In [ ]:

```
 
```

ENGR 1330-2022 Exam 4 - Laboratory Portion

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ENGR 1330 Exam 4 - Demonstrate Laboratory/Programming Skills

Download (right-click, save target as ...) this page as a jupyterlab notebook from: s22-ex4-deploy.ipynb

If you are unable to download the Jupyter file, create an empty notebook and copy paste the problems into Markdown cells and Code cells (problem-by-problem)

Problem 0.0 (2 pts) : *Profile your computer*

Execute the code cell below exactly as written. If you get an error just continue to the remaining problems.

In [37]:

```
# Preamble script block to identify host, user, and kernel
import sys
! hostname
! whoami
print(sys.executable)
print(sys.version)
print(sys.version_info)
bigstring = "import matplotlib.pyplot as plt\nimport qrcode\nimg=qrcode.make('R00000000
exec(bigstring)
```

```
DESKTOP-6HAS1BN
desktop-6has1bn\medra
C:\Users\medra\anaconda3\python.exe
3.8.5 (default, Sep  3 2020, 21:29:08) [MSC v.1916 64 bit (AMD64)]
sys.version_info(major=3, minor=8, micro=5, releaselevel='final', serial=0)
---------------------------------------------------------------------------
ModuleNotFoundError                       Traceback (most recent call last)
<ipython-input-37-8503346dd731> in <module>
      7 print(sys.version_info)
      8 bigstring = "import matplotlib.pyplot as plt\nimport qrcode\nimg=qrcode.make('R0
0000000')\nimport matplotlib.image as mpimg\nimgplot = plt.imshow(img)\nplt.show()"
----> 9 exec(bigstring)

<string> in <module>

ModuleNotFoundError: No module named 'qrcode'
```

Problem 0.1 (3 pts) : *Read the csv data file*

Import the database file directly into a Pandas dataframe object. Execute the code cell exactly as written.

In [38]:
```
import pandas as pd
url = "http://54.243.252.9/engr-1330-webroot/4-Databases/EcommerceCustomers.csv"
dataset = pd.read_csv(url)
```

Problem 1 (5 pts) : *Import any remaining libraries and describe the dataframe

In [39]:
```
#GIVE YOUR ANSWER FOR Problem-1 IN THIS CELL
import matplotlib.pyplot as plt
import numpy as np
import math
import seaborn as sns

dataset.describe()
```

Out[39]:
```
         Avg. Session      Time on      Time on     Length of  Yearly Amount
               Length          App      Website    Membership          Spent
count      500.000000   500.000000    500.00000    500.000000     500.000000
mean        33.052400    12.052600     37.06100      3.532800     499.320000
std          0.992767     0.995588      1.01109      0.999581      79.318045
min         29.500000     8.500000     33.90000      0.300000     257.000000
25%         32.300000    11.400000     36.37500      2.900000     445.000000
50%         33.100000    12.000000     37.10000      3.500000     499.000000
75%         33.700000    12.800000     37.70000      4.100000     549.250000
max         36.100000    15.100000     40.00000      6.900000     766.000000
```

The dataframe lists the email, Adress, and avatar of

ecommerce customers and lists each persons information

namely the average time they play, time on the app,

time on their website, how long theyve been a member,

and the yearly amount of money they spend on their app

with this information tons of data can be analyzed

to maximize profits.

Problem 2: *We will be working with an ecommerce dataset to predict the customer’s yearly spending amount in dollars based on 4 features, namely, average session length in minutes (average in-store style advice sessions), time on app in minutes, time on website in minutes, length of membership in years. Specific tasks for this exercise are given below.*

Task-1 (5 pts): Read the `EcommerceCustomers.csv` file and store it in a variable named `ecommerce`. Display the first 5 rows of the dataframe `ecommerce`.

> **Problem 0.1 above should automatically load the file into the object `dataset`. If that fails, the CSV file is located at http://54.243.252.9/engr-1330-webroot/4-Databases/EcommerceCustomers.csv**

In [40]:

```
#GIVE YOUR ANSWER FOR TASK-1 IN THIS CELL

ecommerce = pd.read_csv('EcommerceCustomers.csv')

ecommerce.head()
```

Out[40]:

	Email	Address	Avatar	Avg. Session Length	Time on App	Time on Website	Le Men
0	mstephenson@fernandez.com	835 Frank Tunnel\nWrightmouth, MI 82180-9605	Violet	34.5	12.7	39.6	
1	hduke@hotmail.com	4547 Archer Common\nDiazchester, CA 06566-8576	DarkGreen	31.9	11.1	37.3	
2	pallen@yahoo.com	24645 Valerie Unions Suite 582\nCobbborough, D...	Bisque	33.0	11.3	37.1	

	Email	Address	Avatar	Avg. Session Length	Time on App	Time on Website	L Mem
3	riverarebecca@gmail.com	1414 David Throughway\nPort Jason, OH 22070-1220	SaddleBrown	34.3	13.7	36.7	
4	mstephens@davidson-herman.com	14023 Rodriguez Passage\nPort Jacobville, PR 3...	MediumAquaMarine	33.3	12.8	37.5	

Task-2 (5 pts): Get the information (i.e, the number of rows and the data types present in each column) and the basic statistical measures about the dataframe **`ecommerce`** using the appropriate functions.

In [41]:

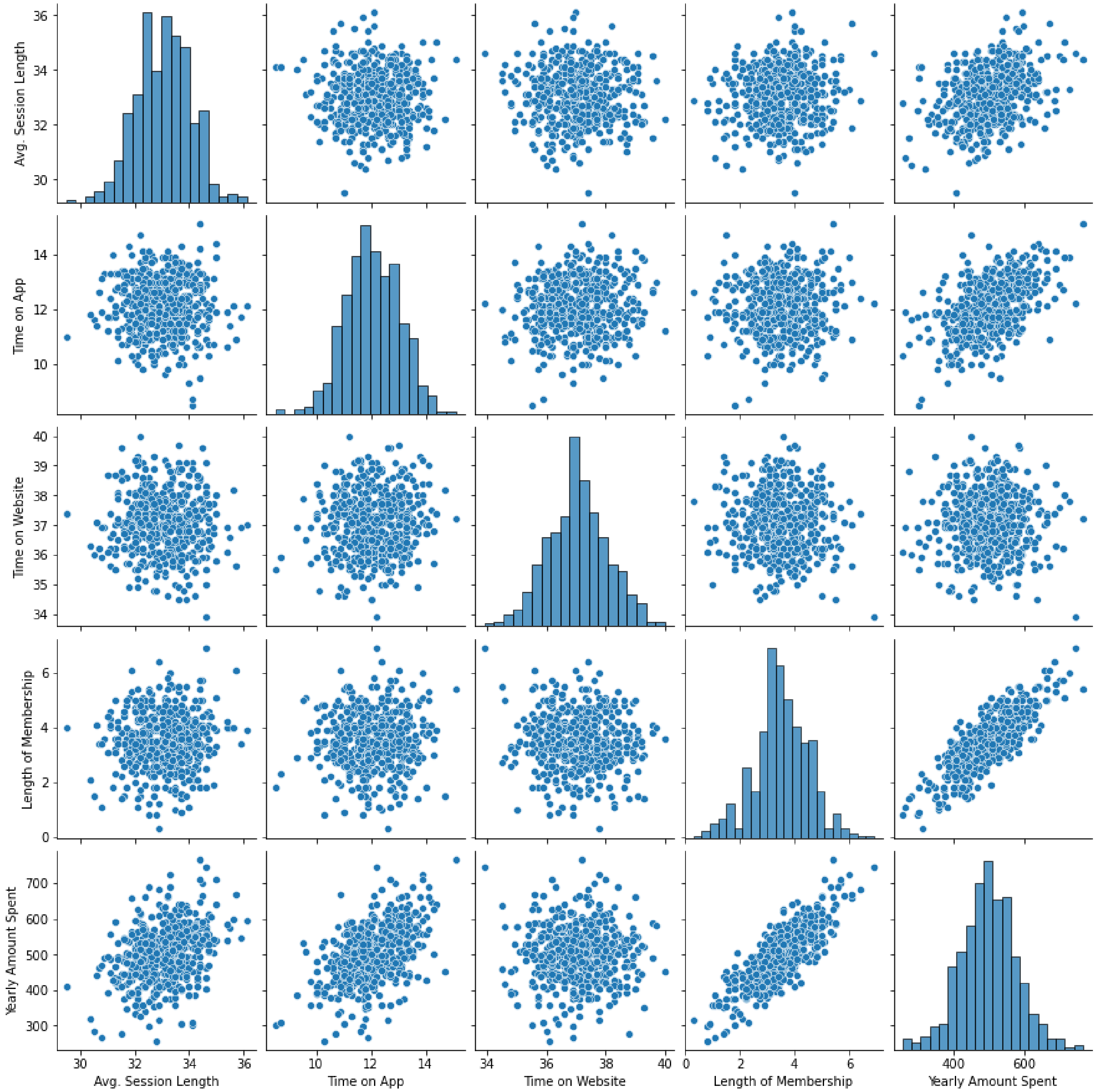
```
#GIVE YOUR ANSWER FOR TASK-2 IN THIS CELL
print('The total number of rows are',ecommerce.shape[0], 'And the total number of colum

dataType = ecommerce.dtypes
print('========================')
print('These are the data types of each column')
print(dataType)
```

```
The total number of rows are 500 And the total number of columns are 8 !
========================
These are the data types of each column
Email                    object
Address                  object
Avatar                   object
Avg. Session Length     float64
Time on App             float64
Time on Website         float64
Length of Membership    float64
Yearly Amount Spent       int64
dtype: object
```

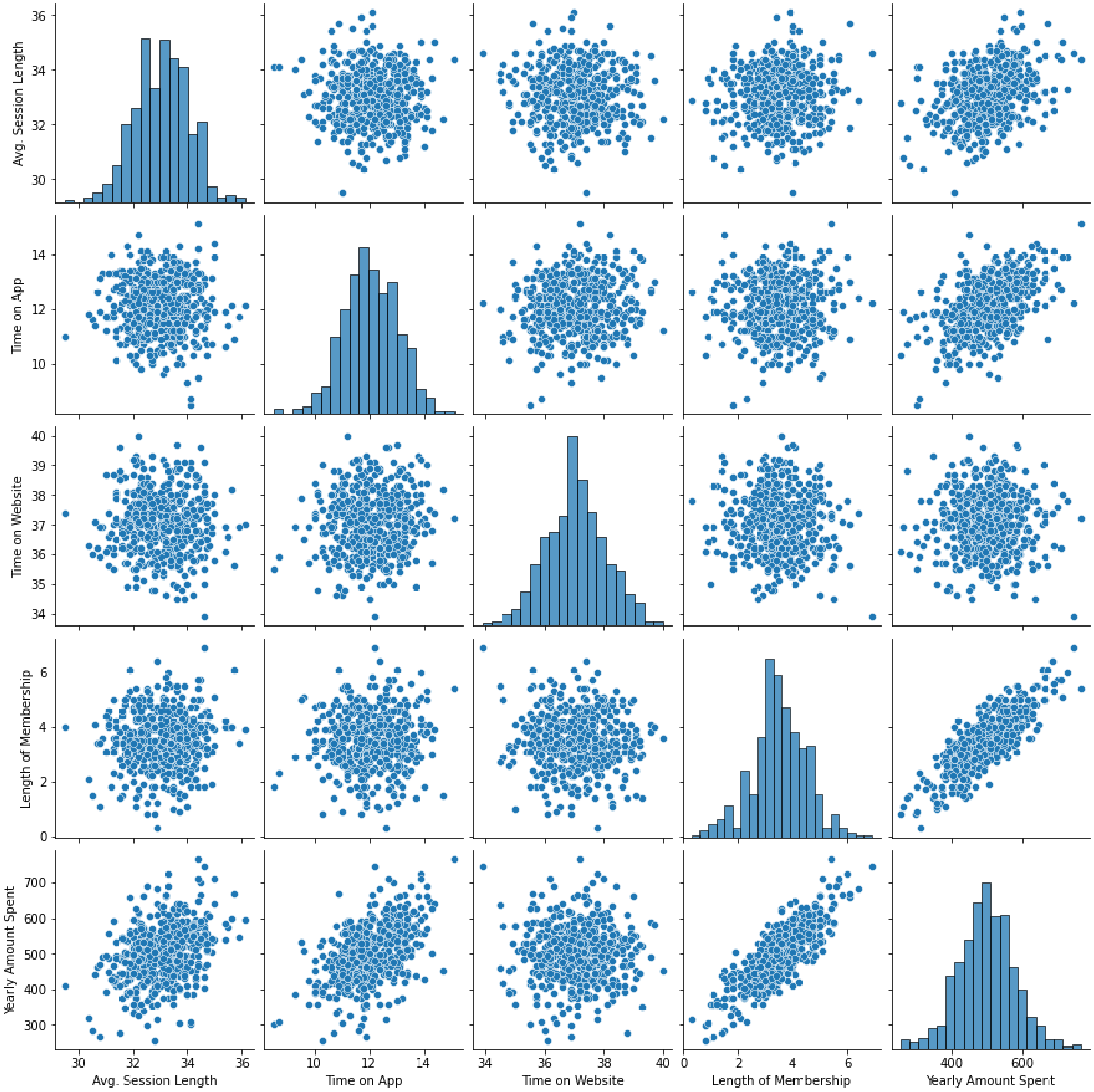
Task-3 (5 pts): Display the plot between all paramaters in the dataset using the appropriate plotting function in the Seaborn library.

In [42]:

```
#GIVE YOUR ANSWER FOR TASK-3 IN THIS CELL

sns.pairplot(ecommerce)
plt.show()
```

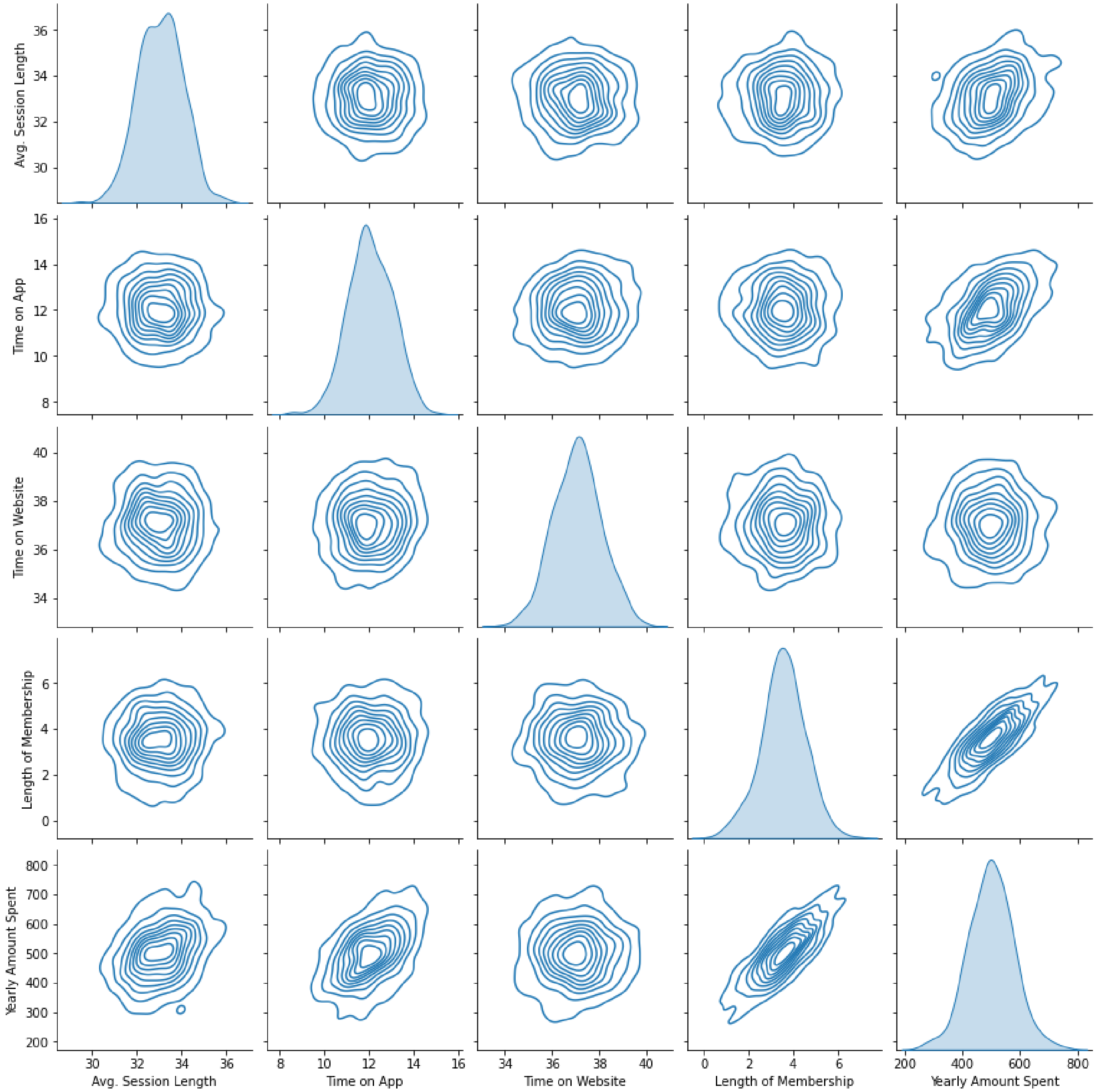


```
In [9]:  sns.pairplot(ecommerce, diag_kind="hist")

Out[9]:  <seaborn.axisgrid.PairGrid at 0x1367d842d60>
```



```
In [10]: sns.pairplot(ecommerce, kind="kde")
```

```
Out[10]: <seaborn.axisgrid.PairGrid at 0x1367e1595e0>
```



I added several models for completion

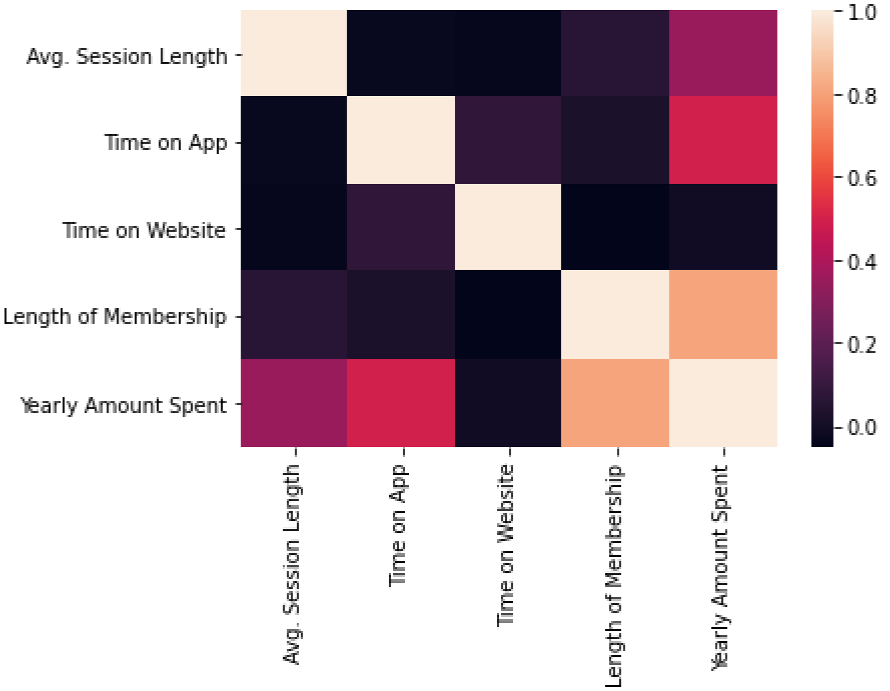
Task-4: (5 pts) Compute the correlation coefficient between all parameters in the dataset using the appropriate function in the Pandas library and store it in a variable named `corr` . Display the heat map of correlation values stored in `corr` using the appropriate function in the Seaborn library. The heat map must display an appropriate title. Identfy if there is any colinearity between the input parameters.

In [11]:

```
#GIVE YOUR ANSWER FOR TASK-4 IN THIS CELL
#make this more general, find the correlation matrix. generate the heatmap
corr = ecommerce.corr()
print(corr)

sns.heatmap(ecommerce.corr());
```

```
                      Avg. Session Length  Time on App  Time on Website  \
Avg. Session Length              1.000000    -0.026253        -0.034575
```

```
Time on App                -0.026253   1.000000          0.084760
Time on Website            -0.034575   0.084760          1.000000
Length of Membership        0.061958   0.028690         -0.049037
Yearly Amount Spent         0.356523   0.497717         -0.003118

                      Length of Membership  Yearly Amount Spent
Avg. Session Length               0.061958             0.356523
Time on App                       0.028690             0.497717
Time on Website                  -0.049037            -0.003118
Length of Membership              1.000000             0.809364
Yearly Amount Spent               0.809364             1.000000
```



Task-5: (5 pts) Index and pick the 4 feature columns and store it in a variable named `x` . Similarly, index and pick the column named `Yearly Amount Spent` and store it in a variable named `y` . Print the first 5 rows of `x` and `y` to the output.

In [20]:

```
#GIVE YOUR ANSWER FOR TASK-5 IN THIS CELL
y = ecommerce['Yearly Amount Spent']
x = ecommerce.drop(columns=['Yearly Amount Spent', 'Email','Address','Avatar'] , axis=1
#x = ecommerce.drop(columns=['Email'] , axis=1)
#x = ecommerce.drop(columns=['Address'] , axis=1)
#x = ecommerce.drop(columns=['Avatar'] , axis=1)




print(x)
print('=================================================-')
print(y)
```

```
     Avg. Session Length  Time on App  Time on Website  Length of Membership
0                   34.5         12.7             39.6                   4.1
1                   31.9         11.1             37.3                   2.7
2                   33.0         11.3             37.1                   4.1
3                   34.3         13.7             36.7                   3.1
4                   33.3         12.8             37.5                   4.4
..                   ...          ...              ...                   ...
495                 33.2         13.6             36.4                   3.7
496                 34.7         11.7             37.2                   3.6
497                 32.6         11.5             38.3                   5.0
```

```
498                   33.3         12.4             36.8                     2.3
499                   33.7         12.4             35.8                     2.7

[500 rows x 4 columns]
==================================================-
0      588
1      392
2      488
3      582
4      599
      ...
495    574
496    529
497    552
498    456
499    498
Name: Yearly Amount Spent, Length: 500, dtype: int64
```

Task-6 (5 pts): Randomly (without replacement) pick 66.66% of the rows from the dataframe `data` and store it in a variable named `training_set` . Similarly, randomly (without replacement) pick 33.33% of the rows from the dataframe `data` and store it in a variable named `test_set` .

In [31]:

```
#GIVE YOUR ANSWER FOR TASK-6 IN THIS CELL
from sklearn import svm
from sklearn.model_selection import train_test_split
from sklearn import metrics
from sklearn.linear_model import LinearRegression



x_train = x.sample(frac=.6666, replace = False)
y_train = y.sample(frac=.6666, replace = False)
x_test =x.sample(frac=.3333, replace = False)
y_test  =y.sample(frac=.3333, replace = False)
```

Task-7 (5 pts): Train the model using `x_train` and `y_train` . Print the coefficients and the intercept to the output.

In [32]:

```
# Task 7 goes here


k = LinearRegression()
print(k.fit(x_train,y_train))
print('----------------------------')
print(k.coef_)
print(k.intercept_)
```

```
LinearRegression()
----------------------------
[-2.2189509   4.19521231  3.18499642  0.73577379]
406.0245688833435
```

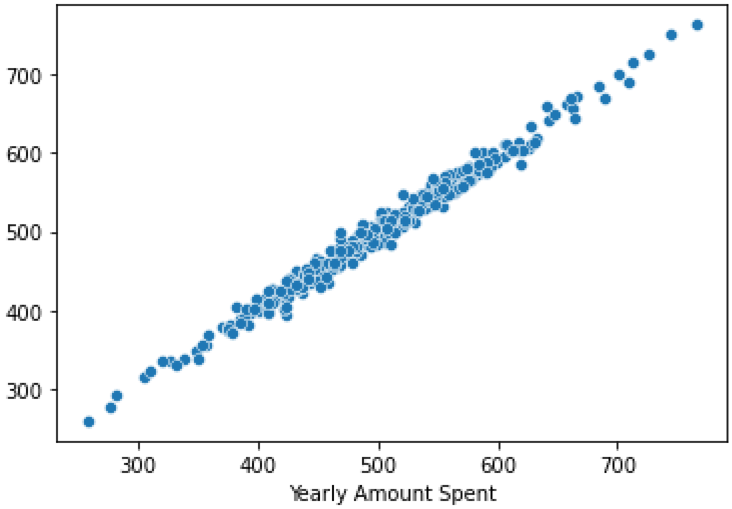
In [34]:

```
# More in depth analysis


x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.6666, random_stat

k = LinearRegression()
k.fit(x_train,y_train)
k.coef_
```

```
predic = k.predict(x_test)


sns.scatterplot(y_test, predic)





mae = metrics.mean_absolute_error(y_test, predic)
mse = metrics.mean_squared_error(y_test, predic)
rmse =  np.sqrt(metrics.mean_squared_error(y_test, predic))
r2 =  metrics.r2_score(y_test,predic)
lin = LinearRegression()

print('Mean Absolute error is:', mae )
print('Mean Square error is:', mse)
print('Root Mean square error is:', rmse)
print('R2 Score is:', r2)
```

```
Mean Absolute error is: 7.891975911150439
Mean Square error is: 99.803890664589
Root Mean square error is: 9.990189721150895
R2 Score is: 0.9850960607668636
```

```
C:\Users\medra\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pas
s the following variables as keyword args: x, y. From version 0.12, the only valid posit
ional argument will be `data`, and passing other arguments without an explicit keyword w
ill result in an error or misinterpretation.
  warnings.warn(
```



Now for .33 version

In [35]:

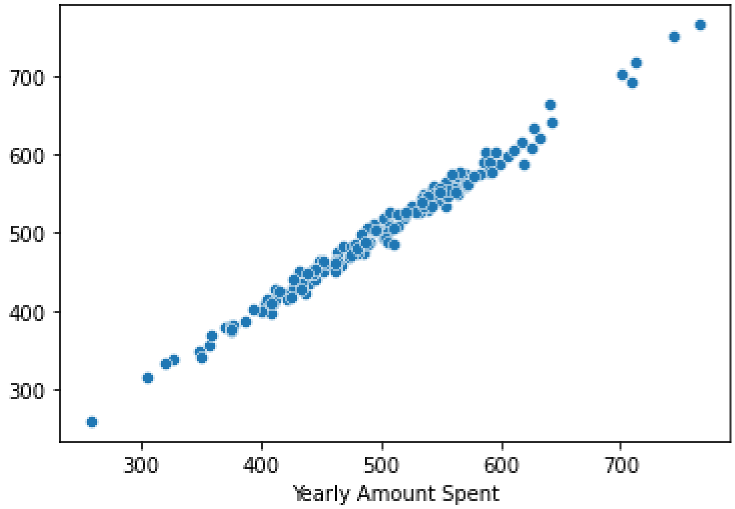
```
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.3333, random_stat

k = LinearRegression()
k.fit(x_train,y_train)
k.coef_


predic = k.predict(x_test)
```

```
sns.scatterplot(y_test, predic)
```

```
C:\Users\medra\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pas
s the following variables as keyword args: x, y. From version 0.12, the only valid posit
ional argument will be `data`, and passing other arguments without an explicit keyword w
ill result in an error or misinterpretation.
  warnings.warn(
```

Out[35]:

```
<AxesSubplot:xlabel='Yearly Amount Spent'>
```



In [36]:

```
mae = metrics.mean_absolute_error(y_test, predic)
mse = metrics.mean_squared_error(y_test, predic)
rmse =  np.sqrt(metrics.mean_squared_error(y_test, predic))
r2 =  metrics.r2_score(y_test,predic)

print('Mean Absolute error is:', mae )
print('Mean Square error is:', mse)
print('Root Mean square error is:', rmse)
print('R2 Score is:', r2)
```

```
Mean Absolute error is: 7.474829475033762
Mean Square error is: 86.34983305468205
Root Mean square error is: 9.292461087068487
R2 Score is: 0.9874765294165274
```

In [ ]: