Name - Sejal Sanas

Task - 2

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import StandardScaler, LabelEncoder
from sklearn.cluster import KMeans
from sklearn.metrics import silhouette_score
```

In [2]:
```
data = pd.read_csv('C:/Users/Shejal Sanas/Downloads/Mall_Customers.csv')
```

In [3]:
```
numeric_columns = data.select_dtypes(include=[np.number]).columns
non_numeric_columns = data.select_dtypes(exclude=[np.number]).columns
```

In [4]:
```
data[numeric_columns] = data[numeric_columns].fillna(data[numeric_columns].mean())
```

In [5]:
```
label_encoder = LabelEncoder()
for column in non_numeric_columns:
    data[column] = label_encoder.fit_transform(data[column].astype(str))
```

In [6]:
```
import os
os.environ['OMP_NUM_THREADS'] = '1'
```

In [7]:
```
features = ['Age', 'Annual Income (k$)', 'Spending Score (1-100)']
X = data[features]
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
sse = []
for k in range(1, 11):
    kmeans = KMeans(n_clusters=k, random_state=42)
    kmeans.fit(X_scaled)
    sse.append(kmeans.inertia_)
```

```
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  warnings.warn(
```
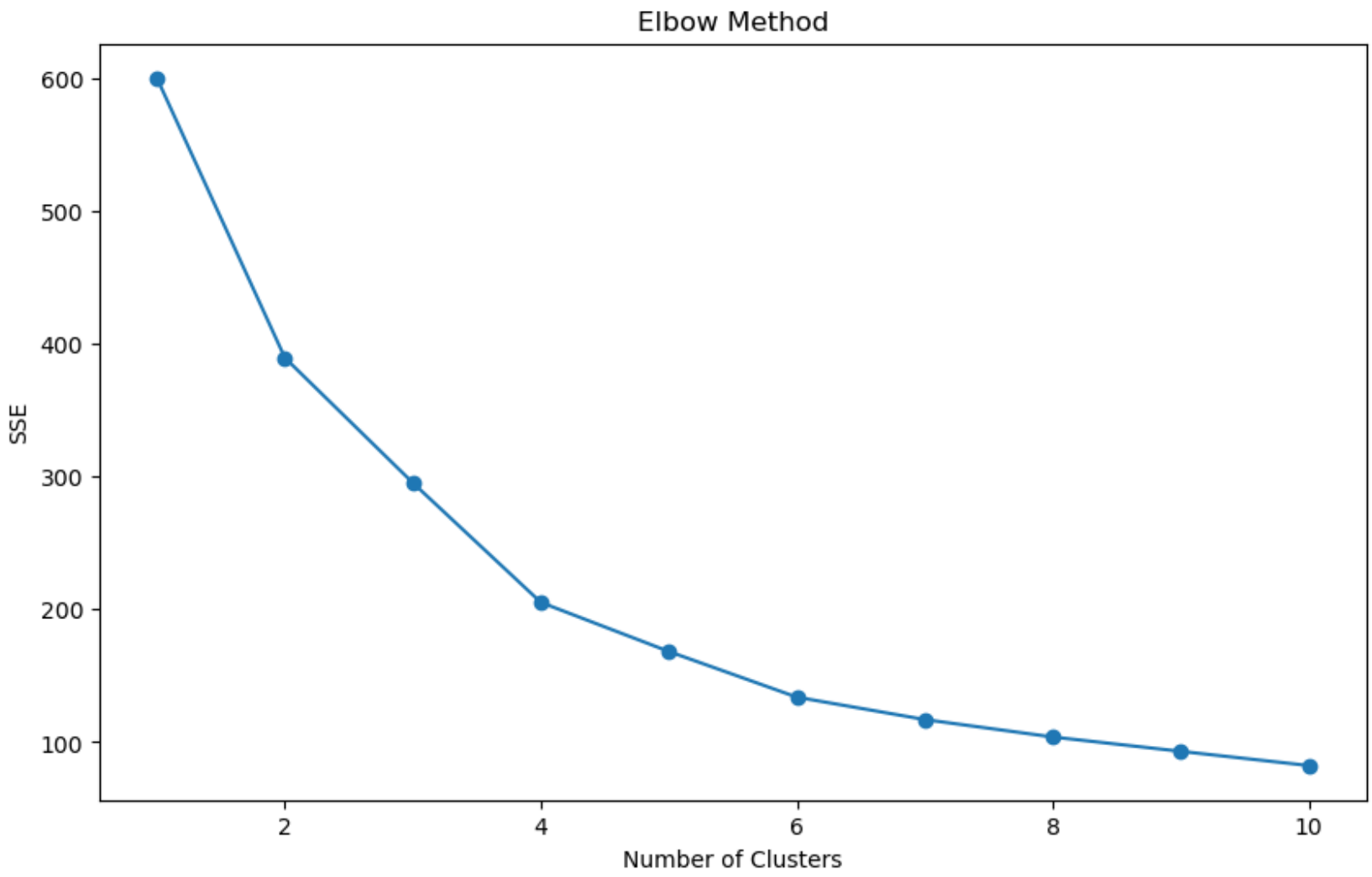

In [8]:
```
plt.figure(figsize=(10, 6))
plt.plot(range(1, 11), sse, marker='o')
plt.xlabel('Number of Clusters')
plt.ylabel('SSE')
plt.title('Elbow Method')
plt.show()
```



In [9]:
```
silhouette_scores = []
for k in range(2, 11):
    kmeans = KMeans(n_clusters=k, random_state=42)
    kmeans.fit(X_scaled)
    silhouette_scores.append(silhouette_score(X_scaled, kmeans.labels_))
```

```
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  warnings.warn(
```
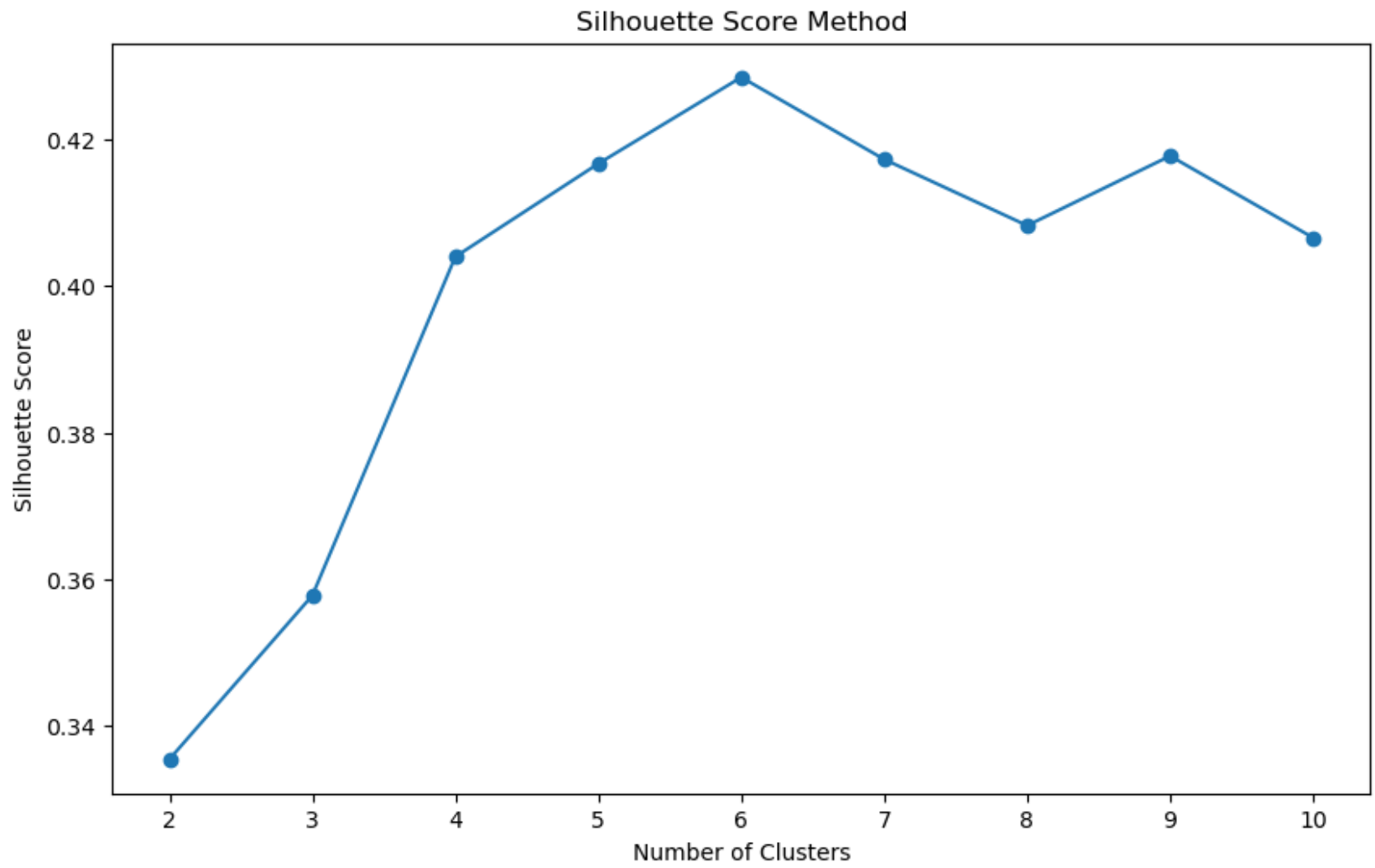

In [10]:
```
plt.figure(figsize=(10, 6))
plt.plot(range(2, 11), silhouette_scores, marker='o')
plt.xlabel('Number of Clusters')
plt.ylabel('Silhouette Score')
plt.title('Silhouette Score Method')
plt.show()
```



In [11]:
```
optimal_k = 5
kmeans = KMeans(n_clusters=optimal_k, random_state=42)
data['Cluster'] = kmeans.fit_predict(X_scaled)
```

```
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  warnings.warn(
```
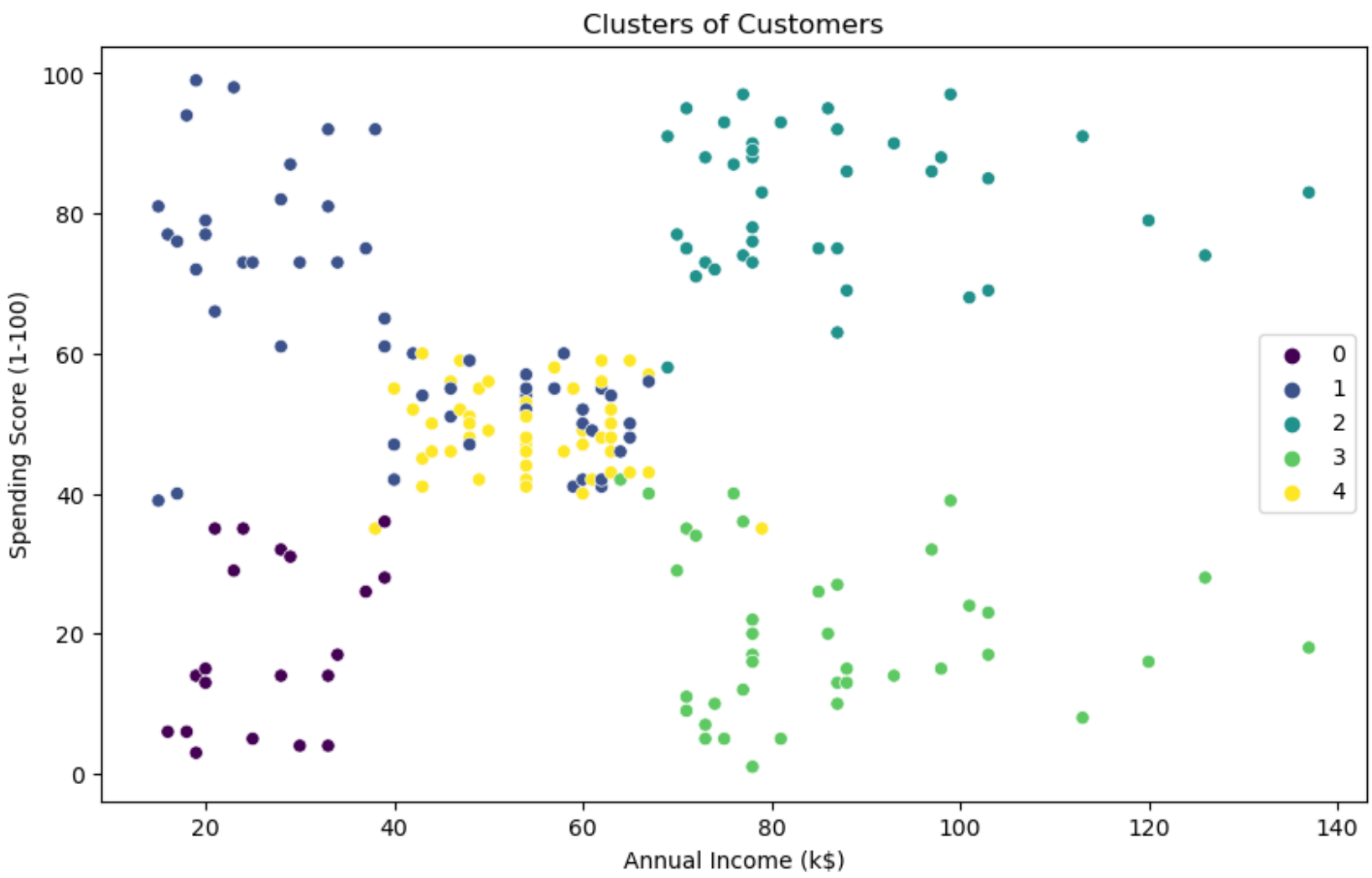
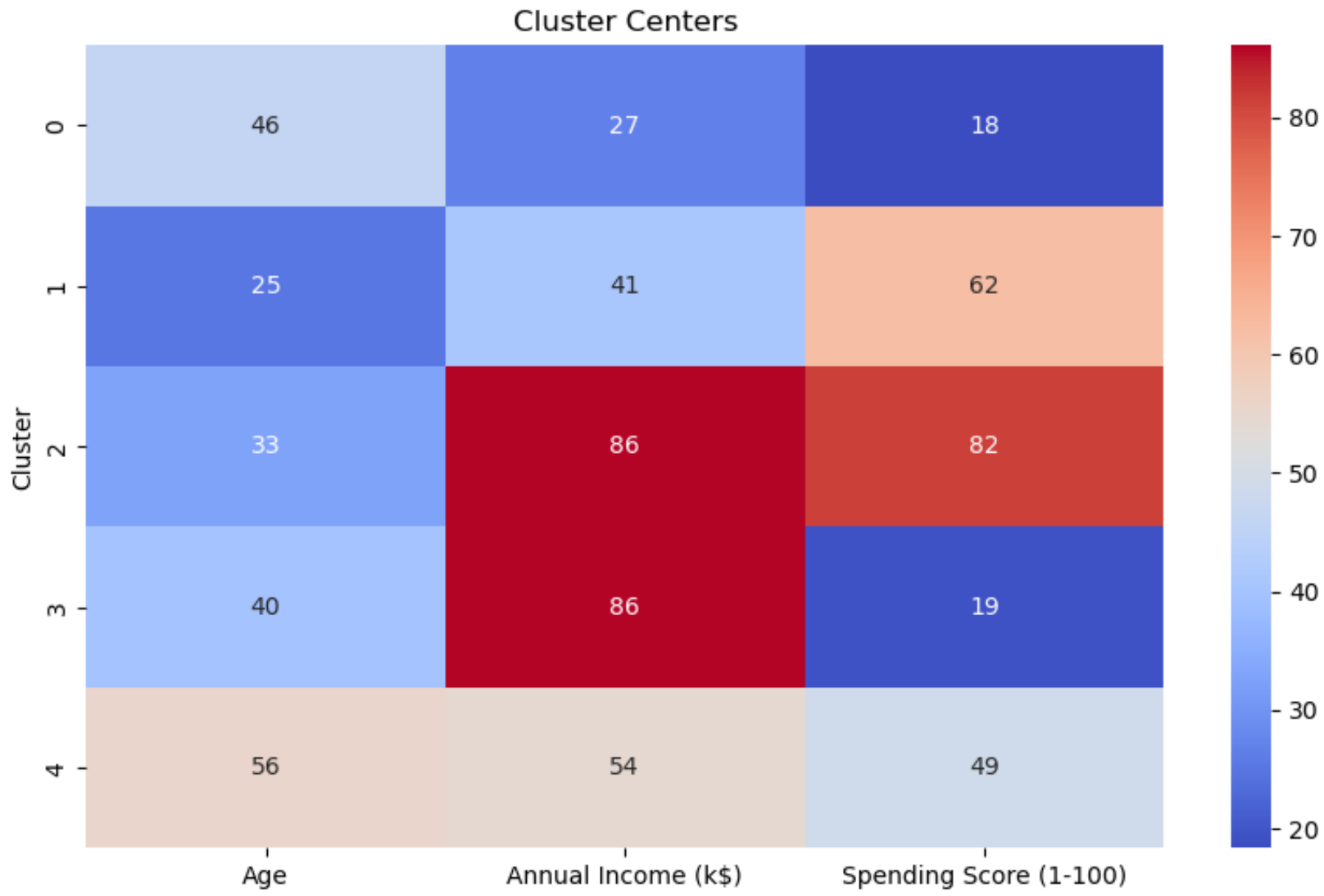

In [12]:
```
plt.figure(figsize=(10, 6))
sns.scatterplot(data=data, x='Annual Income (k$)', y='Spending Score (1-100)', hue='Cluster', palette=
plt.title('Clusters of Customers')
plt.xlabel('Annual Income (k$)')
plt.ylabel('Spending Score (1-100)')
plt.legend()
plt.show()
```

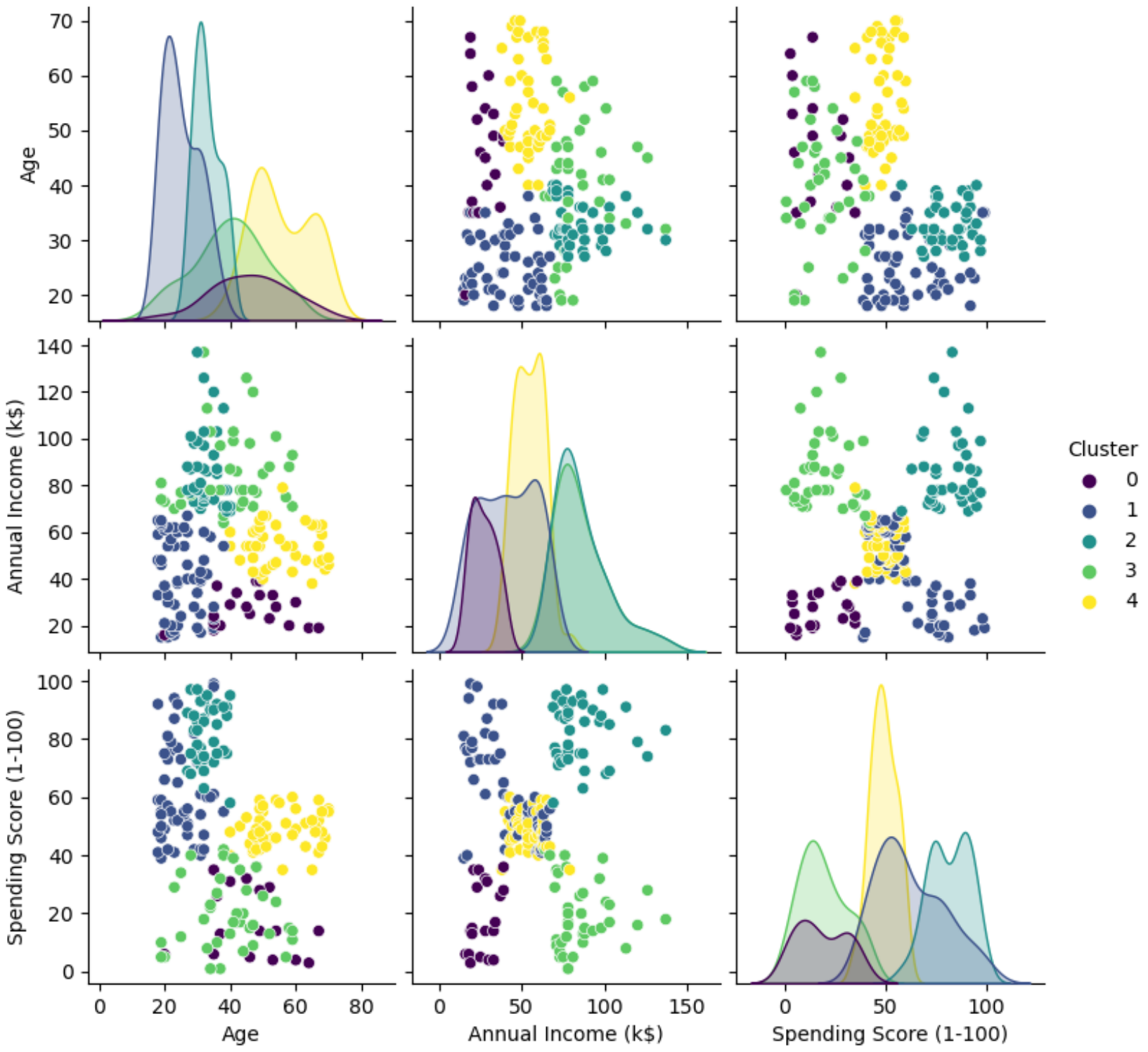


In [13]:
```
cluster_centers = scaler.inverse_transform(kmeans.cluster_centers_)
cluster_centers_df = pd.DataFrame(cluster_centers, columns=features)
cluster_centers_df['Cluster'] = range(optimal_k)
```

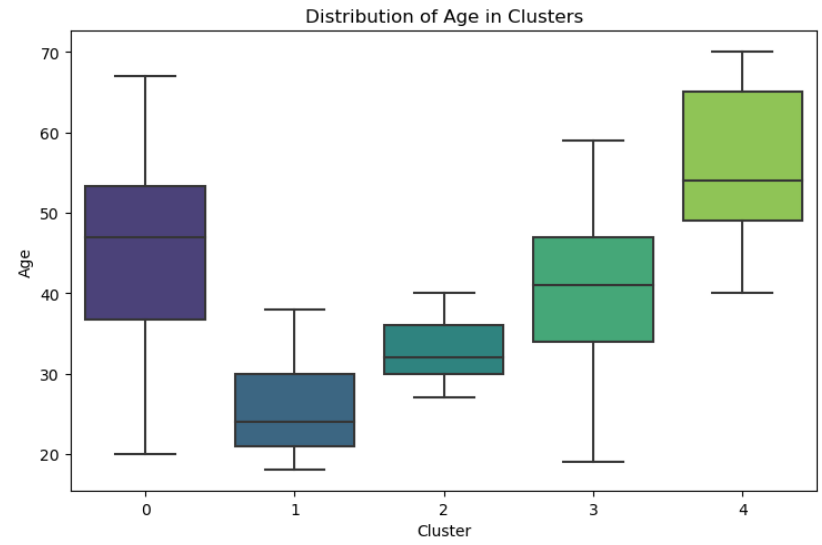
In [14]:
```
plt.figure(figsize=(10, 6))
sns.heatmap(cluster_centers_df.set_index('Cluster'), annot=True, cmap='coolwarm')
plt.title('Cluster Centers')
plt.show()
```



In [15]:
```
sns.pairplot(data, hue='Cluster', palette='viridis', vars=features)
plt.show()
```



In [16]:
```
plt.figure(figsize=(15, 10))
for i, feature in enumerate(features):
    plt.subplot(2, 2, i+1)
    sns.boxplot(x='Cluster', y=feature, data=data, palette='viridis')
    plt.title(f'Distribution of {feature} in Clusters')
plt.tight_layout()
plt.show()
```



In [17]:
```
cluster_summary = data.groupby('Cluster')[features].mean().reset_index()
print(cluster_summary)
data.to_csv('clustered_customers.csv', index=False)
```

	Cluster	Age	Annual Income (k$)	Spending Score (1-100)
0	0	46.250000	26.750000	18.350000
1	1	25.185185	41.092593	62.240741
2	2	32.875000	86.100000	81.525000
3	3	39.871795	86.102564	19.358974
4	4	55.638298	54.382979	48.851064