In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import scipy.stats as stats
import numpy as np
```

In [2]:
```
df=pd.read_csv("Mall_Customers.csv")
df.head()
```

Out[2]:

	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	1	Male	19	15	39
1	2	Male	21	15	81
2	3	Female	20	16	6
3	4	Female	23	16	77
4	5	Female	31	17	40

In [3]:
```
df
```

Out[3]:

	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	1	Male	19	15	39
1	2	Male	21	15	81
2	3	Female	20	16	6
3	4	Female	23	16	77
4	5	Female	31	17	40
...	...	...	...	...	...
195	196	Female	35	120	79
196	197	Female	45	126	28
197	198	Male	32	126	74
198	199	Male	32	137	18
199	200	Male	30	137	83

200 rows × 5 columns

In [4]:
```
df.isnull().sum()
```

Out[4]:
```
CustomerID                0
Gender                    0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

In [5]:
```
display("duplicated:",df.duplicated().sum())
```

```
'duplicated:'
0
```

In [6]:
```
X= df.iloc[:, [3,4]].values
```

In [7]:
```
from sklearn.cluster import KMeans
```

In [8]:
```
wcss = []

for i in range(1,11):
    km = KMeans(n_clusters=i)
    km.fit_predict(X)
    wcss.append(km.inertia_)
```

```
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rning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set t
he value of `n_init` explicitly to suppress the warning
  warnings.warn(
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less chunks than available threads. You can avoid it by setting the environment
variable OMP_NUM_THREADS=1.
  warnings.warn(
```
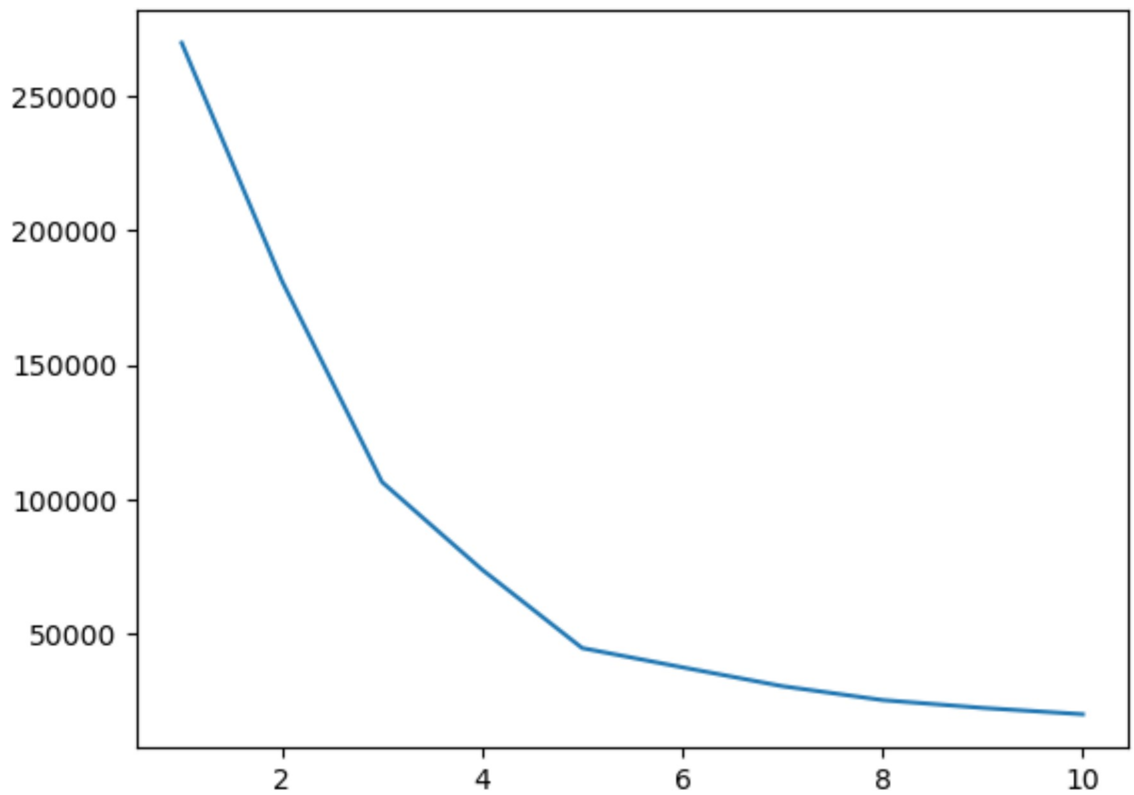

In [9]:
```
#Ignore the above warnings
```

In [10]:
```
import matplotlib.pyplot as plt
plt.plot(range(1,11),wcss)
```

Out[10]:
```
[&lt;matplotlib.lines.Line2D at 0x229fd08b2b0&gt;]
```



In [11]:
```
km = KMeans(n_clusters=5)
y_means = km.fit_predict(X)
```

```
C:\Users\hp\anaconda3\lib\site-packages\sklearn\cluster\_kmeans.py:870: FutureWa
rning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set t
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less chunks than available threads. You can avoid it by setting the environment
variable OMP_NUM_THREADS=1.
  warnings.warn(
```
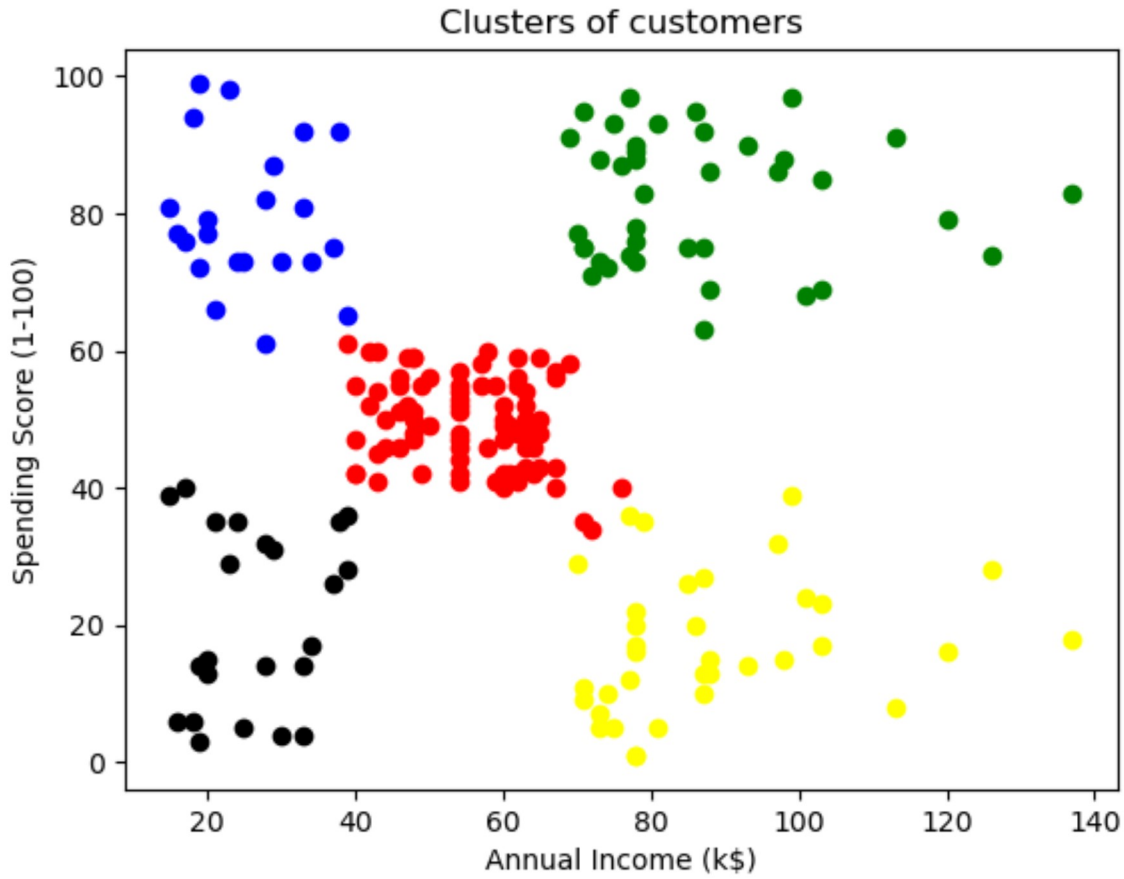

In [12]:
```
plt.scatter(X[y_means == 0,0],X[y_means == 0,1],color='blue')
plt.scatter(X[y_means == 1,0],X[y_means == 1,1],color='red')
plt.scatter(X[y_means == 2,0],X[y_means == 2,1],color='green')
plt.scatter(X[y_means == 3,0],X[y_means == 3,1],color='yellow')
plt.scatter(X[y_means == 4,0],X[y_means == 4,1],color='black')
plt.title('Clusters of customers')
plt.xlabel('Annual Income (k$)')
plt.ylabel('Spending Score (1-100)')
plt.show()
```



In [13]:
```
df["Target"]=y_means
```

In [14]:
```
Clustered_df=df
Clustered_df.head()
```

Out[14]:

	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)	Target
0	1	Male	19	15	39	4
1	2	Male	21	15	81	0
2	3	Female	20	16	6	4
3	4	Female	23	16	77	0
4	5	Female	31	17	40	4

Now our data is ready for classification.

In [15]:
```
X=Clustered_df.iloc[:,1:5]
y=Clustered_df.iloc[:,-1]
```

In [16]:
```
X.head()
```

Out[16]:

	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	Male	19	15	39
1	Male	21	15	81
2	Female	20	16	6
3	Female	23	16	77
4	Female	31	17	40

In [17]:
```
y.head()
```

Out[17]:
```
0    4
1    0
2    4
3    0
4    4
Name: Target, dtype: int32
```

In [18]:
```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder, StandardScaler
```

In [19]:
```
le=LabelEncoder()
X['Gender'] = le.fit_transform(X['Gender'])
```

In [20]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_
```

In [21]:
```
sc=StandardScaler()
X_train=sc.fit_transform(X_train)
X_test=sc.transform(X_test)
```

In [22]:
```
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.metrics import accuracy_score
```

In [23]:
```
gbdt = GradientBoostingClassifier(n_estimators=50,random_state=2)
```

In [24]:
```
gbdt.fit(X_train,y_train)
y_pred=gbdt.predict(X_test)
accuracy = accuracy_score(y_test, y_pred)
accuracy
```

Out[24]:
```
0.975
```

In [25]:
```
y_pred=gbdt.predict(X_test)
y_pred
```

Out[25]:
```
array([1, 0, 4, 3, 3, 1, 1, 3, 3, 1, 1, 3, 2, 1, 3, 2, 1, 3, 1, 1, 3, 4,
       3, 1, 1, 1, 1, 1, 2, 1, 0, 4, 1, 1, 3, 1, 2, 2, 3, 1])
```

In [26]:
```
prediction = pd.DataFrame({'Original Value': y_test, 'Predicted Value': y_pred})

# Print the DataFrame
display(prediction)
```

	Original Value	Predicted Value
95	1	1
15	0	0
30	4	4
158	3	3
128	3	3
115	1	1
69	1	1
170	3	3
174	3	3
45	0	1
66	1	1
182	3	3
165	2	2
78	1	1
186	3	3
177	2	2
56	1	1
152	3	3
82	1	1
68	1	1
124	3	3
16	4	4
148	3	3
93	1	1
65	1	1
60	1	1
84	1	1
67	1	1
125	2	2
132	1	1
9	0	0
18	4	4
55	1	1
75	1	1
150	3	3

	Original Value	Predicted Value
104	1	1
135	2	2
137	2	2
164	3	3
76	1	1

In [ ]: