In [1]:

```
from sklearn import tree
from pandas import read_csv
from sklearn.tree import DecisionTreeClassifier
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
df=read_csv("Travel.csv")
```

In [2]:

```
df
```

Out[2]:

	Age	EmploymentType	GraduateOrNot	AnnualIncome	FamilyMembers	ChronicDiseases	FrequentFlyer	EverTravelledAbroad	TravelInsura
0	31	Government Sector	Yes	400000	6	1	No	No	
1	31	Private Sector/Self Employed	Yes	1250000	7	0	No	No	
2	34	Private Sector/Self Employed	Yes	500000	4	1	No	No	
3	28	Private Sector/Self Employed	Yes	700000	3	1	No	No	
4	28	Private Sector/Self Employed	Yes	700000	8	1	Yes	No	
...	...	...	...	...	...	...	...	...	
1982	33	Private Sector/Self Employed	Yes	1500000	4	0	Yes	Yes	
1983	28	Private Sector/Self Employed	Yes	1750000	5	1	No	Yes	
1984	28	Private Sector/Self Employed	Yes	1150000	6	1	No	No	
1985	34	Private Sector/Self Employed	Yes	1000000	6	0	Yes	Yes	
1986	34	Private Sector/Self Employed	Yes	500000	4	0	No	No	

1987 rows × 9 columns

In [3]:

```
inputs=df
from sklearn.preprocessing import LabelEncoder
```

In [4]:

```
le_EmploymentType=LabelEncoder()
le_GraduateOrNot=LabelEncoder()
le_FrequentFlyer=LabelEncoder()
le_EverTravelledAbroad=LabelEncoder()
le_TravelInsurance=LabelEncoder()
```

In [5]:

```
inputs['EmploymentType_n']=le_EmploymentType.fit_transform(inputs['EmploymentType'])
inputs['GraduateOrNot_n']=le_GraduateOrNot.fit_transform(inputs['GraduateOrNot'])
inputs['FrequentFlyer_n']=le_FrequentFlyer.fit_transform(inputs['FrequentFlyer'])
inputs['EverTravelledAbroad_n']=le_EverTravelledAbroad.fit_transform(inputs['EverTravelledAbroad'])
inputs['TravelInsurance_n']=le_TravelInsurance.fit_transform(inputs['TravelInsurance'])
inputs.head()
```

Out[5]:

	Age	EmploymentType	GraduateOrNot	AnnualIncome	FamilyMembers	ChronicDiseases	FrequentFlyer	EverTravelledAbroad	TravelInsurance
0	31	Government Sector	Yes	400000	6	1	No	No	0
1	31	Private Sector/Self Employed	Yes	1250000	7	0	No	No	0
2	34	Private Sector/Self Employed	Yes	500000	4	1	No	No	1
3	28	Private Sector/Self Employed	Yes	700000	3	1	No	No	0
4	28	Private Sector/Self Employed	Yes	700000	8	1	Yes	No	0

In [6]:

```
inputs_n=inputs.drop(['EmploymentType','GraduateOrNot','FrequentFlyer','EverTravelledAbroad','TravelInsurance']
inputs_n
```

Out[6]:

	Age	AnnualIncome	FamilyMembers	ChronicDiseases	EmploymentType_n	GraduateOrNot_n	FrequentFlyer_n	EverTravelledAbroad_n	Tra
0	31	400000	6	1	0	1	0	0	
1	31	1250000	7	0	1	1	0	0	
2	34	500000	4	1	1	1	0	0	
3	28	700000	3	1	1	1	0	0	
4	28	700000	8	1	1	1	1	0	
...	...	...	...	...	...	...	...	...	
1982	33	1500000	4	0	1	1	1	1	
1983	28	1750000	5	1	1	1	0	1	
1984	28	1150000	6	1	1	1	0	0	
1985	34	1000000	6	0	1	1	1	1	
1986	34	500000	4	0	1	1	0	0	

1987 rows × 9 columns

In [7]:

```
from sklearn.cluster import KMeans
kmeans= KMeans(n_clusters=2,random_state=0)
kmeans.fit(inputs_n)
kmeans.cluster_centers_
```

Out[7]:

```
array([[2.97057613e+01, 1.26692387e+06, 4.76851852e+00, 2.75720165e-01,
        8.40534979e-01, 8.90946502e-01, 2.97325103e-01, 3.38477366e-01,
        4.97942387e-01],
       [2.95970443e+01, 6.12758621e+05, 4.73793103e+00, 2.79802956e-01,
        5.91133005e-01, 8.13793103e-01, 1.26108374e-01, 5.02463054e-02,
        2.22660099e-01]])
```

In [8]:

```
y=np.array(inputs["TravelInsurance"])
labels=kmeans.labels_
correct_labels=sum(y==labels)
print("Result: %d out of %d samples were correctly labeled." %(correct_labels,y.size))
```

```
Result: 714 out of 1987 samples were correctly labeled.
```

In [9]:

```
y
```

Out[9]:

```
array([0, 0, 1, ..., 0, 1, 0], dtype=int64)
```

In [10]:

```
from sklearn.cluster import KMeans
kmeans=KMeans(n_clusters=3,random_state=0)
kmeans.fit(inputs_n)
kmeans.cluster_centers_
```

Out[10]:

```
array([[2.91538462e+01, 1.35000000e+06, 4.78062678e+00, 2.74928775e-01,
        8.78917379e-01, 8.68945869e-01, 3.43304843e-01, 4.48717949e-01,
        5.76923077e-01],
       [2.91686957e+01, 4.74347826e+05, 4.81217391e+00, 2.60869565e-01,
        5.09565217e-01, 7.77391304e-01, 7.47826087e-02, 2.78260870e-02,
        1.96521739e-01],
       [3.05309859e+01, 8.91478873e+05, 4.67746479e+00, 2.94366197e-01,
        7.14084507e-01, 8.94366197e-01, 1.87323944e-01, 6.90140845e-02,
        2.70422535e-01]])
```

In [11]:

```
labels=kmeans.labels_
correct_labels=sum(y==labels)
print("Result:%d out of %d samples were correctly labeled." %(correct_labels,y.size))
```

```
Result:410 out of 1987 samples were correctly labeled.
```

In [12]:

```
labels
```

Out[12]:

```
array([1, 0, 1, ..., 0, 2, 1])
```

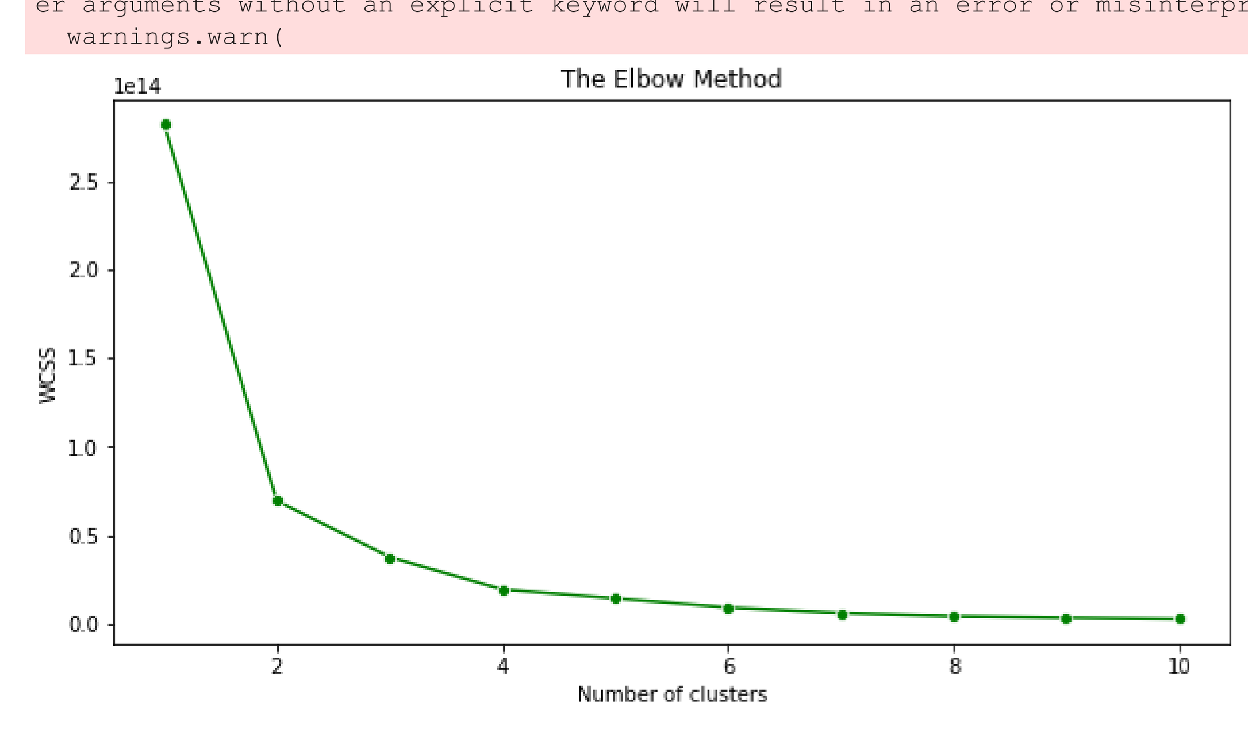
In [13]:

```
from sklearn.cluster import KMeans
wcss=[]
for i in range(1,11):
    kmeans= KMeans(n_clusters=i,init='k-means++',random_state=42)
    kmeans.fit(inputs_n)
    wcss.append(kmeans.inertia_)

import matplotlib.pyplot as plt
plt.figure(figsize=(10,5))
sns.lineplot(range(1,11),wcss,marker='o',color='green')

plt.title('The Elbow Method')
plt.xlabel('Number of clusters')
plt.ylabel('WCSS')
plt.show()
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variabl
es as keyword args: x, y. From version 0.12, the only valid positional argument will be `data`, and passing oth
er arguments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```



In [14]:

```
kmeans=KMeans(n_clusters=3,random_state=42)
y_kmeans=kmeans.fit_predict(inputs_n)
X=np.array(inputs_n)

plt.figure(figsize=(15,7))

sns.scatterplot(X[y_kmeans==0,0],X[y_kmeans==0,1],color='yellow',label='Cluster1')
sns.scatterplot(X[y_kmeans==1,0],X[y_kmeans==1,1],color='blue',label='Cluster3')
sns.scatterplot(X[y_kmeans==2,0],X[y_kmeans==2,1],color='green',label='Cluster3')
sns.scatterplot(kmeans.cluster_centers_[:,0],kmeans.cluster_centers_[:,1],color='red',label='TravelInsurance',s

plt.title('Three Clusters')
plt.xlabel('Status_type')
plt.ylabel('values')
plt.legend()
plt.show()
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variabl
es as keyword args: x, y. From version 0.12, the only valid positional argument will be `data`, and passing oth
er arguments without an explicit keyword will result in an error or misinterpretation.
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er arguments without an explicit keyword will result in an error or misinterpretation.
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C:\ProgramData\Anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variabl
es as keyword args: x, y. From version 0.12, the only valid positional argument will be `data`, and passing oth
er arguments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variabl
es as keyword args: x, y. From version 0.12, the only valid positional argument will be `data`, and passing oth
er arguments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```
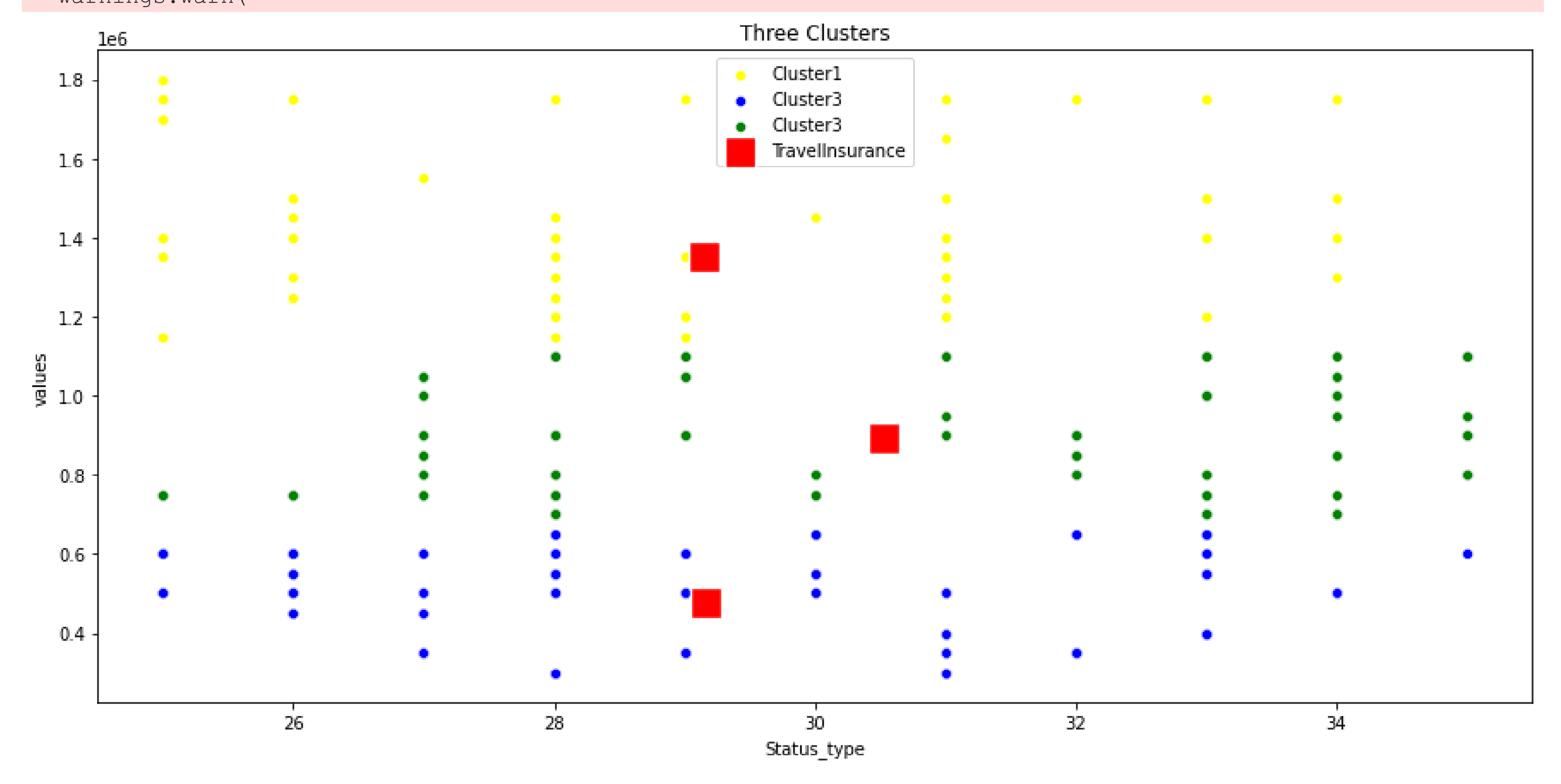



In [15]:

```
dataset2=inputs_n
dataset2.info
```

Out[15]:

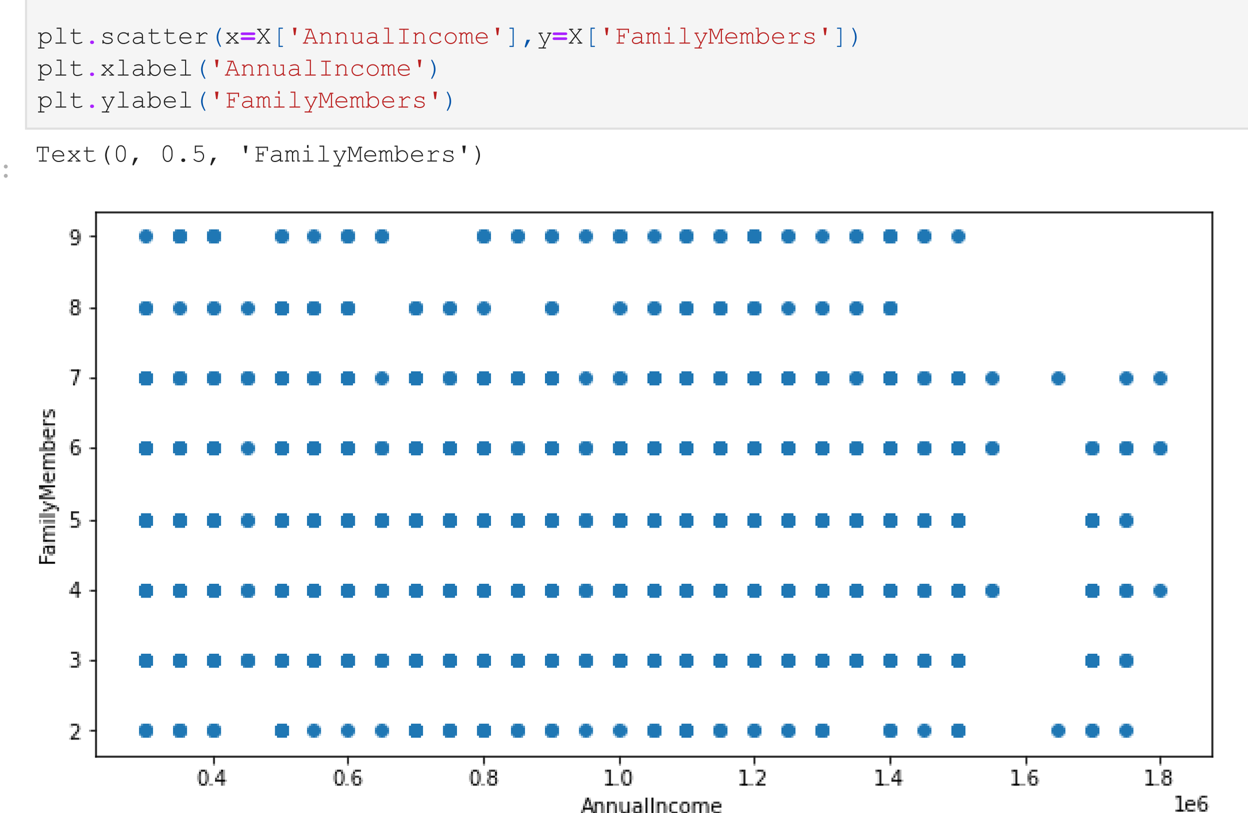
```
<bound method DataFrame.info of       Age  AnnualIncome  FamilyMembers  ChronicDiseases  EmploymentType_n  \
0      31        400000              6                1                 0
1      31       1250000              7                0                 1
2      34        500000              4                1                 1
3      28        700000              3                1                 1
4      28        700000              8                1                 1
...   ...           ...            ...              ...               ...
1982   33       1500000              4                0                 1
1983   28       1750000              5                1                 1
1984   28       1150000              6                1                 1
1985   34       1000000              6                0                 1
1986   34        500000              4                0                 1

      GraduateOrNot_n  FrequentFlyer_n  EverTravelledAbroad_n  \
0                   1                0                      0
1                   1                0                      0
2                   1                0                      0
3                   1                0                      0
4                   1                1                      0
...               ...              ...                    ...
1982                1                1                      1
1983                1                0                      1
1984                1                0                      0
1985                1                1                      1
1986                1                0                      0

      TravelInsurance_n
0                     0
1                     0
2                     1
3                     0
4                     0
...                 ...
1982                  1
1983                  0
1984                  0
1985                  1
1986                  0

[1987 rows x 9 columns]>
```

In [16]:

```
X=dataset2.loc[:,['AnnualIncome','FamilyMembers']]
import matplotlib.pyplot as plt
plt.figure(figsize=(10,5))

plt.scatter(x=X['AnnualIncome'],y=X['FamilyMembers'])
plt.xlabel('AnnualIncome')
plt.ylabel('FamilyMembers')
```

Out[16]:

```
Text(0, 0.5, 'FamilyMembers')
```



In [17]:

```
from sklearn.cluster import KMeans
km=KMeans(n_clusters=3)
km.fit(X)
plt.figure(figsize=(10,5))
plt.scatter(x=X.iloc[:,0],y=X.iloc[:,1],c=km.labels_)
plt.xlabel('AnnualIncome')
plt.ylabel('FamilyMembers')
```

Out[17]:

```
Text(0, 0.5, 'FamilyMembers')
```

In [18]:

```
fig, ax =plt.subplots(1,3,gridspec_kw={'wspace':0.3},figsize=(15,5))

for i in range(3):
    km=KMeans(n_clusters=3,init='random',n_init=1,random_state=1)
    km.fit(X)
    ax[i].scatter(x=X.iloc[:,0],y=X.iloc[:,1],c=km.labels_)
```

In [19]:

```
wcss=[]
for i in range(2,15):
    km=KMeans(n_clusters=i)
    km.fit(X)
    wcss.append(km.inertia_)

plt.plot(range(2,15),wcss,'og-')
plt.annotate('Elbow',xy=(5,50000),xytext=(6,100000),arrowprops=dict(facecolor="red"))
plt.xlabel("K")
plt.ylabel("Inertia");
```