, 1, 0, 0, 0, 0, 4, 1, 1, 2, 1, 3, 0, 2, 1, 0, 4, 1, 0,
       0, 3, 1, 1, 1, 0, 2, 0, 2, 4, 2, 4, 0, 4, 3, 1, 0, 4, 0, 0, 3, 3,
       1, 4, 3, 0, 1, 0, 0, 0, 4, 0, 1, 3, 1, 3, 1, 0, 1, 1, 0, 4, 0, 1,
       3, 0, 0, 0, 4, 1, 3, 0, 1, 4, 1, 1, 2, 1, 0, 0, 0, 4, 1, 0, 1, 0,
       4, 0, 0, 0, 0, 0, 3, 3, 0, 1, 4, 1, 3, 0, 1, 0, 0, 0, 0, 1, 0, 0,
       0, 3, 2, 0, 0, 0, 4, 4, 3, 2, 0, 1, 4, 4, 0, 4, 4, 3, 0, 1, 0, 0,
       4, 3, 1, 2, 1, 0, 0, 1, 1, 4, 1, 4, 0, 1, 0, 0, 4, 4, 3, 0, 0, 0,
       4, 2, 0, 0, 0, 4, 2, 0, 0, 1, 3, 1, 0, 2, 0, 1, 0, 3, 0, 0, 0, 0,
       1, 0, 3, 0, 0, 4, 3, 0, 1, 2, 4, 0, 0, 3, 0, 1, 2, 4, 4, 3, 3, 1,
       4, 4, 4, 0, 0, 4, 0, 0, 0, 1, 4, 3, 1, 0, 1, 0, 0, 0, 2, 0, 0, 2,
       4, 0, 2, 4, 4, 0, 4, 2, 4, 1, 1, 0, 0, 1, 0, 3, 2, 0, 0, 2, 1, 0,
       4, 4, 1, 0, 0, 4, 0, 1, 1, 4, 0])
```

In [37]:
```
from sklearn.neighbors import KNeighborsClassifier
```

In [38]:
```
model = KNeighborsClassifier(n_neighbors=1)
```

In [39]:
```
model.fit(scaled_features,train_set_labels)
predicted = model.predict(scaled_features)
predicted
```

Out[39]:
```
array([0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0,
       0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1,
       0, 0, 0, 1, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
       1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0,
       0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0,
       1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 1, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 1,
       0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0,
       1, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0], dtype=int64)
```

In [40]:
```
sum(abs(predicted-train_set_labels))
```

Out[40]:
```
0
```

In [41]:
```
from sklearn.datasets import make_classification
from sklearn.ensemble import RandomForestClassifier
```

In [42]:
```
model = RandomForestClassifier()
model.fit(train_set, train_set_labels)
```

Out[42]:
```
RandomForestClassifier()
```

In [43]:
```
yhat = model.predict(train_set)
```

In [44]:
```
sum(abs(yhat-train_set_labels))
```

Out[44]:
```
0
```

In [45]:
```
df1.describe().transpose()
```

Out[45]:

	count	mean	std	min	25%	50%	
Gender	399.0	5.864662e-01	4.930851e-01	0.000000e+00	0.000000e+00	1.000000e+00	1.00000
Children	399.0	1.313283e+00	1.022166e+00	0.000000e+00	0.000000e+00	2.000000e+00	2.00000

	count	mean	std	min	25%	50%	
Salary	399.0	7.894247e+04	2.723687e+04	2.068700e+04	5.812850e+04	7.921200e+04	9.57965
Neutral or Not	399.0	1.704261e-01	3.764788e-01	0.000000e+00	0.000000e+00	0.000000e+00	0.00000
__Middle-aged	399.0	5.463659e-01	4.984706e-01	0.000000e+00	0.000000e+00	1.000000e+00	1.00000
__Young	399.0	2.180451e-01	4.134366e-01	0.000000e+00	0.000000e+00	0.000000e+00	0.00000
State_California	399.0	8.270677e-02	2.757843e-01	0.000000e+00	0.000000e+00	0.000000e+00	0.00000
State_Florida	399.0	1.027569e-01	3.040223e-01	0.000000e+00	0.000000e+00	0.000000e+00	0.00000
State_Illinois	399.0	9.523810e-02	2.939121e-01	0.000000e+00	0.000000e+00	0.000000e+00	0.00000
State_Michigan	399.0	1.152882e-01	3.197704e-01	0.000000e+00	0.000000e+00	0.000000e+00	0.00000
State_Minnesota	399.0	7.769424e-02	2.680259e-01	0.000000e+00	0.000000e+00	0.000000e+00	0.00000
State_New York	399.0	1.152882e-01	3.197704e-01	0.000000e+00	0.000000e+00	0.000000e+00	0.00000
State_Ohio	399.0	1.102757e-01	3.136263e-01	0.000000e+00	0.000000e+00	0.000000e+00	0.00000
State_Texas	399.0	1.203008e-01	3.257213e-01	0.000000e+00	0.000000e+00	0.000000e+00	0.00000
State_Virginia	399.0	9.774436e-02	2.973415e-01	0.000000e+00	0.000000e+00	0.000000e+00	0.00000
Gend_child	399.0	8.020050e-01	1.009202e+00	0.000000e+00	0.000000e+00	0.000000e+00	2.00000
log_Salary	399.0	1.121107e+01	3.760868e-01	9.937261e+00	1.097039e+01	1.127988e+01	1.14699
Salary_Sq	399.0	6.971901e+09	4.626720e+09	4.279520e+08	3.379095e+09	6.274541e+09	9.17697

In [46]:
```
from sklearn.neural_network import MLPClassifier
```

In [47]:
```
mlp = MLPClassifier(hidden_layer_sizes=(13,3,2),max_iter=1000)
mlp.fit(scaled_features,train_set_labels)
```

```
C:\Users\Top\anaconda3\lib\site-packages\sklearn\neural_network\_multilayer_perceptron.p
y:614: ConvergenceWarning: Stochastic Optimizer: Maximum iterations (1000) reached and t
he optimization hasn't converged yet.
  warnings.warn(
```

Out[47]:
```
MLPClassifier(hidden_layer_sizes=(13, 3, 2), max_iter=1000)
```

In [48]:
```
MLPClassifier(activation='relu', alpha=0.0001, batch_size='auto', beta_1=0.9,
       beta_2=0.999, early_stopping=False, epsilon=1e-08,
       hidden_layer_sizes=(17,13,13,13), learning_rate='constant',
       learning_rate_init=0.001, max_iter=1000, momentum=0.9,
       nesterovs_momentum=True, power_t=0.5, random_state=None,
       shuffle=True, solver='adam', tol=0.0001, validation_fraction=0.1,
       verbose=False, warm_start=False)
```

Out[48]:
```
MLPClassifier(hidden_layer_sizes=(17, 13, 13, 13), max_iter=1000)
```

In [49]:
```
predictions = mlp.predict(train_set) #to predict with the test set you'd also have to s
predictions
```

Out[49]:
```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0], dtype=int64)
```

In [50]:
```
from sklearn.metrics import classification_report,confusion_matrix
print(confusion_matrix(train_set_labels,predictions)) #this is the same result we got w
#experiment with settings to see if you can improve it
```

```
[[263   0]
 [ 56   0]]
```

In [51]:
```
print(classification_report(train_set_labels,predictions))
```

```
              precision    recall  f1-score   support

           0       0.82      1.00      0.90       263
           1       0.00      0.00      0.00        56

    accuracy                           0.82       319
   macro avg       0.41      0.50      0.45       319
weighted avg       0.68      0.82      0.75       319

C:\Users\Top\anaconda3\lib\site-packages\sklearn\metrics\_classification.py:1245: Undefi
nedMetricWarning: Precision and F-score are ill-defined and being set to 0.0 in labels w
ith no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
C:\Users\Top\anaconda3\lib\site-packages\sklearn\metrics\_classification.py:1245: Undefi
nedMetricWarning: Precision and F-score are ill-defined and being set to 0.0 in labels w
ith no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
C:\Users\Top\anaconda3\lib\site-packages\sklearn\metrics\_classification.py:1245: Undefi
nedMetricWarning: Precision and F-score are ill-defined and being set to 0.0 in labels w
ith no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

In [52]:
```
import re

txt = "The rain in Spain is mainly on the plain."
x = re.findall("ai", txt)
print(x)
```

```
['ai', 'ai', 'ai', 'ai']
```

In [54]:
```
x = re.split("\s", txt)
print(x)
```

```
['The', 'rain', 'in', 'Spain', 'is', 'mainly', 'on', 'the', 'plain.']
```

In [53]:
```
x = re.split("\s", txt, 1) #splits at only the first space
print(x)
```

```
['The', 'rain in Spain is mainly on the plain.']
```

In [54]:
```
x = re.sub("\s", "-", txt)
print(x)
```

```
The-rain-in-Spain-is-mainly-on-the-plain.
```

In [55]:
```
x = re.search(r"\bS\w+", txt) #looks for a word with uppercase S at the start, gives st
print(x.span())
```

```
(12, 17)
```

In [56]:
```
print(x.string) #prints whole string where the word appeared
```

```
The rain in Spain is mainly on the plain.
```

In [57]:
```
print(x.group()) #prints just the word
```

```
Spain
```

In [58]:
```
x = re.findall("[mat]", txt)
print(x)
```

```
['a', 'a', 'm', 'a', 't', 'a']
```

In [59]:
```
x = re.findall("ain+", txt)
print(x)
```

```
['ain', 'ain', 'ain', 'ain']
```

In [ ]:
```
#https://www.w3schools.com/python/python_regex.asp more code keys here
```