Project 3b Retail Biz Segmentation

Step 1: Import Libraries

In [5]:
```
# Importing necessary libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import silhouette_score

# Setting up the visualization style
sns.set(style="whitegrid")
```

Step 2: Load the Dataset

In [10]:
```
# Step 1: Load the dataset
data_path = r"C:\Users\Hello\Downloads\Mall_Customers.csv"
data = pd.read_csv(data_path)
```

Step 3: Explore Data

In [13]:
```
# Summary statistics
data.info()
data.describe()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   CustomerID              200 non-null    int64
 1   Genre                   200 non-null    object
 2   Age                     200 non-null    int64
 3   Annual Income (k$)      200 non-null    int64
 4   Spending Score (1-100)  200 non-null    int64
dtypes: int64(4), object(1)
memory usage: 7.9+ KB
```

Out[13]:

	CustomerID	Age	Annual Income (k$)	Spending Score (1-100)
count	200.000000	200.000000	200.000000	200.000000
mean	100.500000	38.850000	60.560000	50.200000
std	57.879185	13.969007	26.264721	25.823522
min	1.000000	18.000000	15.000000	1.000000
25%	50.750000	28.750000	41.500000	34.750000
50%	100.500000	36.000000	61.500000	50.000000
75%	150.250000	49.000000	78.000000	73.000000
max	200.000000	70.000000	137.000000	99.000000

Step 4: Check for Missing Values

In [16]:
```
# Check for missing values
missing_values = data.isnull().sum()
print("Missing values in each column:\n", missing_values)
```

```
Missing values in each column:
 CustomerID                0
Genre                     0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

Step 5: Data Visualization

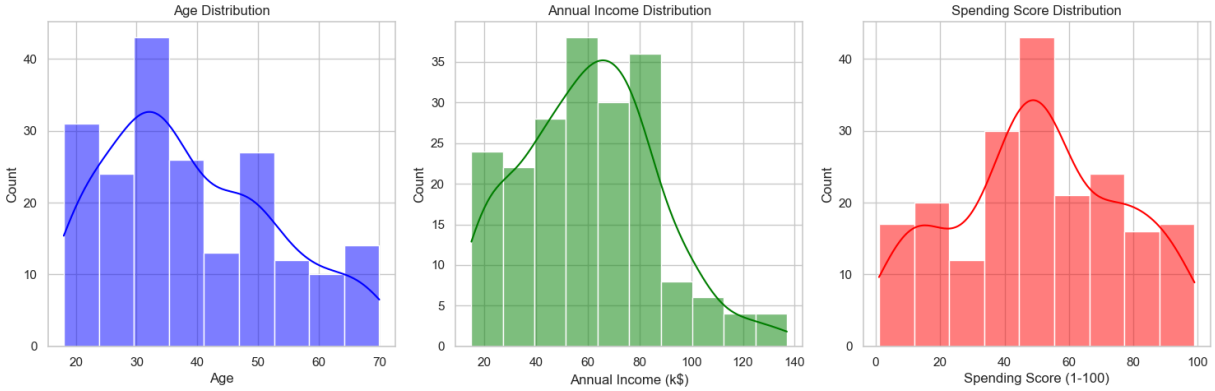
In [19]:
```
# Visualize the distribution of Age, Income, and Spending Score
plt.figure(figsize=(15, 5))

# Age distribution
plt.subplot(1, 3, 1)
sns.histplot(data['Age'], kde=True, color='blue')
plt.title('Age Distribution')

# Annual Income distribution
plt.subplot(1, 3, 2)
sns.histplot(data['Annual Income (k$)'], kde=True, color='green')
plt.title('Annual Income Distribution')

# Spending Score distribution
plt.subplot(1, 3, 3)
sns.histplot(data['Spending Score (1-100)'], kde=True, color='red')
plt.title('Spending Score Distribution')

plt.tight_layout()
plt.show()
```



Step 6: Feature Selection and Standardization

In [22]:
```
# Selecting relevant features
features = data[['Age', 'Annual Income (k$)', 'Spending Score (1-100)']]

# Standardizing the data
scaler = StandardScaler()
scaled_features = scaler.fit_transform(features)
```

Step 7: Determine Optimal Number of Clusters

In [25]:
```
# Elbow method to find the optimal number of clusters
inertia = []
for i in range(1, 11):
    kmeans = KMeans(n_clusters=i, random_state=42)
    kmeans.fit(scaled_features)
    inertia.append(kmeans.inertia_)

plt.figure(figsize=(8, 4))
plt.plot(range(1, 11), inertia, marker='o')
plt.title('Elbow Method')
plt.xlabel('Number of Clusters')
plt.ylabel('Inertia')
plt.show()
```

```
C:\Users\Hello\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1446: UserWarn
ing: KMeans is known to have a memory leak on Windows with MKL, when there are less
chunks than available threads. You can avoid it by setting the environment variable
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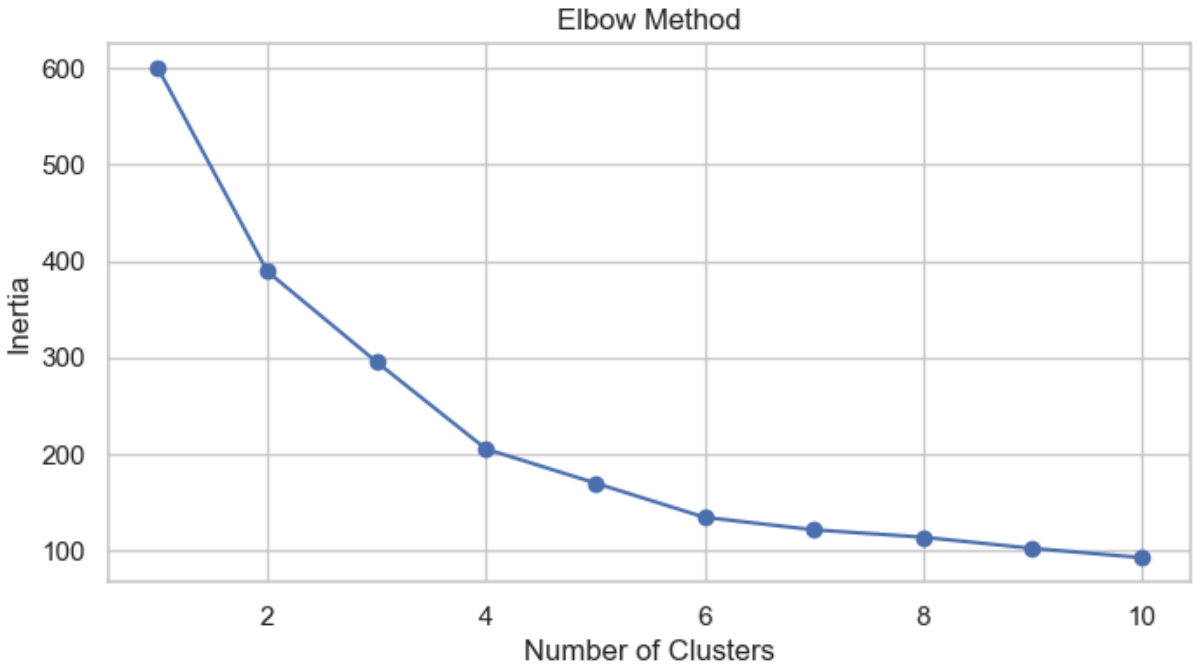

In [27]:
```
# Silhouette Score for optimal cluster validation
silhouette_scores = []
for i in range(2, 11):
    kmeans = KMeans(n_clusters=i, random_state=42)
    cluster_labels = kmeans.fit_predict(scaled_features)
    silhouette_scores.append(silhouette_score(scaled_features, cluster_labels))

plt.figure(figsize=(8, 4))
plt.plot(range(2, 11), silhouette_scores, marker='o', color='green')
plt.title('Silhouette Score Method')
plt.xlabel('Number of Clusters')
plt.ylabel('Silhouette Score')
plt.show()
```

```
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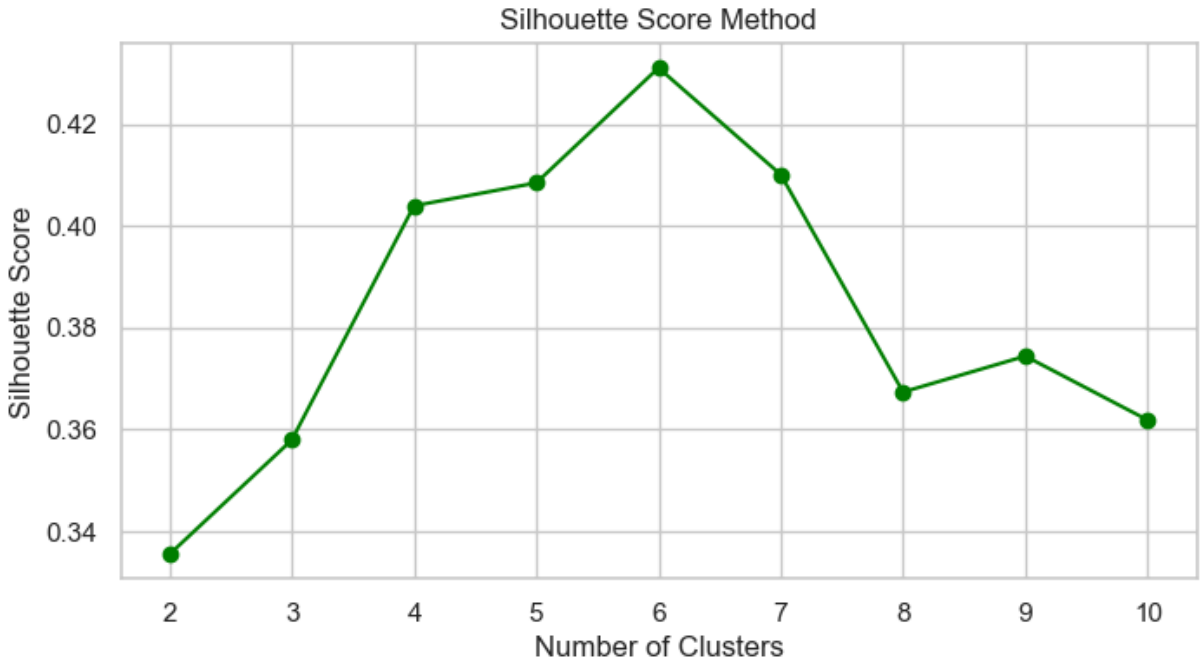

Step 8: Apply K-means Clustering

In [30]:
```
# Apply K-means clustering with optimal clusters (e.g., 5)
optimal_clusters = 5
kmeans = KMeans(n_clusters=optimal_clusters, random_state=42)
data['Cluster'] = kmeans.fit_predict(scaled_features)
```

```
C:\Users\Hello\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1446: UserWarn
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chunks than available threads. You can avoid it by setting the environment variable
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  warnings.warn(
```
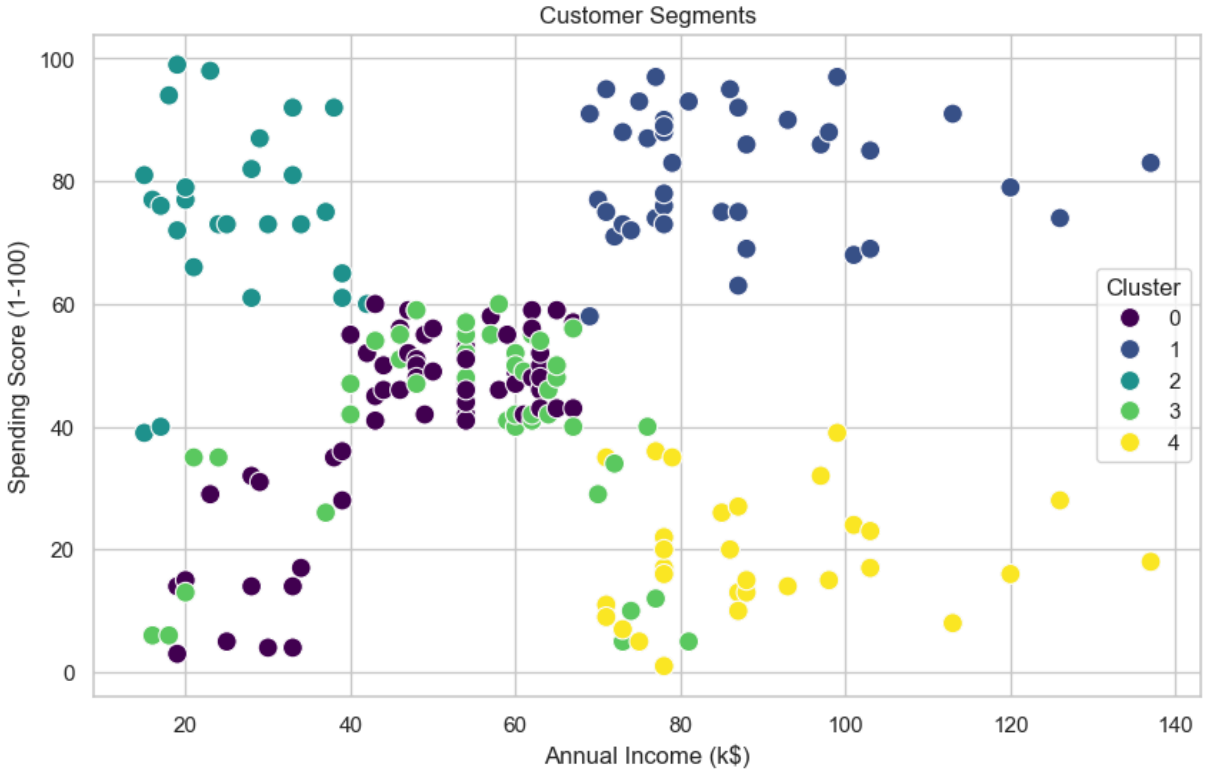

Step 9: Visualize Clusters

In [33]:
```
# Visualize clusters
plt.figure(figsize=(10, 6))
sns.scatterplot(x=data['Annual Income (k$)'], y=data['Spending Score (1-100)'],
                hue=data['Cluster'], palette='viridis', s=100)
plt.title('Customer Segments')
plt.xlabel('Annual Income (k$)')
plt.ylabel('Spending Score (1-100)')
plt.legend(title='Cluster')
plt.show()
```



Step 10: Draw Insights

In [36]:
```
# Cluster characteristics
for i in range(optimal_clusters):
    print(f"Cluster {i}:")
    print(data[data['Cluster'] == i].describe())
```

```
Cluster 0:
       CustomerID        Age  Annual Income (k$)  Spending Score (1-100)  \
count   58.000000  58.000000           58.000000               58.000000
mean    68.775862  55.275862           47.620690               41.706897
std     31.021805   8.571256           13.413567               15.697814
min      9.000000  40.000000           19.000000                3.000000
25%     45.500000  49.000000           39.250000               37.250000
50%     69.500000  53.000000           48.500000               46.000000
75%     92.500000  63.750000           59.750000               52.000000
max    120.000000  70.000000           67.000000               60.000000

       Cluster
count     58.0
mean       0.0
std        0.0
min        0.0
25%        0.0
50%        0.0
75%        0.0
max        0.0
Cluster 1:
       CustomerID        Age  Annual Income (k$)  Spending Score (1-100)  \
count    40.00000  40.000000           40.000000               40.000000
mean    161.02500  32.875000           86.100000               81.525000
std      23.33863   3.857643           16.339036                9.999968
min     123.00000  27.000000           69.000000               58.000000
25%     141.50000  30.000000           74.750000               74.000000
50%     161.00000  32.000000           78.500000               83.000000
75%     180.50000  36.000000           94.000000               90.000000
max     200.00000  40.000000          137.000000               97.000000

       Cluster
count     40.0
mean       1.0
std        0.0
min        1.0
25%        1.0
50%        1.0
75%        1.0
max        1.0
Cluster 2:
       CustomerID        Age  Annual Income (k$)  Spending Score (1-100)  \
count   26.000000  26.000000           26.000000               26.000000
mean    23.461538  25.769231           26.115385               74.846154
std     15.118812   5.435496            8.557228               15.069684
min      1.000000  18.000000           15.000000               39.000000
25%     10.500000  21.250000           19.000000               67.500000
50%     23.000000  24.000000           24.500000               75.500000
75%     35.500000  30.750000           33.000000               81.750000
max     52.000000  35.000000           42.000000               99.000000

       Cluster
count     26.0
mean       2.0
std        0.0
min        2.0
```

```
25%        2.0
50%        2.0
75%        2.0
max        2.0
Cluster 3:
       CustomerID        Age  Annual Income (k$)  Spending Score (1-100)  \
count   45.000000  45.000000           45.000000               45.000000
mean    86.377778  26.733333           54.311111               40.911111
std     38.926089   7.085196           16.162277               16.285552
min      3.000000  18.000000           16.000000                5.000000
25%     62.000000  20.000000           46.000000               35.000000
50%     92.000000  26.000000           59.000000               46.000000
75%    114.000000  32.000000           64.000000               54.000000
max    163.000000  40.000000           81.000000               60.000000

       Cluster
count     45.0
mean       3.0
std        0.0
min        3.0
25%        3.0
50%        3.0
75%        3.0
max        3.0
Cluster 4:
       CustomerID        Age  Annual Income (k$)  Spending Score (1-100)  \
count   31.000000  31.000000           31.000000               31.000000
mean   166.870968  44.387097           89.774194               18.483871
std     21.153001   8.232770           16.754521               10.194348
min    127.000000  32.000000           71.000000                1.000000
25%    152.000000  37.000000           78.000000               12.000000
50%    169.000000  44.000000           87.000000               17.000000
75%    184.000000  49.000000           98.500000               25.000000
max    199.000000  59.000000          137.000000               39.000000

       Cluster
count     31.0
mean       4.0
std        0.0
min        4.0
25%        4.0
50%        4.0
75%        4.0
max        4.0
```

In [ ]: