#1.A) BASIC PRACTICE EXPERIMENTS 1-4

#230701008

#ABIRAMI.K

#30/07/24

import pandas as pd

import matplotlib.pyplot as plt

data = {'Year': list(range(2010, 2021)),

'Job Postings': [150, 300, 450, 600, 800, 1200, 1600, 2100, 2700, 3400, 4200]}

df = pd.DataFrame(data)

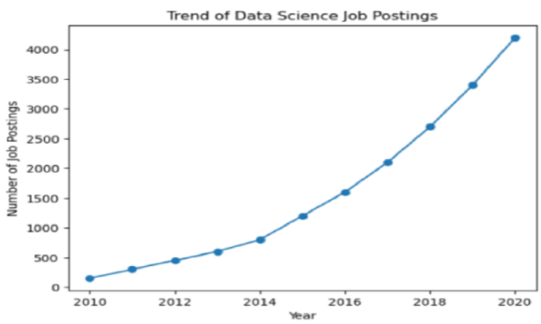
plt.plot(df['Year'], df['job Postings rob Postings'], marker='o')

plt.title('Trend of Data Science Job Postings')

plt.xlabel('Year')

plt.ylabel('Number of Job Postings')

plt.show()



```
In [2]: import pandas
        x=[1,7,2]
        y=pandas.DataFrame(x,index=["a","b","c"])
        print(y)
```

```
   0
a  1
b  7
c  2
```

```
In [3]: import pandas
        x={'Subjects':["Math","Physics","English"] ,'Marks': [89,92,96]}
        print(pandas.DataFrame(x))
```

```
  Subjects  Marks
0     Math     89
1  Physics     92
2  English     96
```

#1.B) PANDAS BUIT IN FUNCTION; NUMPY BUIT IN FUCTION- ARRAY SLICING, RAVEL,RESHAPE,NDIM

#230701008

#ABIRAMI.K

#06.08.2024

#NUMPY FUNCTIONS

import numpy as np

import pandas as pd

df=pd.read_csv('Salary_data.csv')

df

df.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 30 entries, 0 to 29
Data columns (total 2 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   YearsExperience  30 non-null     float64
 1   Salary           30 non-null     int64
dtypes: float64(1), int64(1)
memory usage: 612.0 bytes
```

df.dropna(inplace=True)

df.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 30 entries, 0 to 29
Data columns (total 2 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   YearsExperience  30 non-null     float64
 1   Salary           30 non-null     int64
dtypes: float64(1), int64(1)
memory usage: 612.0 bytes
```

df.describe()

	YearsExperience	Salary
count	30.000000	30.000000
mean	5.313333	76003.000000
std	2.837888	27414.429785
min	1.100000	37731.000000
25%	3.200000	56720.750000
50%	4.700000	65237.000000
75%	7.700000	100544.750000
max	10.500000	122391.000000

features=df.iloc[:,[0]].values

label=df.iloc[:,[1]].values

from sklearn.model_selection import train_test_split

x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0.2,random_st

from sklearn.linear_model import LinearRegression

model=LinearRegression()

model.fit(x_train,y_train)

```
▾ LinearRegression
LinearRegression()
```

model.score(x_train,y_train)

```
0.9603182547438908
```

model.score(x_test,y_test)

```
0.9184170849214232
```

model.coef_

```
array([[9281.30847068]])
```

model.intercept_

```
array([27166.73682891])
```

import pickle

pickle.dump(model,open('SalaryPred.model','wb'))

model=pickle.load(open('SalaryPred.model','rb'))

yr_of_exp=float(input("Enter Years of Experience: "))

yr_of_exp_NP=np.array([[yr_of_exp]])

Salary=model.predict(yr_of_exp_NP)

```
Enter Years of Experience: 44
```

print("Estimated Salary for {} years of experience is {}: " .format(yr_of_exp,Salary)

```
Estimated Salary for 44.0 years of experience is [[435544.30953887]]:
```

#PANDAS FUNCTIONS

import numpy as np

import pandas as pd

list=[[1,'Smith',50000],[2,'Jones',60000]]

df=pd.DataFrame(list)

df

	0	1	2
0	1	Smith	50000
1	2	Jones	60000

df.columns=['Empd','Name','Salary']

df

	Empd	Name	Salary
0	1	Smith	50000
1	2	Jones	60000

df.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2 entries, 0 to 1
Data columns (total 3 columns):
 #   Column  Non-Null Count  Dtype 
---  ------  --------------  ----- 
 0   Empd    2 non-null      int64 
 1   Name    2 non-null      object
 2   Salary  2 non-null      int64 
dtypes: int64(2), object(1)
memory usage: 176.0+ bytes
```

df=pd.read_csv("/content/50_Startups.csv") df.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50 entries, 0 to 49
Data columns (total 5 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   R&D Spend        50 non-null     float64
 1   Administration   50 non-null     float64
 2   Marketing Spend  50 non-null     float64
 3   State            50 non-null     object
 4   Profit           50 non-null     float64
dtypes: float64(4), object(1)
memory usage: 2.1+ KB
```

df.head()

df.tail()

import numpy as np

import pandas as pd

df = pd.read_csv("/content/employee.csv")

df.head()

df.tail()

df.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7 entries, 0 to 6
Data columns (total 3 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   emp id  7 non-null      int64
 1   name    7 non-null      object
 2   salary  7 non-null      int64
dtypes: int64(2), object(1)
memory usage: 296.0+ bytes
```

df.salary()

	salary
0	5000
1	6000
2	7000
3	5000
4	8000
5	3000
6	6000

type(df.salary)

df.salary.mean()

```
df.salary.median()
```

```
6000.0
```

```
df.salary.mode()
```

	salary
0	5000
1	6000

```
df.salary.var()
```

```
2571428.5714285714
```

```
df.salary.std()
```

```
1603.5674514745463
```

empCol=df.columns

empCol

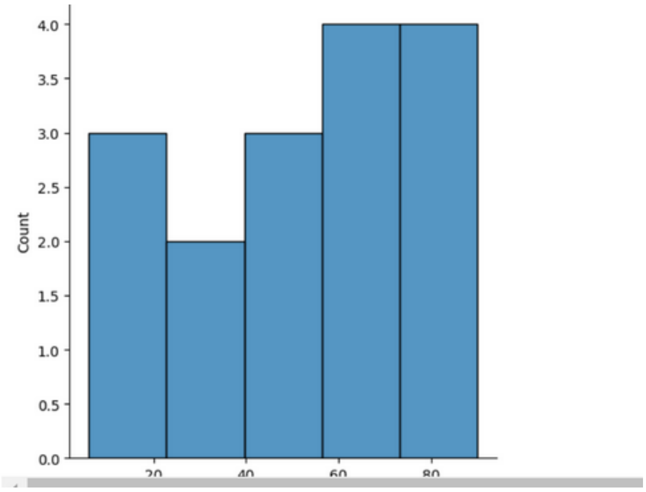
```
Index(['emp id', 'name ', 'salary'], dtype='object')
```

emparray=df.values

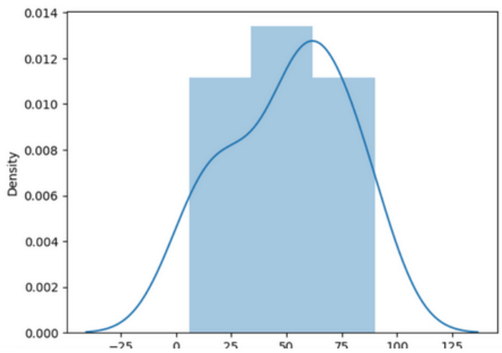
employee_DF=pd.DataFrame(emparray,columns=empCol)

```
#OUTLIER DETECTION

#230701008

#ABIRAMI.K

#13.08.2024

#sample calculation for low range(lr) , upper range (ur),percentile

import numpy as np

array=np.random.randint(1,100,16) # randomly generate 16 numbers between 1 to 100

array

array.mean()

np.percentile(array,25)

np.percentile(array,50)

np.percentile(array,75)

np.percentile(array,100)

#outliers detection

def outDetection(array):
    sorted(array)
    Q1,Q3=np.percentile(array,[25,75])
    IQR=Q3-Q1
    lr=Q1-(1.5*IQR)
    ur=Q3+(1.5*IQR)
    return lr,ur

lr,ur=outDetection(array)

lr,ur

import seaborn as sns

%matplotlib inline
```

sns.displot(array)



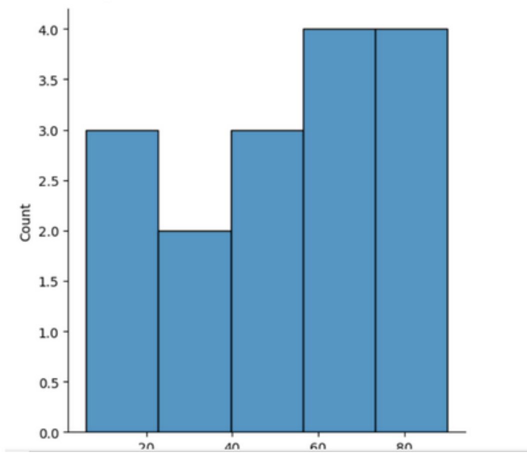
sns.distplot(array)



new_array=array[(array>lr) & (array<ur)]

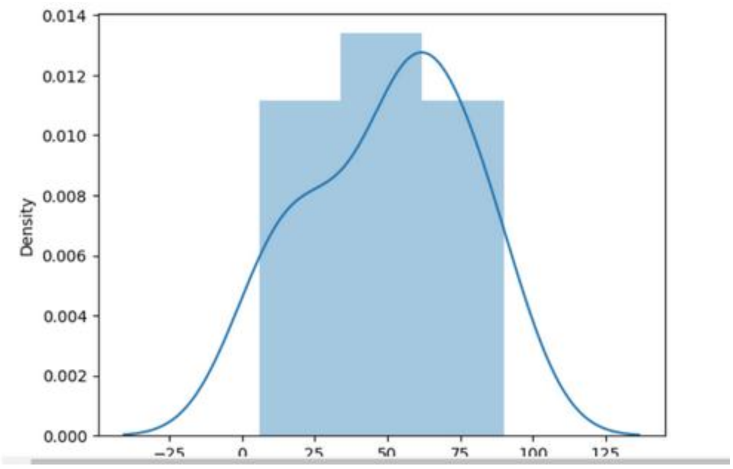
new_array

sns.displot(new_array)



lr1,ur1=outDetection(new_array)

```
lr1,ur1
final_array=new_array[(new_array>lr1) & (new_array<ur1)]
final_array
sns.distplot(final_array)
```



#3) Missing and inappropriate data

#230701008

#ABIRAMI.K

#20.08.2024

import numpy as np

import pandas as pd

df=pd.read_csv("Hotel_Dataset.csv")

df

	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	EstimatedSalary	Age_Group.1
0	1	20-25	4	Ibis	veg	1300	2	40000	20-25
1	2	30-35	5	LemonTree	Non-Veg	2000	3	59000	30-35
2	3	25-30	6	RedFox	Veg	1322	2	30000	25-30
3	4	20-25	-1	LemonTree	Veg	1234	2	120000	20-25
4	5	35+	3	Ibis	Vegetarian	989	2	45000	35+
5	6	35+	3	Ibys	Non-Veg	1909	2	122220	35+
6	7	35+	4	RedFox	Vegetarian	1000	-1	21122	35+
7	8	20-25	7	LemonTree	Veg	2999	-10	345673	20-25
8	9	25-30	2	Ibis	Non-Veg	3456	3	-99999	25-30
9	9	25-30	2	Ibis	Non-Veg	3456	3	-99999	25-30
10	10	30-35	5	RedFox	non-Veg	-6755	4	87777	30-35

df.duplicated()

```
0     False
1     False
2     False
3     False
4     False
5     False
6     False
7     False
8     False
9      True
10    False
dtype: bool
```

df.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 11 entries, 0 to 10
Data columns (total 9 columns):
 #   Column           Non-Null Count  Dtype 
---  ------           --------------  ----- 
 0   CustomerID       11 non-null     int64 
 1   Age_Group        11 non-null     object
 2   Rating(1-5)      11 non-null     int64 
 3   Hotel            11 non-null     object
 4   FoodPreference   11 non-null     object
 5   Bill             11 non-null     int64 
 6   NoOfPax          11 non-null     int64 
 7   EstimatedSalary  11 non-null     int64 
 8   Age_Group.1      11 non-null     object
dtypes: int64(5), object(4)
memory usage: 924.0+ bytes
```

df.drop_duplicates(inplace=True)

df

	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	EstimatedSalary	Age_Group.1
0	1	20-25	4	Ibis	veg	1300	2	40000	20-25
1	2	30-35	5	LemonTree	Non-Veg	2000	3	59000	30-35
2	3	25-30	6	RedFox	Veg	1322	2	30000	25-30
3	4	20-25	-1	LemonTree	Veg	1234	2	120000	20-25
4	5	35+	3	Ibis	Vegetarian	989	2	45000	35+
5	6	35+	3	Ibys	Non-Veg	1909	2	122220	35+
6	7	35+	4	RedFox	Vegetarian	1000	-1	21122	35+
7	8	20-25	7	LemonTree	Veg	2999	-10	345673	20-25
8	9	25-30	2	Ibis	Non-Veg	3456	3	-99999	25-30
10	10	30-35	5	RedFox	non-Veg	-6755	4	87777	30-35

len(df)

index=np.array(list(range(0,len(df))))

df.set_index(index,inplace=True)

index

array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])

df

	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	EstimatedSalary	Age_Group.1
0	1	20-25	4	Ibis	veg	1300	2	40000	20-25
1	2	30-35	5	LemonTree	Non-Veg	2000	3	59000	30-35
2	3	25-30	6	RedFox	Veg	1322	2	30000	25-30
3	4	20-25	-1	LemonTree	Veg	1234	2	120000	20-25
4	5	35+	3	Ibis	Vegetarian	989	2	45000	35+
5	6	35+	3	Ibys	Non-Veg	1909	2	122220	35+
6	7	35+	4	RedFox	Vegetarian	1000	-1	21122	35+
7	8	20-25	7	LemonTree	Veg	2999	-10	345673	20-25
8	9	25-30	2	Ibis	Non-Veg	3456	3	-99999	25-30
9	10	30-35	5	RedFox	non-Veg	-6755	4	87777	30-35

df.drop(['Age_Group.1'],axis=1,inplace=True)

df

df.CustomerID.loc[df.CustomerID<0]=np.nan df.Bill.loc[df.Bill<0]=np.nan

df.EstimatedSalary.loc[df.EstimatedSalary<0]=np.nan

df

	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	EstimatedSalary
0	1.0	20-25	4.0	Ibis	veg	1300.0	2	40000.0
1	2.0	30-35	5.0	LemonTree	Non-Veg	2000.0	3	59000.0
2	3.0	25-30	NaN	RedFox	Veg	1322.0	2	30000.0
3	4.0	20-25	NaN	LemonTree	Veg	1234.0	2	120000.0
4	5.0	35+	3.0	Ibis	Vegetarian	989.0	2	45000.0
5	6.0	35+	3.0	Ibys	Non-Veg	1909.0	2	122220.0
6	7.0	35+	4.0	RedFox	Vegetarian	1000.0	-1	21122.0
7	8.0	20-25	NaN	LemonTree	Veg	2999.0	-10	345673.0
8	9.0	25-30	2.0	Ibis	Non-Veg	3456.0	3	NaN
9	10.0	30-35	5.0	RedFox	non-Veg	NaN	4	87777.0

df['NoOfPax'].loc[(df['NoOfPax']<1) | (df['NoOfPax']>20)]=np.nan

df

df.Age_Group.unique()

```
array(['20-25', '30-35', '25-30', '35+'], dtype=object)
```

df.Hotel.unique()

```
array(['Ibis', 'LemonTree', 'RedFox', 'Ibys'], dtype=object)
```

df.Hotel.replace(['Ibys'],'Ibis',inplace=True)

df.FoodPreference.unique

```
<bound method Series.unique of 0           veg
1       Non-Veg
2           Veg
3           Veg
4    Vegetarian
5       Non-Veg
6    Vegetarian
7           Veg
8       Non-Veg
9       non-Veg
Name: FoodPreference, dtype: object>
```

df.FoodPreference.replace(['Vegetarian','veg'],'Veg',inplace=True)

df.FoodPreference.replace(['non-Veg'],'Non-Veg',inplace=True)

df.EstimatedSalary.fillna(round(df.EstimatedSalary.mean()),inplace=True)

df.NoOfPax.fillna(round(df.NoOfPax.median()),inplace=True)

df['Rating(1-5)'].fillna(round(df['Rating(1-5)'].median()), inplace=True)

df.Bill.fillna(round(df.Bill.mean()),inplace=True)

df

	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	EstimatedSalary
0	1.0	20-25	4.0	Ibis	Veg	1300.0	2.0	40000.0
1	2.0	30-35	5.0	LemonTree	Non-Veg	2000.0	3.0	59000.0
2	3.0	25-30	4.0	RedFox	Veg	1322.0	2.0	30000.0
3	4.0	20-25	4.0	LemonTree	Veg	1234.0	2.0	120000.0
4	5.0	35+	3.0	Ibis	Veg	989.0	2.0	45000.0
5	6.0	35+	3.0	Ibis	Non-Veg	1909.0	2.0	122220.0
6	7.0	35+	4.0	RedFox	Veg	1000.0	2.0	21122.0
7	8.0	20-25	4.0	LemonTree	Veg	2999.0	2.0	345673.0
8	9.0	25-30	2.0	Ibis	Non-Veg	3456.0	3.0	96755.0
9	10.0	30-35	5.0	RedFox	Non-Veg	1801.0	4.0	87777.0

#4)Data Preprocessing

#230701008

#ABIRAMI.K

#27.08.2024

import numpy as np

import pandas as pd

df=pd.read_csv("/content/pre-process_datasample.csv")

df

	Country	Age	Salary	Purchased
0	France	44.0	72000.0	No
1	Spain	27.0	48000.0	Yes
2	Germany	30.0	54000.0	No
3	Spain	38.0	61000.0	No
4	Germany	40.0	NaN	Yes
5	France	35.0	58000.0	Yes
6	Spain	NaN	52000.0	No
7	France	48.0	79000.0	Yes
8	NaN	50.0	83000.0	No
9	France	37.0	67000.0	Yes

df.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to 9
Data columns (total 4 columns):
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   Country    9 non-null      object
 1   Age        9 non-null      float64
 2   Salary     9 non-null      float64
 3   Purchased  10 non-null     object
dtypes: float64(2), object(2)
memory usage: 448.0+ bytes
```

df.Country.mode()

	Country
0	France

df.Country.mode()[0]

type(df.Country.mode())

df.Country.fillna(df.Country.mode()[0],inplace=True)

df.Age.fillna(df.Age.median(),inplace=True)

df.Salary.fillna(round(df.Salary.mean()),inplace=True)

df

	Country	Age	Salary	Purchased
0	France	44.0	72000.0	No
1	Spain	27.0	48000.0	Yes
2	Germany	30.0	54000.0	No
3	Spain	38.0	61000.0	No
4	Germany	40.0	63778.0	Yes
5	France	35.0	58000.0	Yes
6	Spain	38.0	52000.0	No
7	France	48.0	79000.0	Yes
8	France	50.0	83000.0	No

pd.get_dummies(df.Country)

updated_dataset=pd.concat([pd.get_dummies(df.Country),df.iloc[:,[1,2,3]]],axis=1)

France Germany Spain Age Salary Purchased

0 True False False 44.0 72000.0 No

1 False False True 27.0 48000.0 Yes

2 False True False 30.0 54000.0 No

3 False False True 38.0 61000.0 No

4 False True False 40.0 63778.0 Yes

5 True False False 35.0 58000.0 Yes

6 False False True 38.0 52000.0 No

7 True False False 48.0 79000.0 Yes

8 True False False 50.0 83000.0 No

9 True False False 37 0 67000 0 Yes

df.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to 9
Data columns (total 4 columns):
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   Country    10 non-null     object
 1   Age        10 non-null     float64
 2   Salary     10 non-null     float64
 3   Purchased  10 non-null     object
dtypes: float64(2), object(2)
memory usage: 448.0+ bytes
```

```
updated_dataset.Purchased.replace(['No','Yes'],[0,1],inplace=True)
updated_dataset
```

	France	Germany	Spain	Age	Salary	Purchased
0	True	False	False	44.0	72000.0	0
1	False	False	True	27.0	48000.0	1
2	False	True	False	30.0	54000.0	0
3	False	False	True	38.0	61000.0	0
4	False	True	False	40.0	63778.0	1
5	True	False	False	35.0	58000.0	1
6	False	False	True	38.0	52000.0	0
7	True	False	False	48.0	79000.0	1
8	True	False	False	50.0	83000.0	0
9	True	False	False	37.0	67000.0	1

EDA-Quantitative and Qualitative plots - Experiments 1

#230701008

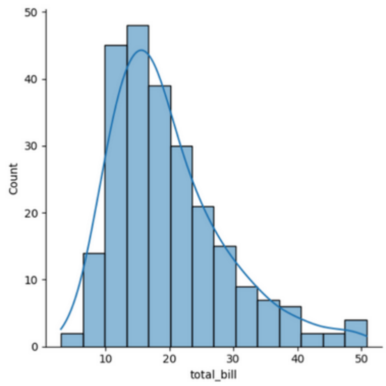
#ABIRAMI.K

03.09.2024

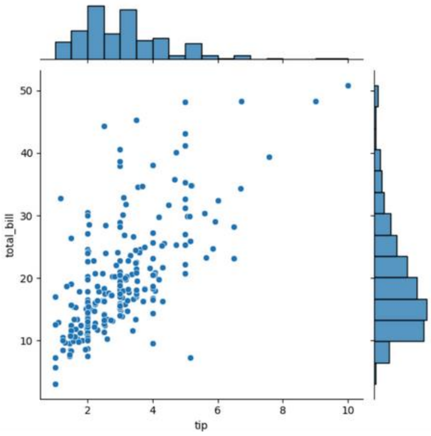
```
import seaborn as sns
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
tips=sns.load_dataset('tips')
tips.head()
```

	total_bill	tip	sex	smoker	day	time	size
0	16.99	1.01	Female	No	Sun	Dinner	2
1	10.34	1.66	Male	No	Sun	Dinner	3
2	21.01	3.50	Male	No	Sun	Dinner	3
3	23.68	3.31	Male	No	Sun	Dinner	2
4	24.59	3.61	Female	No	Sun	Dinner	4

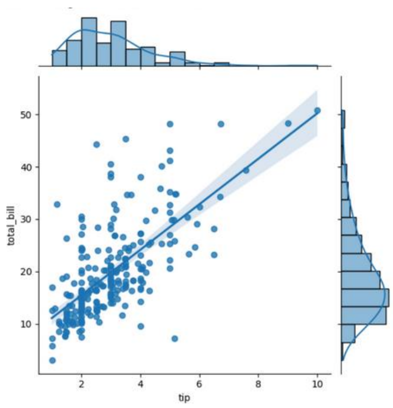
```
sns.displot(tips.total_bill,kde=True)
```



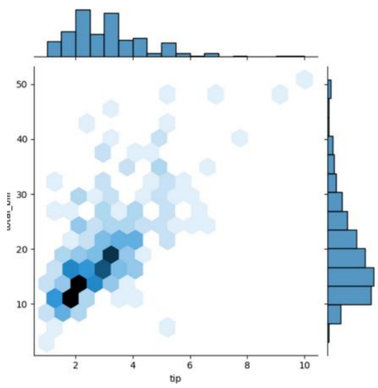

```
sns.jointplot(x=tips.tip,y=tips.total_bill)
```



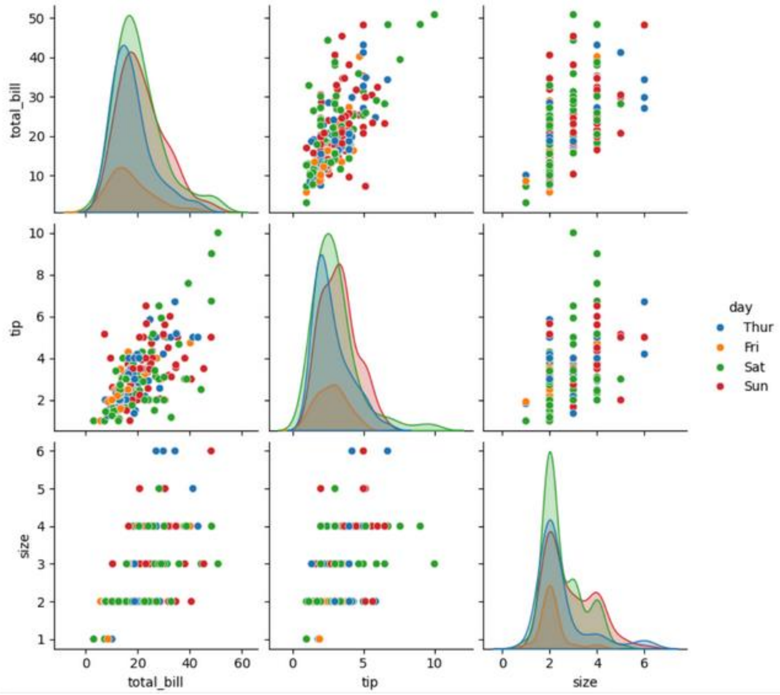
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="reg")



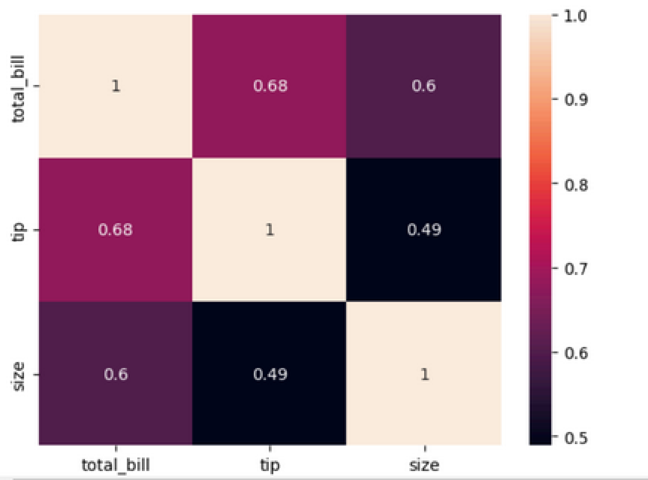
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="hex")



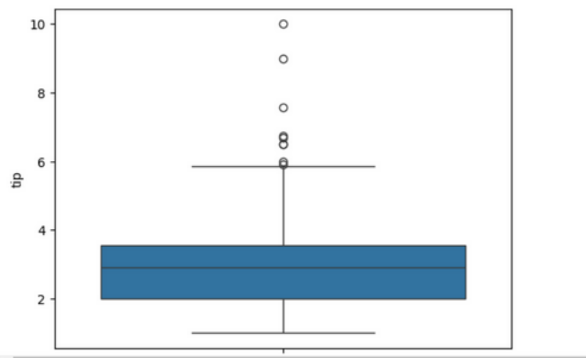
sns.pairplot(tips,hue='day')



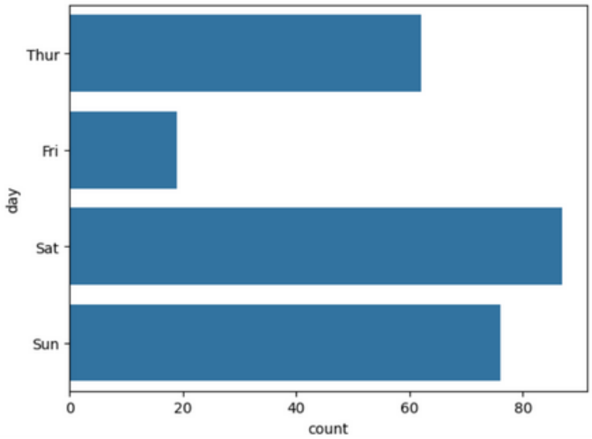
sns.heatmap(tips.corr(numeric_only=True),annot=True)



sns.boxplot(tips.tip)

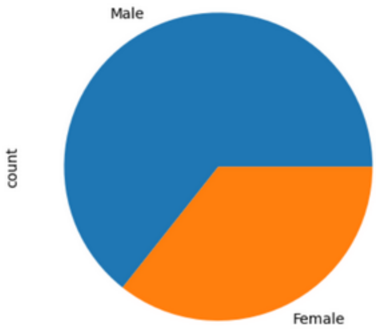


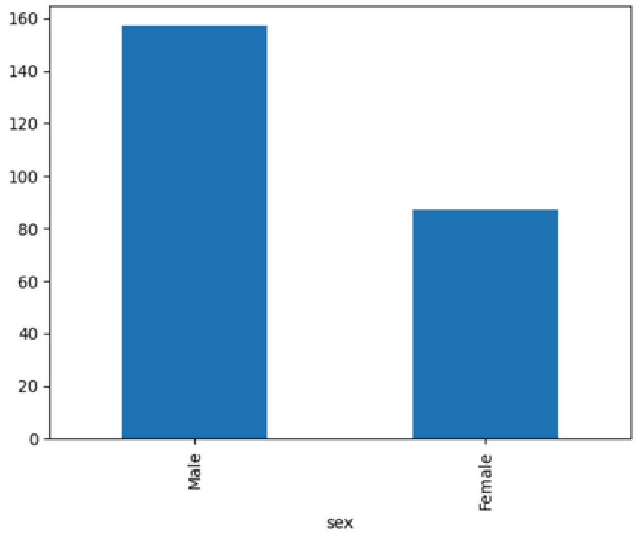
sns.countplot(tips.day)



tips.sex.value_counts().plot(kind='pie')

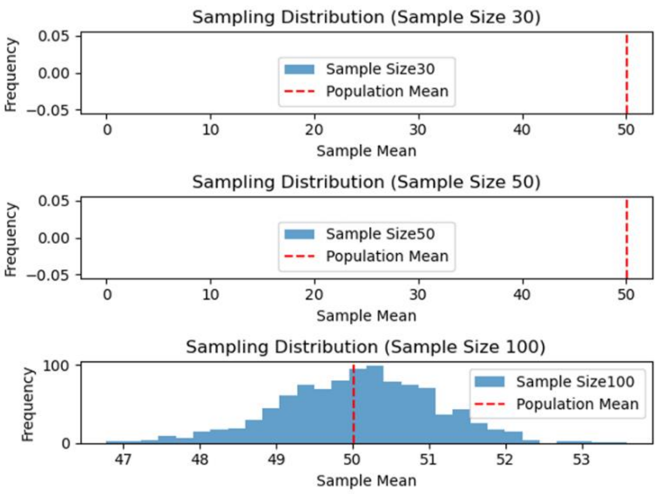
tips.sex.value_counts().plot(kind='bar')





```
#Random Sampling and Sampling Distribution
#230701008
#ABIRAMI.K
# 10.09.2024
import numpy as np
import matplotlib.pyplot as plt
population_mean = 50
population_std = 10
population_size = 100000
population = np.random.normal(population_mean, population_std, population_size)
plt.figure(figsize=(8, 5))
plt.hist(population, bins=50, color='skyblue', edgecolor='black', alpha=0.7)
plt.title('Population Distribution')
plt.xlabel('Value')
plt.ylabel('Frequency')
plt.axvline(population_mean, color='red', linestyle='dashed', linewidth=1.5, label='Population Mean')
plt.legend()
plt.show()
sample_sizes = [30, 50, 100]
num_samples = 1000
sample_means = {}
for size in sample_sizes:
sample_means[size] = []
for _ in range(num_samples):
sample = np.random.choice(population, size=size, replace=False)
sample_means[size].append(np.mean(sample))
plt.figure(figsize=(12, 8))
for i, size in enumerate(sample_sizes):
plt.subplot(len(sample_sizes), 1, i + 1)
plt.hist(sample_means[size], bins=30, alpha=0.7, color='orange', edgecolor='black',
label=f'Sample Size {size}')
```

```
plt.axvline(np.mean(population), color='red', linestyle='dashed', linewidth=1.5, label='Population Mean')

plt.title(f'Sampling Distribution of the Sample Mean (Sample Size {size})')

plt.xlabel('Sample Mean')

plt.ylabel('Frequency')

plt.legend()

plt.tight_layout()

plt.show()

plt.figure(figsize=(12, 8))

for i, size in enumerate(sample_sizes):

plt.subplot(len(sample_sizes), 1, i + 1)

plt.hist(sample_means[size], bins=30, alpha=0.7, color='purple', edgecolor='black',

label=f'Sample Size {size}', density=True)

plt.axvline(np.mean(population), color='red', linestyle='dashed', linewidth=1.5, label='Population Mean')

plt.title(f'Sampling Distribution (Sample Size {size}) - CLT Demonstration')

plt.xlabel('Sample Mean')

plt.ylabel('Density')

plt.legend()

plt.tight_layout()

plt.show()
```



```
# Z-Test
# 230701008
# ABIRAMI.K
# 10.09.2024

import numpy as np
import scipy.stats as stats
sample_data = np.array([
152, 148, 151, 149, 147, 153, 150, 148, 152, 149,
151, 150, 149, 152, 151, 148, 150, 152, 149, 150,
148, 153, 151, 150, 149, 152, 148, 151, 150, 153
])
population_mean = 150
sample_mean = np.mean(sample_data)
sample_std = np.std(sample_data, ddof=1)
n = len(sample_data)
z_statistic = (sample_mean - population_mean) / (sample_std / np.sqrt(n))
p_value = 2 * (1 - stats.norm.cdf(np.abs(z_statistic)))
print(f"Sample Mean: {sample_mean:.2f}")
print(f"Z-Statistic: {z_statistic:.4f}")
print(f"P-Value: {p_value:.4f}")
alpha = 0.05
if p_value < alpha:
print("Reject the null hypothesis: The average weight is significantly different from 150 grams.")
else:
print("Fail to reject the null hypothesis: There is no significant difference in average weight from 150 grams.")
```

Sample Mean: 150.20

Z-Statistic: 0.6406

P-Value: 0.5218

Fail to reject the null hypothesis: There is no significant difference in average weight from 150 grams.

```
# T-Test

# 230701008

# ABIRAMI.K

# 08.10.2024

import numpy as np
import scipy.stats as stats
np.random.seed(42)
sample_size = 25
sample_data = np.random.normal(loc=102, scale=15, size=sample_size)
population_mean = 100
sample_mean = np.mean(sample_data)
sample_std = np.std(sample_data, ddof=1)
n = len(sample_data)
t_statistic, p_value = stats.ttest_1samp(sample_data, population_mean)
print(f"Sample Mean: {sample_mean:.2f}")
print(f"T-Statistic: {t_statistic:.4f}")
print(f"P-Value: {p_value:.4f}")
alpha = 0.05
if p_value < alpha:
print("Reject the null hypothesis: The average IQ score is significantly different from 100.")
else:
print("Fail to reject the null hypothesis: There is no significant difference in average IQ score from 100."
```

quot;Sample Mean: 99.55

T-Statistic:-0.1577

P-Value: 0.8760

Fail to reject the null hypothesis: There is no significant difference in average of IQ Score from 100.

```
# Anova TEST
# 230701008
# ABIRAMI.K
# 08.10.2024

import numpy as np
import scipy.stats as stats
np.random.seed(42)
n_plants = 25
growth_A = np.random.normal(loc=10, scale=2, size=n_plants)
growth_B = np.random.normal(loc=12, scale=3, size=n_plants)
growth_C = np.random.normal(loc=15, scale=2.5, size=n_plants)
f_statistic, p_value = stats.f_oneway(growth_A, growth_B, growth_C)
print("Treatment A Mean Growth:", np.mean(growth_A))
print("Treatment B Mean Growth:", np.mean(growth_B))
print("Treatment C Mean Growth:", np.mean(growth_C))
print()
print(f"F-Statistic: {f_statistic:.4f}")
print(f"P-Value: {p_value:.4f}")
alpha = 0.05
if p_value < alpha:
print("Reject the null hypothesis: There is a significant difference in mean growth rates among the
three
treatments.")
else:
print("Fail to reject the null hypothesis: There is no significant difference in mean growth rates
among the
three treatments.")
if p_value < alpha:
all_data = np.concatenate([growth_A, growth_B, growth_C])
treatment_labels = ['A'] * n_plants + ['B'] * n_plants + ['C'] * n_plants
tukey_results = pairwise_tukeyhsd(all_data, treatment_labels, alpha=0.05)
print("\nTukey's HSD Post-hoc Test:")
print(tukey_results)
```

Treatment A Mean Growth:", np.mean(growth_A)

Treatment B Mean Growth:", np.mean(growth_B)

Treatment C Mean Growth:", np.mean(growth_C)

F-Statistic: 36.1214

P-Value: 0.0000

Reject the null hypothesis: There is a significant difference in mean growth rates among the three treatments.

Tukey's HSD Post-hoc Test:

Multiple Comparison of Means- Tukey HSD, FWER=0.05

```
=====================================================
group1 group2 meandiff   p-adj    lower    upper   reject
-----------------------------------------------------------------------------------
A         B          1.4647      0.0877  -0.1683  3.0977  False
A         C          5.5923      0.0        3.9593   7.2252  True
B         C          4.1276      0.0        2.4946   5.7605   True
-----------------------------------------------------------------------------------
```

```
# Feature Scaling
# 230701008
# ABIRAMI.K
# 22.10.2024

import numpy as np
import pandas as pd
df = pd.read_csv('/content/pre-process_datasample.csv')
print("Original Data:")
print(df)
df['Country'].fillna(df['Country'].mode()[0], inplace=True)
features = df.iloc[:, :-1].values
label = df.iloc[:, -1].values
from sklearn.impute import SimpleImputer
age_imputer = SimpleImputer(strategy="mean")
salary_imputer = SimpleImputer(strategy="mean")
age_imputer.fit(features[:, [1]])
salary_imputer.fit(features[:, [2]])
features[:, [1]] = age_imputer.transform(features[:, [1]])
features[:, [2]] = salary_imputer.transform(features[:, [2]])
print("Features after handling missing values:")
print(features)
from sklearn.preprocessing import OneHotEncoder
oh = OneHotEncoder(sparse_output=False)
Country = oh.fit_transform(features[:, [0]])
print("OneHotEncoded 'Country' column:")
print(Country)
final_set = np.concatenate((Country, features[:, [1, 2]]), axis=1)
print("Final dataset with OneHotEncoded 'Country' and other features:")
print(final_set)
from sklearn.preprocessing import StandardScaler
```

```
sc = StandardScaler()
sc.fit(final_set)
feat_standard_scaler = sc.transform(final_set)
print("Standardized features:")
print(feat_standard_scaler)
from sklearn.preprocessing import MinMaxScaler
mms = MinMaxScaler(feature_range=(0, 1))
mms.fit(final_set)
feat_minmax_scaler = mms.transform(final_set)
print("Normalized features:")
print(feat_minmax_scaler)
```

	Country	Age	Salary	Purchased
0	France	44.0	72000.0	No
1	Spain	27.0	48000.0	Yes
2	Germany	30.0	54000.0	No
3	Spain	38.0	61000.0	No
4	Germany	40.0	NaN	Yes
5	France	35.0	58000.0	Yes
6	Spain	NaN	52000.0	No
7	France	48.0	79000.0	Yes
8	NaN	50.0	83000.0	No
9	France	37.0	67000.0	Yes

```
array([['France', 44.0, 72000.0],
 ['Spain', 27.0, 48000.0],
 ['Germany', 30.0, 54000.0],
 ['Spain', 38.0, 61000.0],
 ['Germany', 40.0, 63777.77777777778],
 ['France', 35.0, 58000.0],
 ['Spain', 38.77777777777778, 52000.0],
 ['France', 48.0, 79000.0],
 ['France', 50.0, 83000.0],
 ['France', 37.0, 67000.0]], dtype=object)
```

```
array([[1., 0., 0.],
 [0., 0., 1.],
 [0., 1., 0.],
 [0., 0., 1.],
 [0., 1., 0.],
 [1., 0., 0.],
 [0., 0., 1.],
 [1., 0., 0.],
```

```
array([[1.0, 0.0, 0.0, 44.0, 72000.0],
 [0.0, 0.0, 1.0, 27.0, 48000.0],
 [0.0, 1.0, 0.0, 30.0, 54000.0],
 [0.0, 0.0, 1.0, 38.0, 61000.0],
 [0.0, 1.0, 0.0, 40.0, 63777.77777777778],
 [1.0, 0.0, 0.0, 35.0, 58000.0],
 [0.0, 0.0, 1.0, 38.77777777777778, 52000.0],
 [1.0, 0.0, 0.0, 48.0, 79000.0],
 [1.0, 0.0, 0.0, 50.0, 83000.0],
 [1.0, 0.0, 0.0, 37.0, 67000.0]], dtype=object)
```

```
array([[ 1.00000000e+00, -5.00000000e-01, -6.54653671e-01,
 7.58874362e-01, 7.49473254e-01],
 [-1.00000000e+00, -5.00000000e-01, 1.52752523e+00,
 -1.71150388e+00, -1.43817841e+00],
 [-1.00000000e+00, 2.00000000e+00, -6.54653671e-01,
 -1.27555478e+00, -8.91265492e-01],
 [-1.00000000e+00, -5.00000000e-01, 1.52752523e+00,
 -1.13023841e-01, -2.53200424e-01],
 [-1.00000000e+00, 2.00000000e+00, -6.54653671e-01,
 1.77608893e-01, 6.63219199e-16],
 [ 1.00000000e+00, -5.00000000e-01, -6.54653671e-01,
 -5.48972942e-01, -5.26656882e-01],
 [-1.00000000e+00, -5.00000000e-01, 1.52752523e+00,
 0.00000000e+00, -1.07356980e+00],
 [ 1.00000000e+00, -5.00000000e-01, -6.54653671e-01,
 1.34013983e+00, 1.38753832e+00],
 [ 1.00000000e+00, -5.00000000e-01, -6.54653671e-01,
 1.63077256e+00, 1.75214693e+00],
 [ 1.00000000e+00, -5.00000000e-01, -6.54653671e-01,
 -2.58340208e-01, 2.93712492e-01]])
```

```
array([[1. , 0. , 0. , 0.73913043, 0.68571429],
 [0. , 0. , 1. , 0. , 0. ],
 [0. , 1. , 0. , 0.13043478, 0.17142857],
 [0. , 0. , 1. , 0.47826087, 0.37142857],
 [0. , 1. , 0. , 0.56521739, 0.45079365],
 [1. , 0. , 0. , 0.34782609, 0.28571429],
 [0. , 0. , 1. , 0.51207729, 0.11428571],
 [1. , 0. , 0. , 0.91304348, 0.88571429],
 [1. , 0. , 0. , 1. , 1. ],
 [1. , 0. , 0. , 0.43478261, 0.54285714]])
```

```
# Linear Regression

# 230701008

# ABIRAMI.K

# 29.10.2024


import numpy as np

import pandas as pd

df=pd.read_csv('Salary_data.csv')

df

df.info()

df.dropna(inplace=True)

df.info()

df.describe()
```

YearsExperience **Salary** **count** 30.000000

30.000000 **mean** 5.313333 76003.000000 **std** 2.837888

27414.429785

min 1.100000 37731.000000

25% 3.200000 56720.750000

50% 4.700000 65237.000000

75% 7.700000 100544.750000

max 10.500000 122391.000000

```
features=df.iloc[:,[0]].values

label=df.iloc[:,[1]].values

from sklearn.model_selection import train_test_split

x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0.2,random_state=23)

from sklearn.linear_model import LinearRegression

model=LinearRegression()

model.fit(x_train,y_train)

model.score(x_train,y_train)
```

```
model.score(x_test,y_test)

model.coef_

model.intercept_

import pickle

pickle.dump(model,open('SalaryPred.model','wb'))

model=pickle.load(open('SalaryPred.model','rb'))

yr_of_exp=float(input("Enter Years of Experience: "))

yr_of_exp_NP=np.array([[yr_of_exp]])

Salary=model.predict(yr_of_exp_NP)

print("Estimated Salary for {} years of experience is {}: " .format(yr_of_exp,Salary)
```

Logistic Regression

230701008

#ABIRAMI.K

05.11.2024

```
import numpy as np
import pandas as pd
df=pd.read_csv('Social_Network_Ads.csv')
df
```

User ID Gender Age EstimatedSalary Purchased 0 15624510

Male 19 19000 0 1 15810944 Male 35 20000 0 2 15668575

Female 26 43000 0 3 15603246 Female 27 57000 0 4 15804002

Male 19 76000 0 ... ...

395 15691863 Female 46 41000 1 396 15706071 Male 51 23000

1 397 15654296 Female 50 20000 1 398 15755018 Male 36

33000 0 399 15594041 Female 49 36000 1

400 rows × 5 columns

```
df.head()
```

	User ID	Gender	Age	EstimatedSalary	Purchased
0	15624510	Male	19	19000	0
1	15810944	Male	35	20000	0
2	15668575	Female	26	43000	0
3	15603246	Female	27	57000	0
4	15804002	Male	19	76000	0

```
features=df.iloc[:,[2,3]].values
```

label=df.iloc[:,4].values

features

label

```
array([0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1,
  1, 1, 1, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,  0,
  0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,  0, 0,
  0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,  0, 0, 0,
  0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,  0, 0, 0, 0,
  0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,  0, 0, 0, 0, 0,
  1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,  0, 0, 0, 0, 0, 1,
  1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,  0, 0, 0, 0, 0, 0, 1,
  0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,  0, 0, 0, 0, 1, 0, 1, 0,
  1, 0, 1, 0, 1, 1, 0, 0, 0, 1, 0, 0, 0, 1,  0, 1, 1, 1, 0, 0, 1, 1, 0,
  1, 1, 0, 1, 1, 0, 1, 0, 0, 0, 1, 1, 0,  1, 1, 0, 1, 0, 1, 0, 1, 0, 0,
  1, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 0,  1, 1, 0, 0, 1, 0, 0, 1, 1, 1, 1,
  1, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1,  0, 1, 0, 1, 1, 1, 1, 0, 0, 0, 1, 1,
  0, 1, 1, 1, 1, 1, 0, 0, 0, 1,  1, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 0, 1,
  1, 0, 1, 1, 0, 0, 0, 1, 1,  0, 1, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0, 0, 1,
  1, 0, 1, 1, 0, 0, 1, 0,  1, 0, 1, 1, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 1,
  1, 0, 1, 1, 1, 0, 1,  0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1,
  1, 1, 1, 1, 0, 1,  1, 1, 0, 1], dtype=int64)
```

from sklearn.model_selection import train_test_split

from sklearn.linear_model import LogisticRegression

for i in range(1,401):

x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0.2,random_state=i)

model=LogisticRegression()

model.fit(x_train,y_train)

train_score=model.score(x_train,y_train)

test_score=model.score(x_test,y_test)

if test_score>train_score:

print("Test {} Train{} Random State {}".format(test_score,train_score,i)

x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0.2,random_state=314)

finalModel=LogisticRegression()

finalModel.fit(x_train,y_train)

print(finalModel.score(x_train,y_train))

print(finalModel.score(x_test,y_test))

from sklearn.metrics import classification_report

print(classification_report(label,finalModel.predict(features)))

K-MEANS CLUSTERING

230701008

#ABIRAMI.K

05.11.2024

import numpy as np

import pandas as pd

import matplotlib.pyplot as plt

import seaborn as sns

%matplotlib inline

df=pd.read_csv('Mall_Customers.csv')

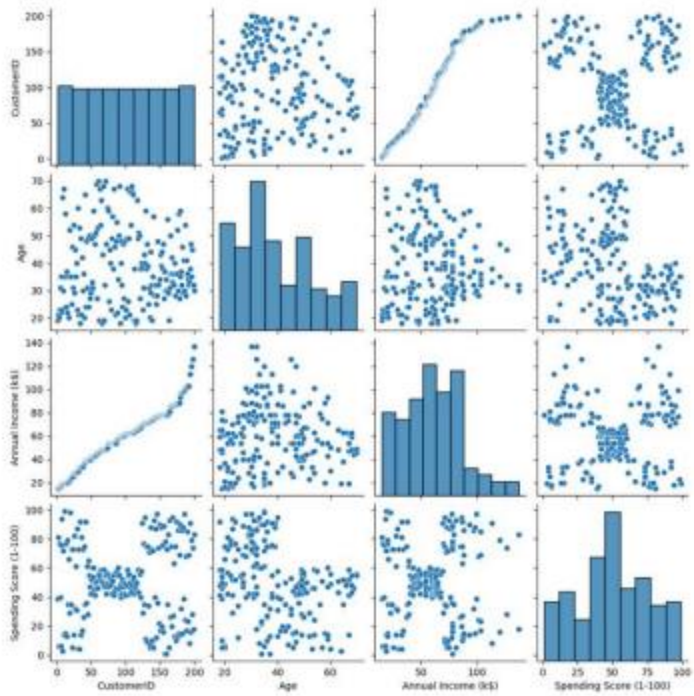
df.info()

```
<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
```

df.head()

	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

sns.pairplot(df)



features=df.iloc[:,[3,4]].values

from sklearn.cluster import KMeans

model=KMeans(n_clusters=5)

model.fit(features)

KMeans(n_clusters=5)

```
KMeans(n_clusters=5)
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

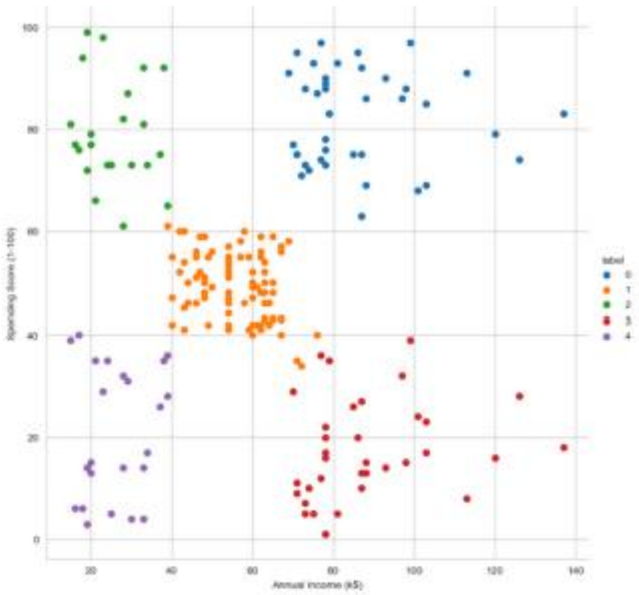
Final=df.iloc[:,[3,4]]

Final['label']=model.predict(features)

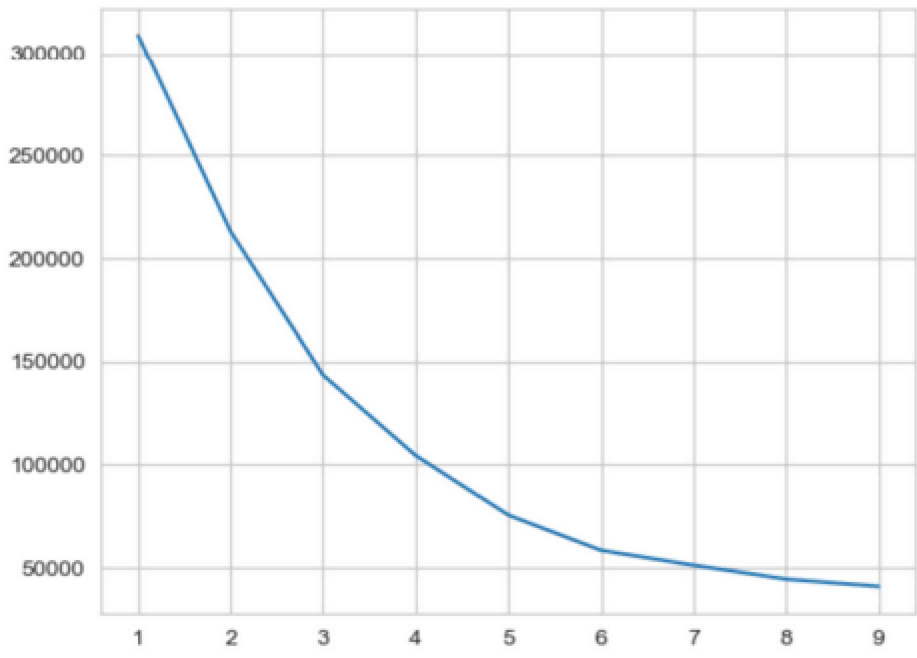
Final.head()

	Annual Income (k$)	Spending Score (1-100)	label
0	15	39	4
1	15	81	2
2	16	6	4
3	16	77	2
4	17	40	4

```
sns.set_style("whitegrid")
sns.FacetGrid(Final,hue="label",height=8) \
.map(plt.scatter,"Annual Income (k$)", "Spending Score (1-100)") \
.add_legend();
plt.show()
```



```
features_el=df.iloc[:,[2,3,4]].values
from sklearn.cluster import KMeans
wcss=[]
for i in range(1,10):
model=KMeans(n_clusters=i)
model.fit(features_el)
wcss.append(model.inertia_)
plt.plot(range(1,10),wcss)
```



300000
250000
200000
150000
100000
50000
1
2
3
4
5
6
7
8
9