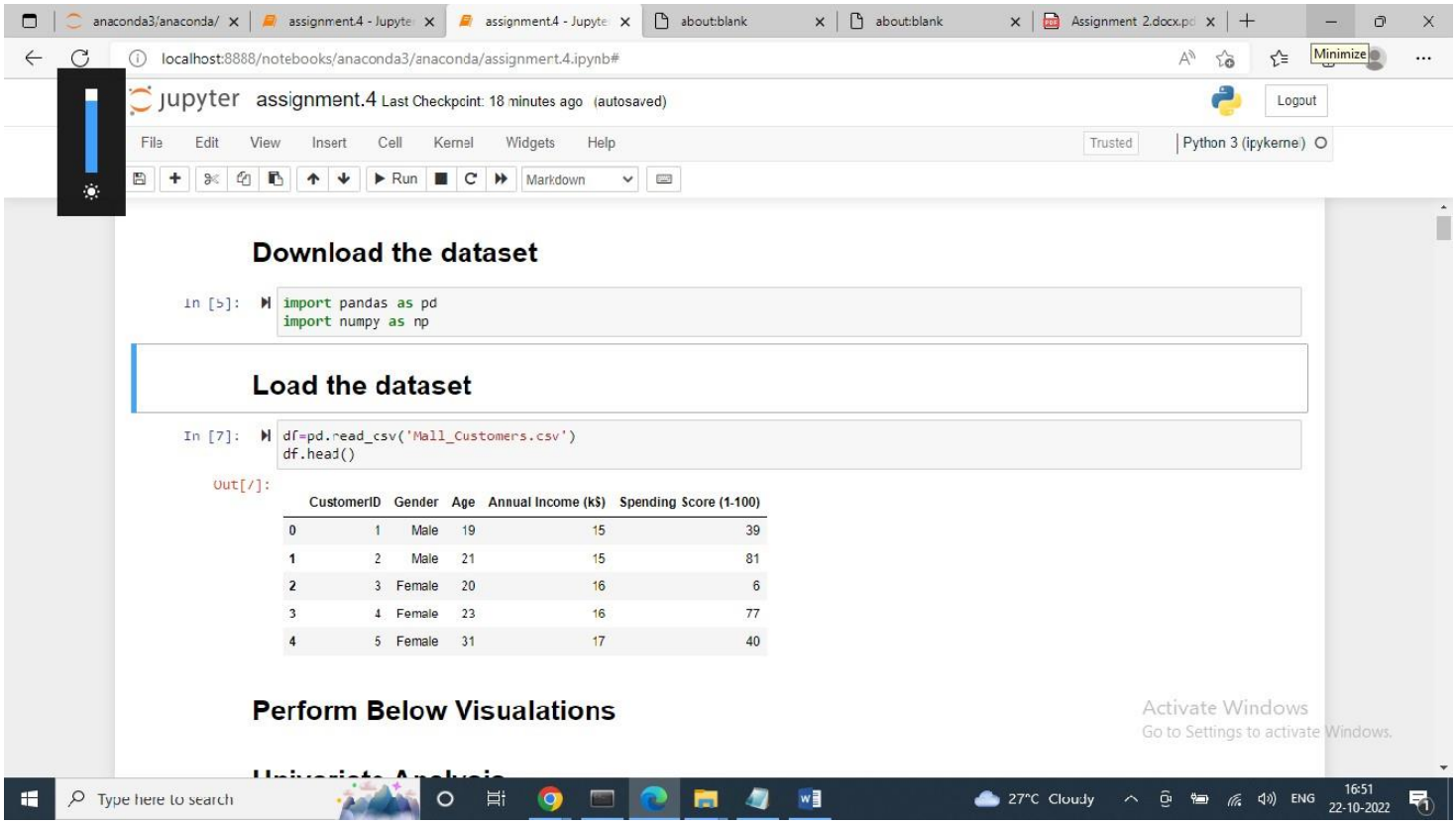
ASSIGNMENT-4

APPLIED DATA SCIENCE

Assignment date	22 October 2022
Student Name	**Akash Mukherjee**
Student Roll Number	7309730919104008
Maximum Marks	2 Marks



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localhost:8888/notebooks/anaconda3/anaconda/assignment.4.ipynb#

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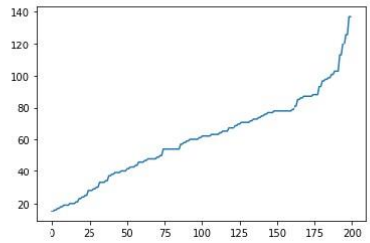
Univariate Analysis

In [8]:
```
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [11]:
```
plt.plot(df['Annual Income (k$)'])
plt.show()
```



In [10]:
```
data=np.array(df['Age'])
plt.plot(data,linestyle = 'dotted')
```

Out[10]: [<matplotlib.lines.Line2D at 0x26f3e956f10>]

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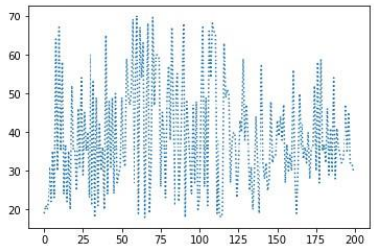
Out[10]: [<matplotlib.lines.Line2D at 0x26f3e95bf10>]



In [12]:
```
sns.countplot(df['Age'])
```

```
C:\Users\admin\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a keywor
d arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an expli
cit keyword will result in an error or misinterpretation.
  warnings.warn(
```

Out[12]: <AxesSubplot:xlabel='Age', ylabel='count'>

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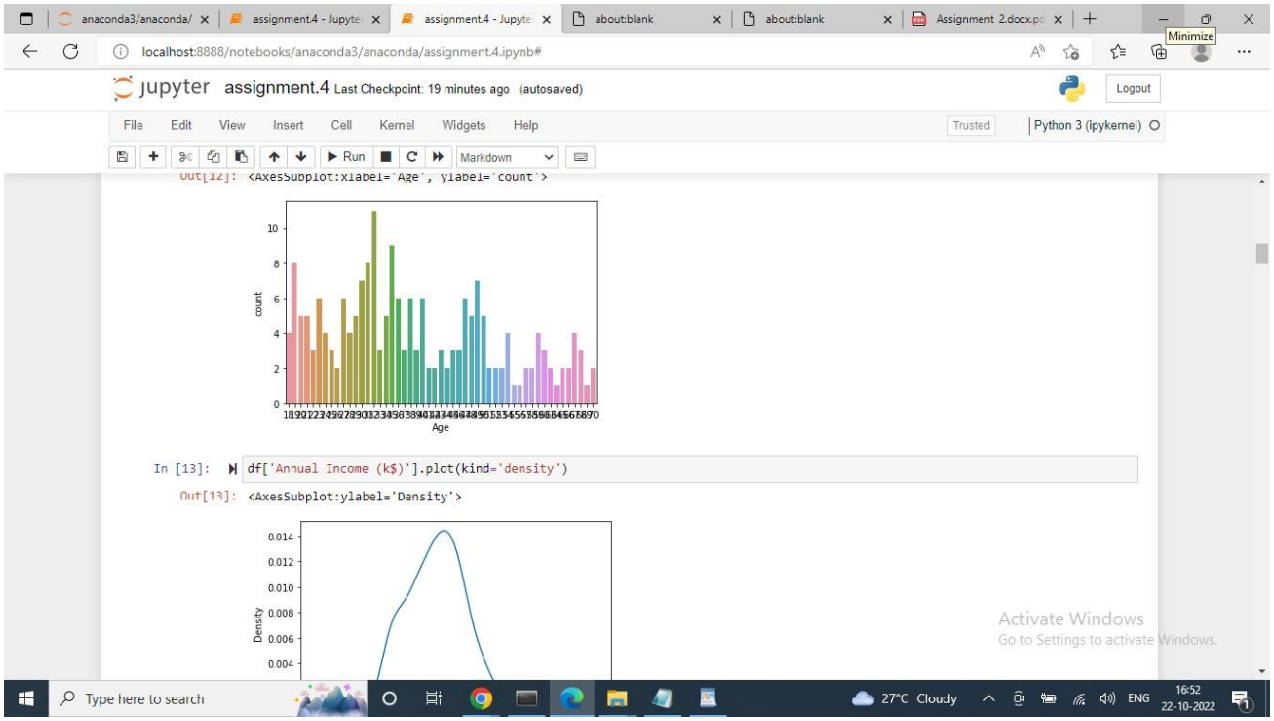
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Python 3 (ipykernel)
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Out[12]: <AxesSubplot:xlabel='Age', ylabel='count'>
count
Age
In [13]: df['Annual Income (k$)'].plot(kind='density')
Out[13]: <AxesSubplot:ylabel='Density'>
Density
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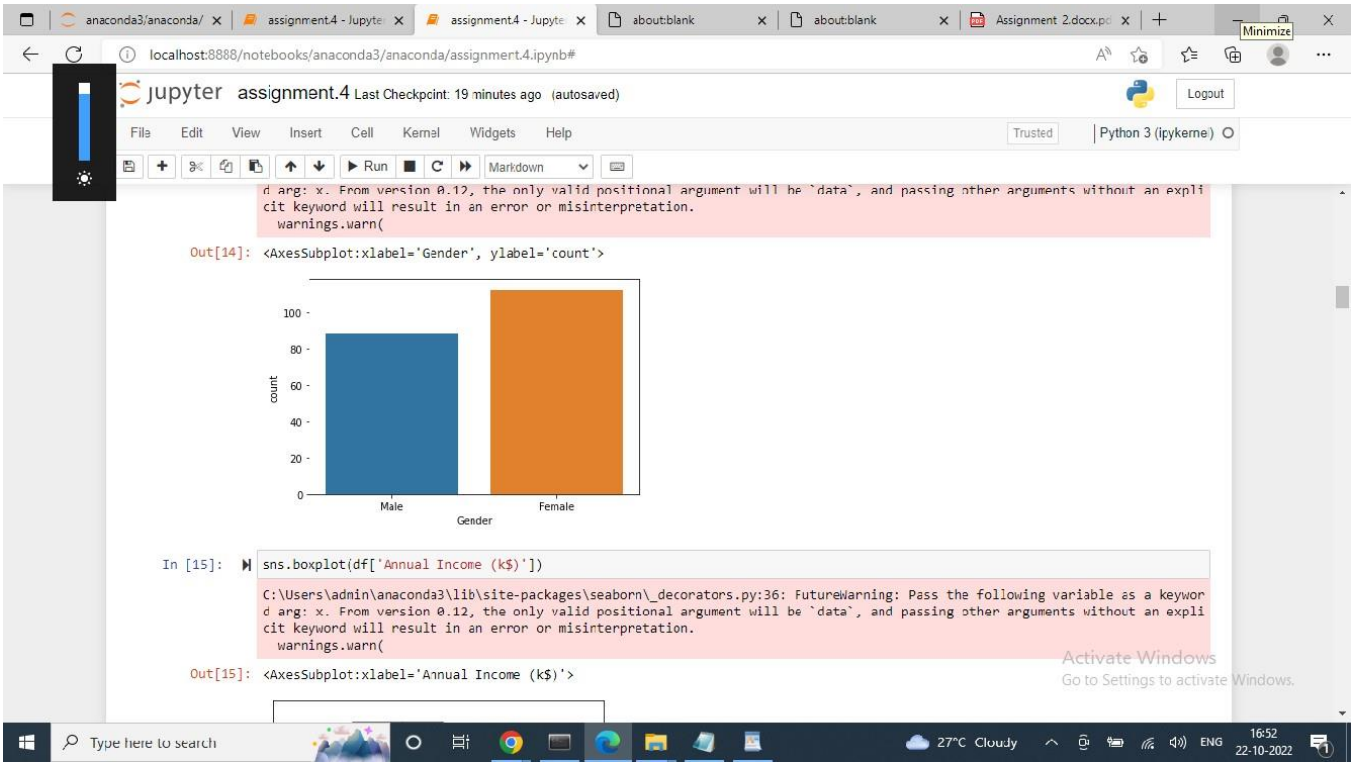
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d arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an expli
cit keyword will result in an error or misinterpretation.
warnings.warn(
Out[14]: <AxesSubplot:xlabel='Gender', ylabel='count'>
count
Male
Female
Gender
In [15]: sns.boxplot(df['Annual Income (k$)'])
C:\Users\admin\anaconda3\lib\site-packages\seaborn_decorators.py:36: FutureWarning: Pass the following variable as a keywor
d arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an expli
cit keyword will result in an error or misinterpretation.
warnings.warn(
Out[15]: <AxesSubplot:xlabel='Annual Income (k$)'>
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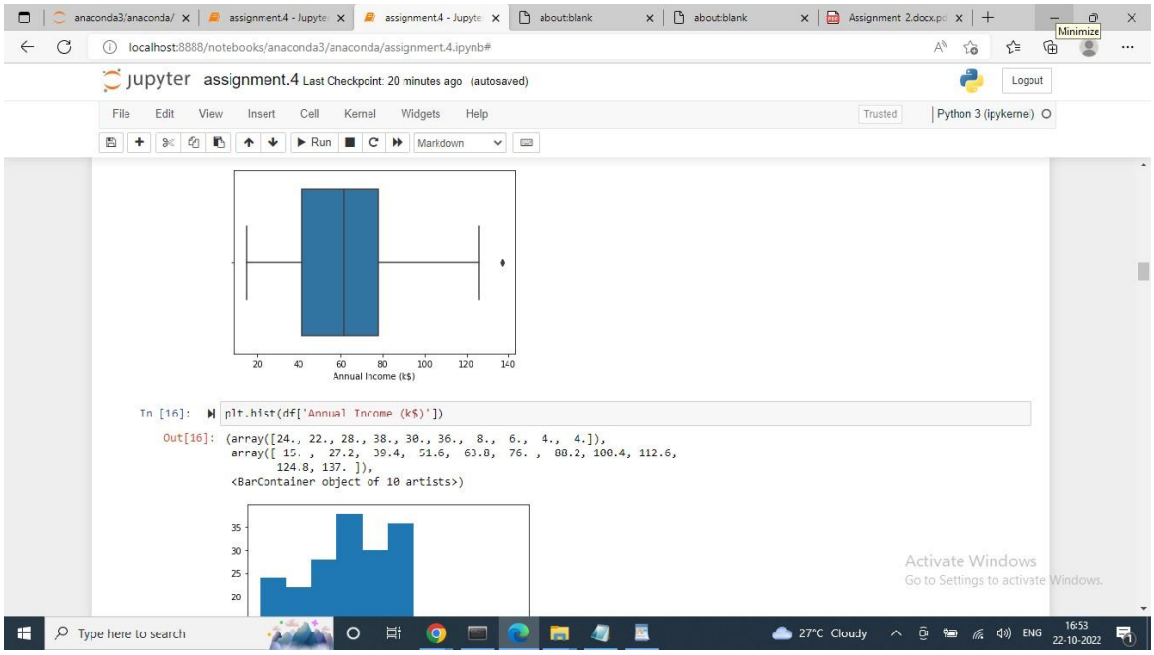
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Python 3 (ipykernel)
Run
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20 40 60 80 100 120 140
Annual Income (k$)
In [16]:
plt.hist(df['Annual Income (k$)'])
Out[16]:
(array([24., 22., 28., 38., 30., 36., 8., 6., 4., 4.]),
array([15. , 27.2, 39.4, 51.6, 63.8, 76. , 88.2, 100.4, 112.6,
124.8, 137.]),
<BarContainer object of 10 artists>)
35
30
25
20
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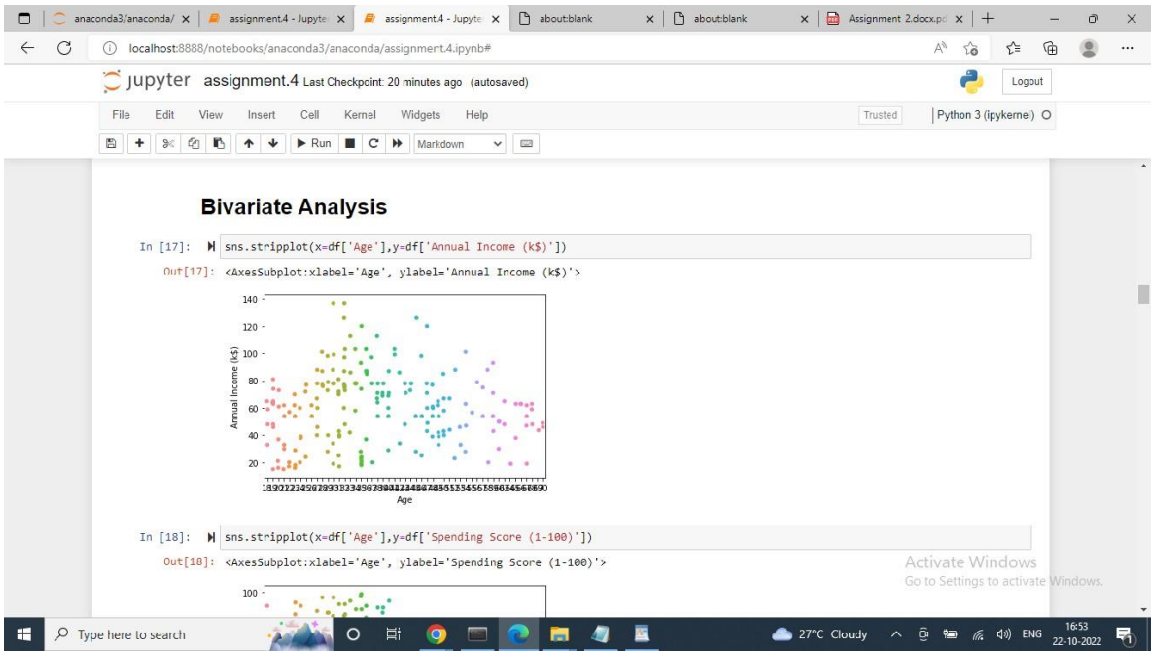
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Python 3 (ipykernel)
Run
Markdown
Bivariate Analysis
In [17]:
sns.stripplot(x=df['Age'],y=df['Annual Income (k$)'])
Out[17]:
<AxesSubplot:xlabel='Age', ylabel='Annual Income (k$)'>
140
120
100
80
60
40
20
Annual Income (k$)
Age
In [18]:
sns.stripplot(x=df['Age'],y=df['Spending Score (1-100)'])
Out[18]:
<AxesSubplot:xlabel='Age', ylabel='Spending Score (1-100)'>
100
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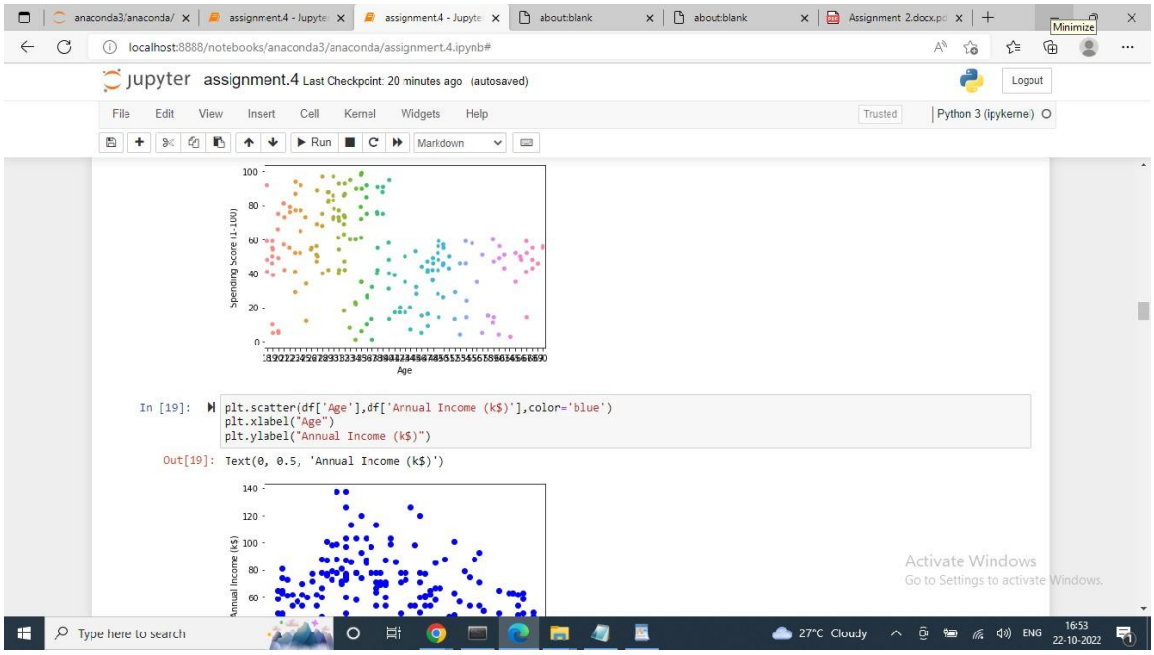
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Python 3 (ipykernel)
Run
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Spending Score (1-100)
Age
In [19]:
plt.scatter(df['Age'],df['Annual Income (k$)'],color='blue')
plt.xlabel("Age")
plt.ylabel("Annual Income (k$)")
Out[19]:
Text(0, 0.5, 'Annual Income (k$)')
Annual Income (k$)
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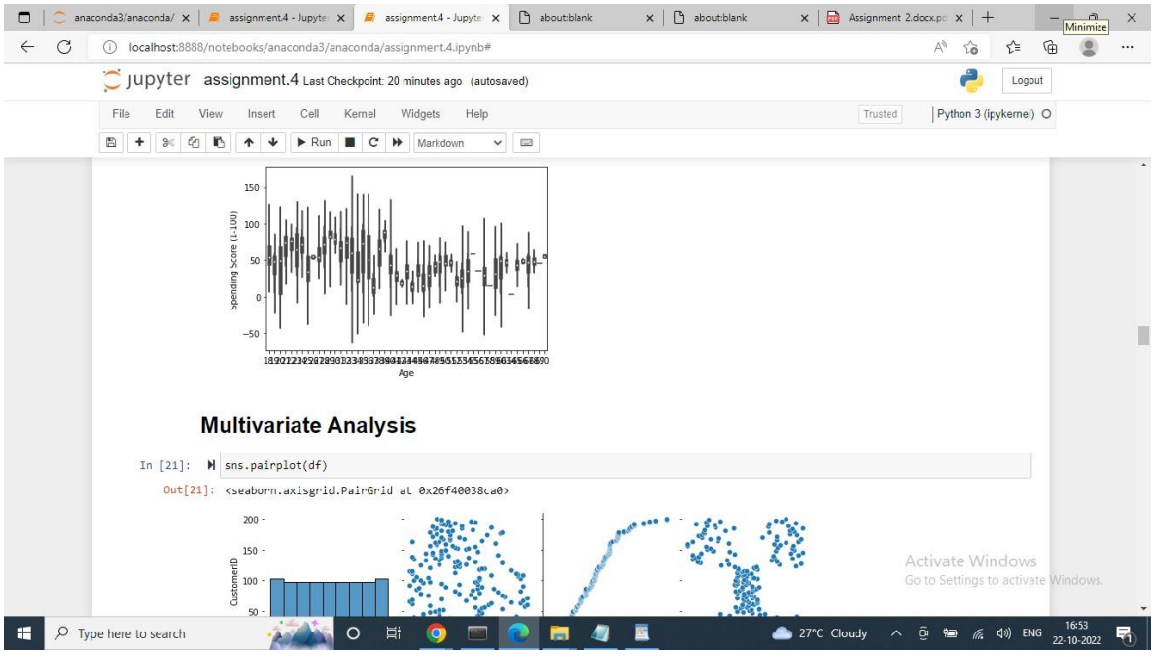
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Python 3 (ipykernel)
Run
Markdown
Spending Score (1-100)
Age
Multivariate Analysis
In [21]:
sns.pairplot(df)
Out[21]:
<seaborn.axisgrid.PairGrid at 0x26f40038ca0>
CustomerID
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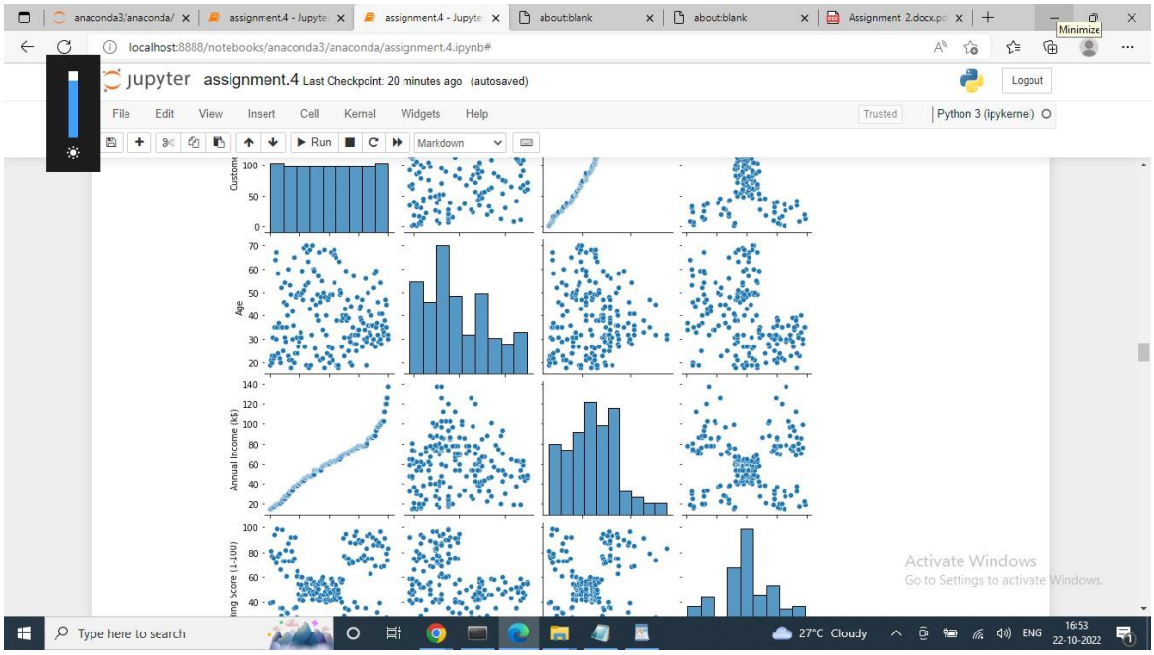
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Python 3 (ipykernel)
Run
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Customer ID
Age
Annual Income (k$)
ing Score (1-100)
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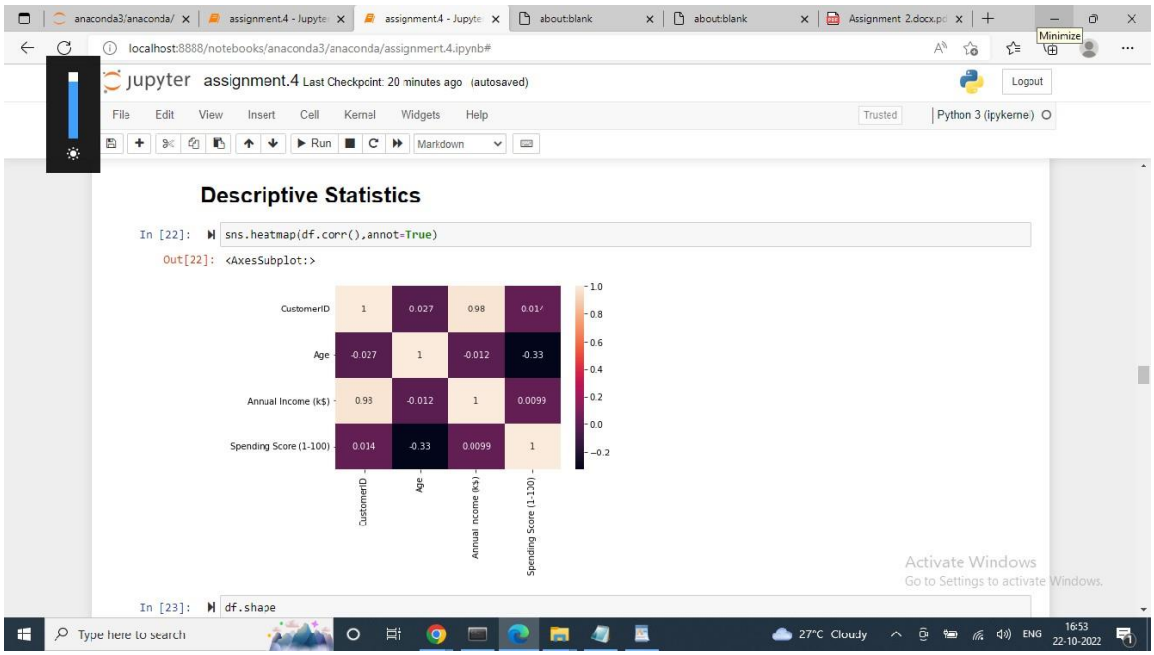
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Python 3 (ipykernel)
Run
Markdown
Descriptive Statistics
In [22]: sns.heatmap(df.corr(),annot=True)
Out[22]: <AxesSubplot:>
CustomerID
Age
Annual Income (k$)
Spending Score (1-100)
1
0.027
0.98
0.01
-0.027
1
-0.012
-0.33
0.93
-0.012
1
0.0099
0.014
-0.33
0.0099
1
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
In [23]: df.shape
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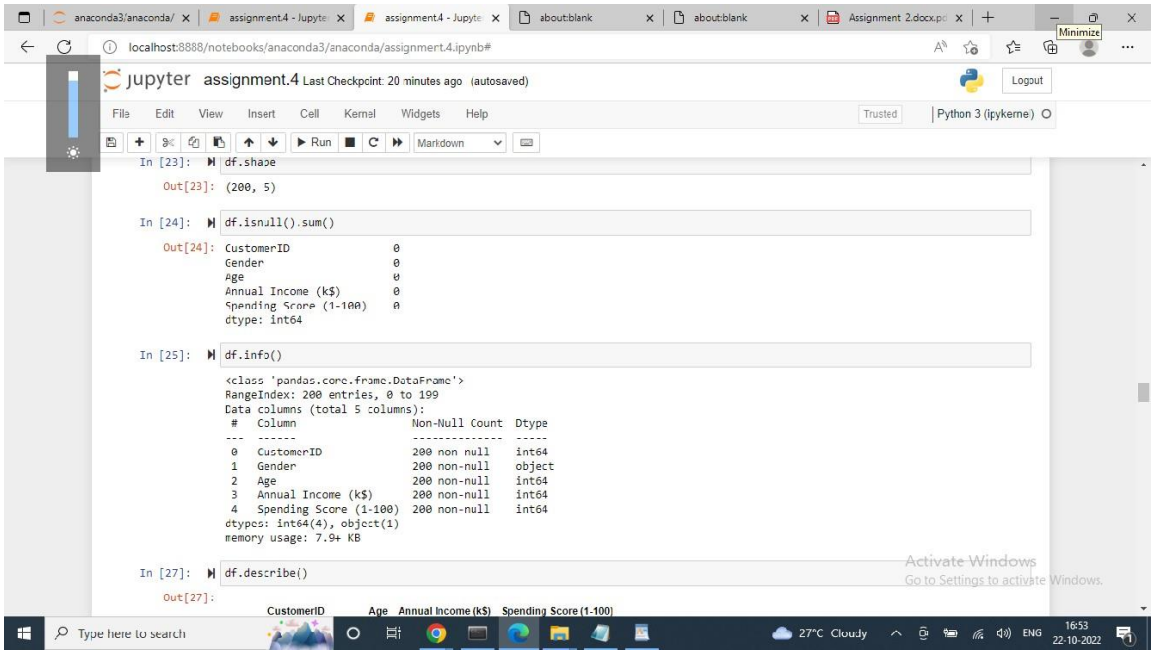
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Python 3 (ipykernel)
Run
Markdown
In [23]: df.shape
Out[23]: (200, 5)
In [24]: df.isnull().sum()
Out[24]: CustomerID 0
Gender 0
Age 0
Annual Income (k$) 0
Spending Score (1-100) 0
dtype: int64
In [25]: df.info()
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
Column Non-Null Count Dtype
0 CustomerID 200 non-null int64
1 Gender 200 non-null object
2 Age 200 non-null int64
3 Annual Income (k$) 200 non-null int64
4 Spending Score (1-100) 200 non-null int64
dtypes: int64(4), object(1)
memory usage: 7.9+ KB
In [27]: df.describe()
Out[27]:
CustomerID Age Annual Income (k$) Spending Score (1-100)
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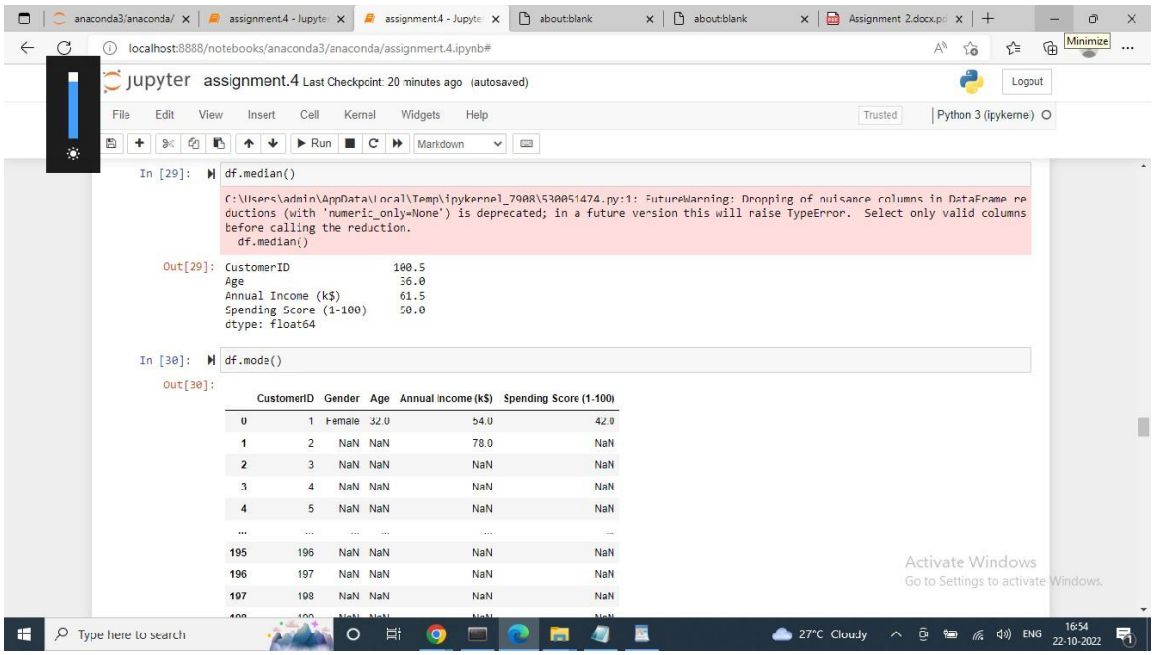
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Python 3 (ipykernel)
Run
Markdown
In [29]: df.median()
C:\Users\admin\AppData\Local\Temp\ipykernel_7908\530051474.py:1: FutureWarning: Dropping of nuisance columns in DataFrame reductions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError. Select only valid columns before calling the reduction.
df.median()
Out[29]: CustomerID 100.5
Age 36.0
Annual Income (k$) 61.5
Spending Score (1-100) 50.0
dtype: float64
In [30]: df.mode()
Out[30]:
CustomerID Gender Age Annual Income (k$) Spending Score (1-100)
0 1 Female 32.0 54.0 42.0
1 2 NaN NaN 78.0 NaN
2 3 NaN NaN NaN NaN
3 4 NaN NaN NaN NaN
4 5 NaN NaN NaN NaN
195 196 NaN NaN NaN NaN
196 197 NaN NaN NaN NaN
197 198 NaN NaN NaN NaN
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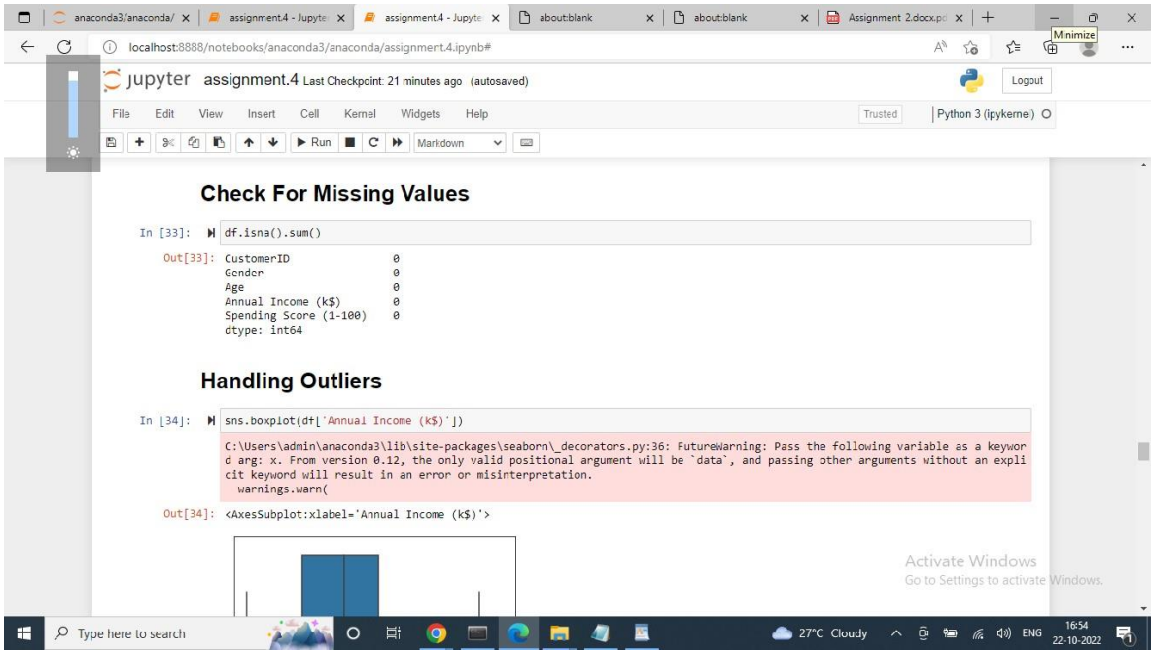
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Python 3 (ipykernel)
Run
Markdown
Check For Missing Values
In [33]:
df.isna().sum()
Out[33]:
CustomerID 0
Gender 0
Age 0
Annual Income (k$) 0
Spending Score (1-100) 0
dtype: int64
Handling Outliers
In [34]:
sns.boxplot(df['Annual Income (k$)'])
C:\Users\admin\anaconda3\lib\site-packages\seaborn_decorators.py:36: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.
warnings.warn(
Out[34]:
<AxesSubplot:xlabel='Annual Income (k$)'>
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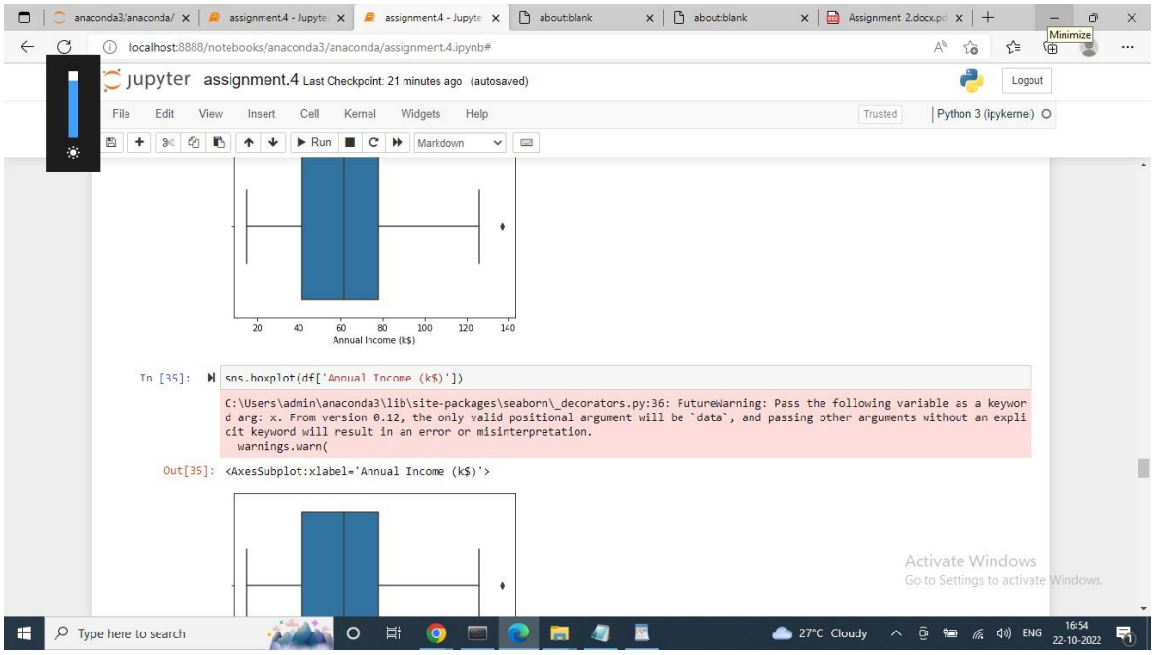
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20 40 60 80 100 120 140
Annual Income (k$)
In [35]:
sns.boxplot(df['Annual Income (k$)'])
C:\Users\admin\anaconda3\lib\site-packages\seaborn_decorators.py:36: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.
warnings.warn(
Out[35]:
<AxesSubplot:xlabel='Annual Income (k$)'>
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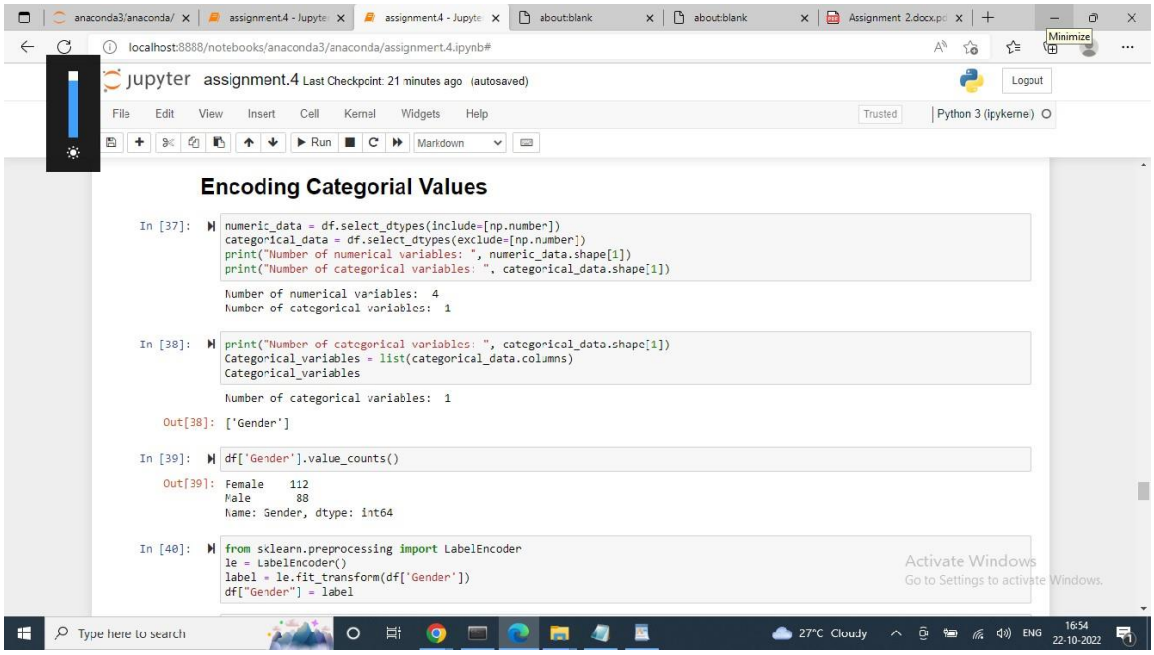
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Python 3 (ipykernel)
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Encoding Categorial Values
In [37]:
numeric_data = df.select_dtypes(include=[np.number])
categorical_data = df.select_dtypes(exclude=[np.number])
print("Number of numerical variables: ", numeric_data.shape[1])
print("Number of categorical variables: ", categorical_data.shape[1])
Number of numerical variables: 4
Number of categorical variables: 1
In [38]:
print("Number of categorical variables: ", categorical_data.shape[1])
Categorical_variables = list(categorical_data.columns)
Categorical_variables
Number of categorical variables: 1
Out[38]:
['Gender']
In [39]:
df['Gender'].value_counts()
Out[39]:
Female 112
Male 88
Name: Gender, dtype: int64
In [40]:
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
label = le.fit_transform(df['Gender'])
df["Gender"] = label
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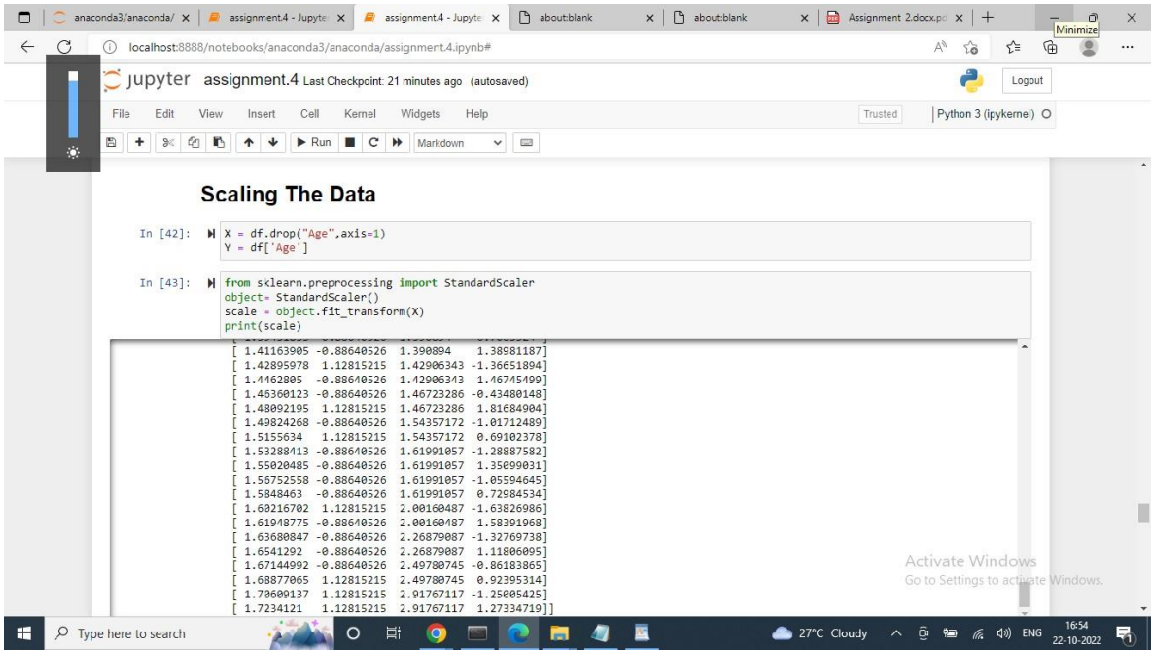
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Python 3 (ipykernel)
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Scaling The Data
In [42]:
X = df.drop("Age",axis=1)
Y = df['Age']
In [43]:
from sklearn.preprocessing import StandardScaler
object= StandardScaler()
scale = object.fit_transform(X)
print(scale)
[1.41163905 -0.88640526 1.390894 1.38581187]
[1.42895978 1.12815215 1.42906343 -1.36651894]
[1.4462805 -0.88640526 1.42906343 1.46715499]
[1.46360123 -0.88640526 1.46723286 -0.43480148]
[1.48092195 1.12815215 1.46723286 1.81684904]
[1.49824268 -0.88640526 1.54357172 -1.01712489]
[1.5155634 1.12815215 1.54357172 0.69102378]
[1.53288413 -0.88640526 1.61991057 -1.38887582]
[1.55020485 -0.88640526 1.61991057 1.35699031]
[1.56752558 -0.88640526 1.61991057 -1.05594645]
[1.5848463 -0.88640526 1.61991057 0.72584534]
[1.60216702 1.12815215 2.00160487 -1.63826986]
[1.61948775 -0.88640526 2.00160487 1.58391968]
[1.63680847 -0.88640526 2.26879087 -1.32769738]
[1.6541292 -0.88640526 2.26879087 1.11806095]
[1.67144992 -0.88640526 2.49780745 -0.86183865]
[1.68877065 1.12815215 2.49780745 0.92395314]
[1.70609137 1.12815215 2.91767117 -1.25005425]
[1.7234121 1.12815215 2.91767117 1.27334719]]
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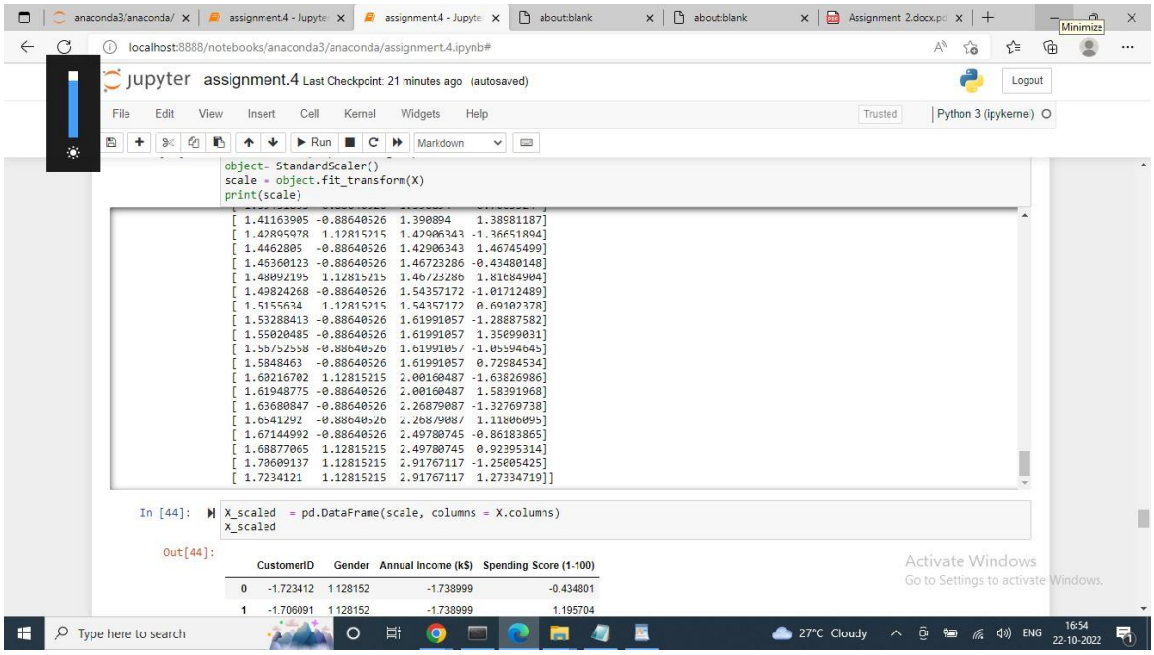
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object= StandardScaler()
scale = object.fit_transform(X)
print(scale)
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[1.42899978 1.12815215 1.42906343 -1.36651894]
[1.4462805 -0.88640526 1.42906343 1.46745499]
[1.46360123 -0.88640526 1.46723286 -0.43480148]
[1.48092195 1.12815215 1.46723286 1.81684904]
[1.49824268 -0.88640526 1.54357172 -1.01712489]
[1.5155634 1.12815215 1.54357172 0.69102378]
[1.53288413 -0.88640526 1.61991057 -1.28887582]
[1.55020485 -0.88640526 1.61991057 1.35699031]
[1.56752558 -0.88640526 1.61991057 -1.05594645]
[1.5848463 -0.88640526 1.61991057 0.72984534]
[1.60216702 1.12815215 2.00160487 -1.63826986]
[1.61948775 -0.88640526 2.00160487 1.58391968]
[1.63680847 -0.88640526 2.26879087 -1.32769738]
[1.6541292 -0.88640526 2.26879087 1.11806095]
[1.67144992 -0.88640526 2.49780745 -0.86183865]
[1.68877065 1.12815215 2.49780745 0.92395314]
[1.70609137 1.12815215 2.91767117 -1.25005425]
[1.7234121 1.12815215 2.91767117 1.27334719]]
In [44]:
X_scaled = pd.DataFrame(scale, columns = X.columns)
X_scaled
Out[44]:
CustomerID Gender Annual Income (k$) Spending Score (1-100)
0 -1.723412 1.128152 -1.738999 -0.434801
1 -1.706091 1.128152 -1.738999 1.195704
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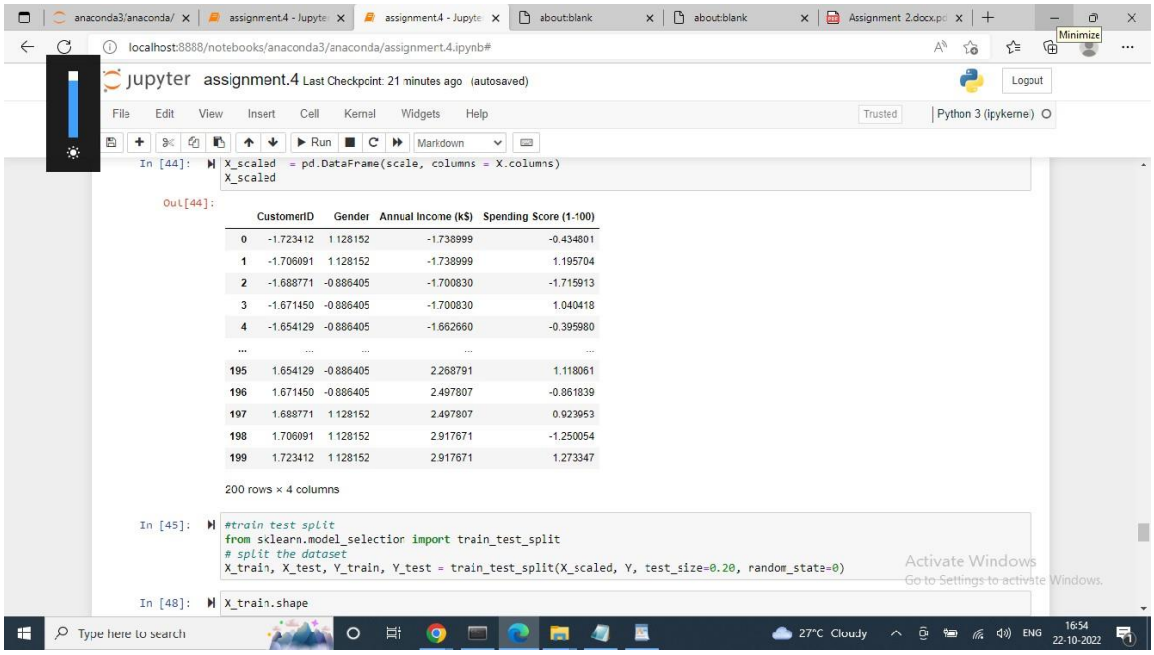
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Assignment 2.docx.pd
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localhost:8888/notebooks/anaconda3/anaconda/assignment.4.ipynb#
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Python 3 (ipykernel)
Run
Markdown
In [44]:
X_scaled = pd.DataFrame(scale, columns = X.columns)
X_scaled
Out[44]:
CustomerID Gender Annual Income (k$) Spending Score (1-100)
0 -1.723412 1.128152 -1.738999 -0.434801
1 -1.706091 1.128152 -1.738999 1.195704
2 -1.688771 -0.886405 -1.700830 -1.715913
3 -1.671450 -0.886405 -1.700830 1.040418
4 -1.654129 -0.886405 -1.662660 -0.395980
... ...
195 1.654129 -0.886405 2.268791 1.118061
196 1.671450 -0.886405 2.497807 -0.861839
197 1.688771 1.128152 2.497807 0.923953
198 1.706091 1.128152 2.917671 -1.250054
199 1.723412 1.128152 2.917671 1.273347
200 rows × 4 columns
In [45]:
#train test split
from sklearn.model_selectior import train_test_split
# split the dataset
X_train, X_test, Y_train, Y_test = train_test_split(X_scaled, Y, test_size=0.20, random_state=0)
In [48]:
X_train.shape
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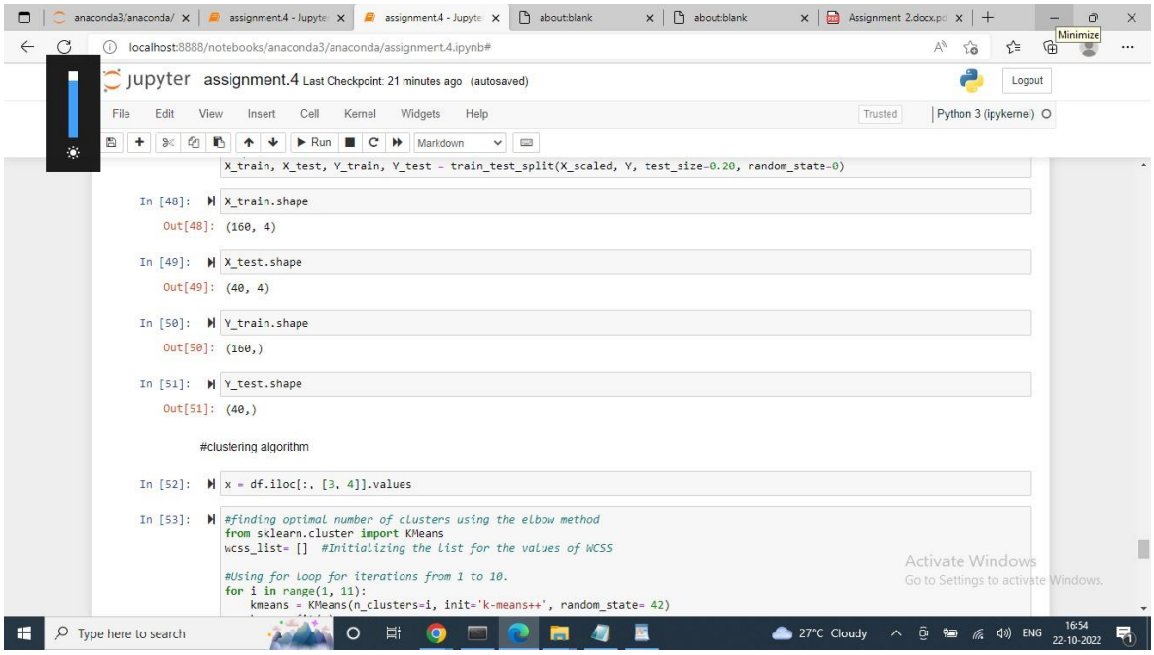
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Python 3 (ipykerne)
Run
Markdown
X_train, X_test, Y_train, Y_test = train_test_split(X_scaled, Y, test_size=0.20, random_state=0)
In [48]: X_train.shape
Out[48]: (160, 4)
In [49]: X_test.shape
Out[49]: (40, 4)
In [50]: Y_train.shape
Out[50]: (160,)
In [51]: Y_test.shape
Out[51]: (40,)
#clustering algorithm
In [52]: x = df.iloc[:, [3, 4]].values
In [53]: #finding optimal number of clusters using the elbow method
from sklearn.cluster import KMeans
wcss_list= [] #Initializing the list for the values of WCSS
#Using for loop for iterations from 1 to 10.
for i in range(1, 11):
kmeans = KMeans(n_clusters=i, init='k-means++', random_state= 42)
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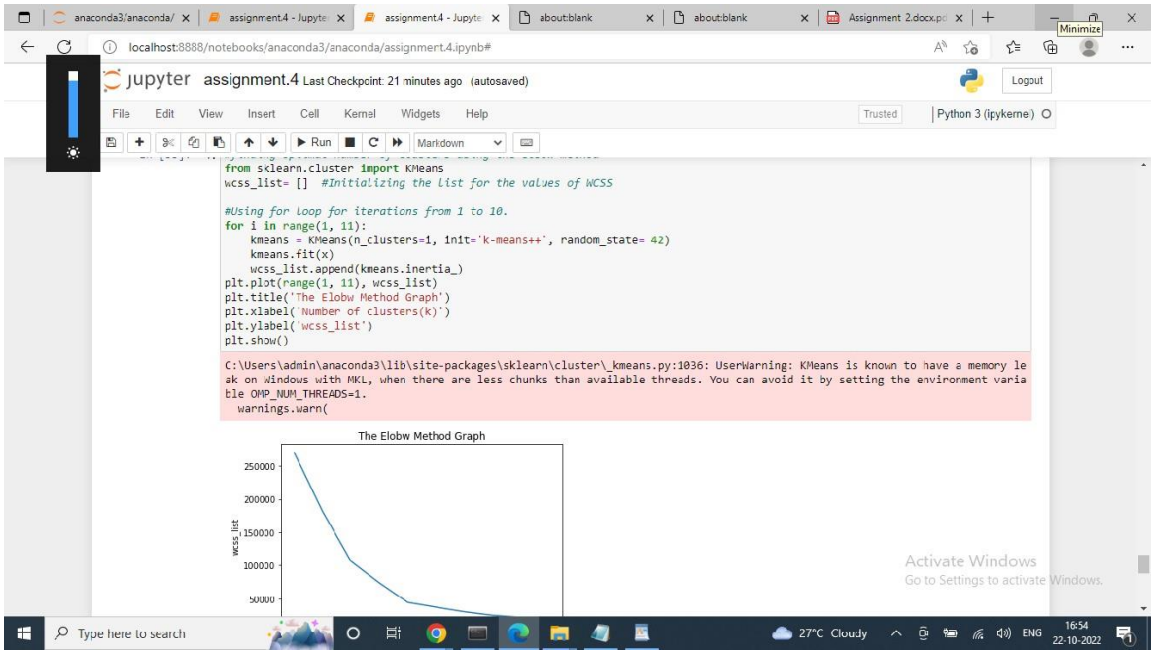
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Python 3 (ipykerne)
Run
Markdown
from sklearn.cluster import KMeans
wcss_list= [] #Initializing the list for the values of WCSS
#Using for loop for iterations from 1 to 10.
for i in range(1, 11):
kmeans = KMeans(n_clusters=1, init='k-means++', random_state= 42)
kmeans.fit(x)
wcss_list.append(kmeans.inertia_)
plt.plot(range(1, 11), wcss_list)
plt.title('The Elobw Method Graph')
plt.xlabel('Number of clusters(K)')
plt.ylabel('wcss_list')
plt.show()
C:\Users\admin\anaconda3\lib\site-packages\sklearn\cluster_kmeans.py:1036: UserWarning: KMeans is known to have a memory le
sk on windows with MKL, when there are less chunks than available threads. You can avoid it by setting the environment varia
ble OMP_NUM_THREADS=1.
warnings.warn(
The Elobw Method Graph
wcss_list
250000
200000
150000
100000
50000
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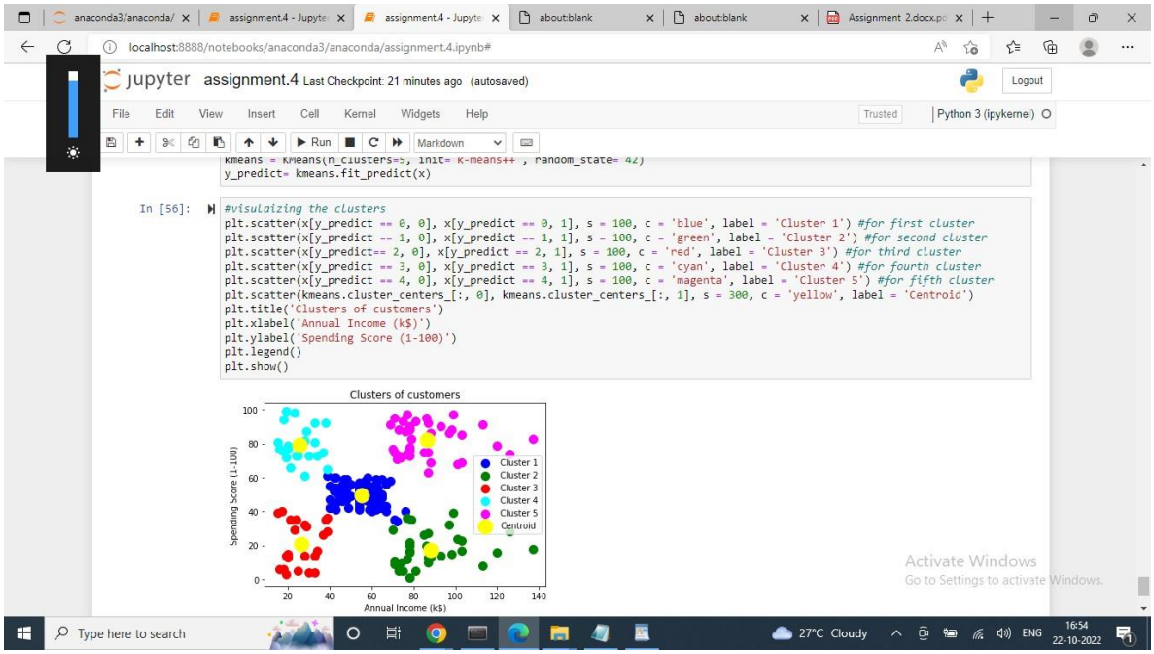
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localhost:8888/notebooks/anaconda3/anaconda/assignment.4.ipynb#
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Python 3 (ipykernel)
Run
Markdown
kmeans = KMeans(n_clusters=5, init='k-means++', random_state=42)
y_predict= kmeans.fit_predict(x)
In [56]:
#visualizing the clusters
plt.scatter(x[y_predict == 0, 0], x[y_predict == 0, 1], s = 100, c = 'blue', label = 'Cluster 1') #for first cluster
plt.scatter(x[y_predict == 1, 0], x[y_predict == 1, 1], s = 100, c = 'green', label = 'Cluster 2') #for second cluster
plt.scatter(x[y_predict== 2, 0], x[y_predict == 2, 1], s = 100, c = 'red', label = 'Cluster 3') #for third cluster
plt.scatter(x[y_predict == 3, 0], x[y_predict == 3, 1], s = 100, c = 'cyan', label = 'Cluster 4') #for fourth cluster
plt.scatter(x[y_predict == 4, 0], x[y_predict == 4, 1], s = 100, c = 'magenta', label = 'Cluster 5') #for fifth cluster
plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1], s = 300, c = 'yellow', label = 'Centroid')
plt.title('Clusters of customers')
plt.xlabel('Annual Income (k$)')
plt.ylabel('Spending Score (1-100)')
plt.legend()
plt.show()
Clusters of customers
Spending Score (1-100)
Annual Income (k$)
Cluster 1
Cluster 2
Cluster 3
Cluster 4
Cluster 5
Centroid
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