CS-23334 FUNDAMENTALS OF DATA SCIENCE

ABENANTHAN P 240701005

EXPERIMENT 3

3.A Handling Missing Data In a Dataset

Aim:

To demonstrate an experiment to handle missing data and inappropriate data using pandas

Algorithm:

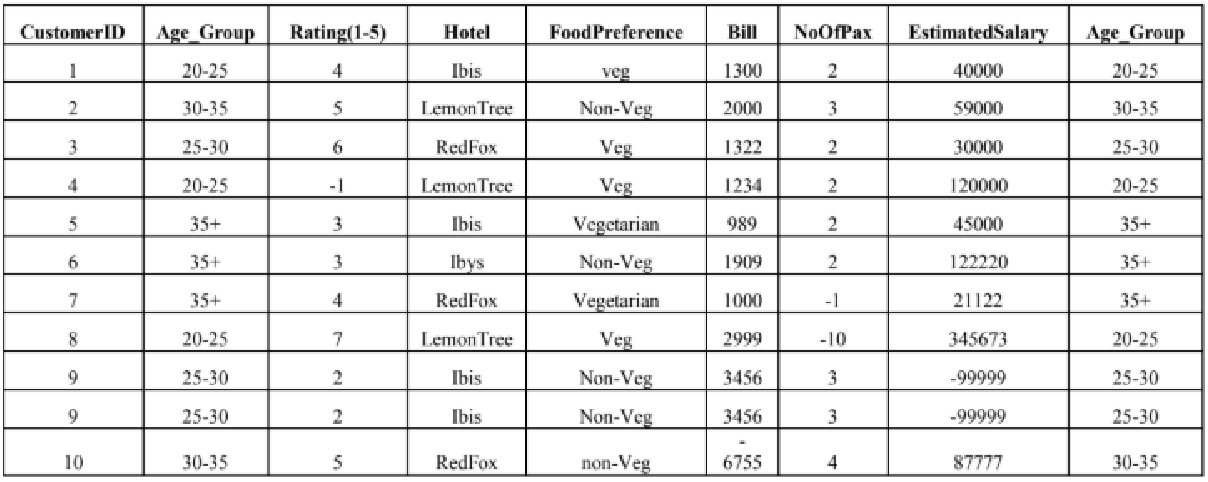
Step 1: Identify Missing Data

Step 2: Quantify and Visualize Missingness

Step 3: Decide on a Strategy (Drop, Impute, Flag)

Step 4: Apply the Chosen Method and Validate

Given Dataset:



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

About Dataset:

No.of Columns =9 (called as series – Customer ID, Age Group, Rating(1-5),Hotel, Food Preference, Bill, No Of Pax, Estimated Salary)

CutomerID: Numerical Continuous data

Age: Categorical Data

Rating (1-5): Numerical Discrete Data

Hotel: Categorical Data

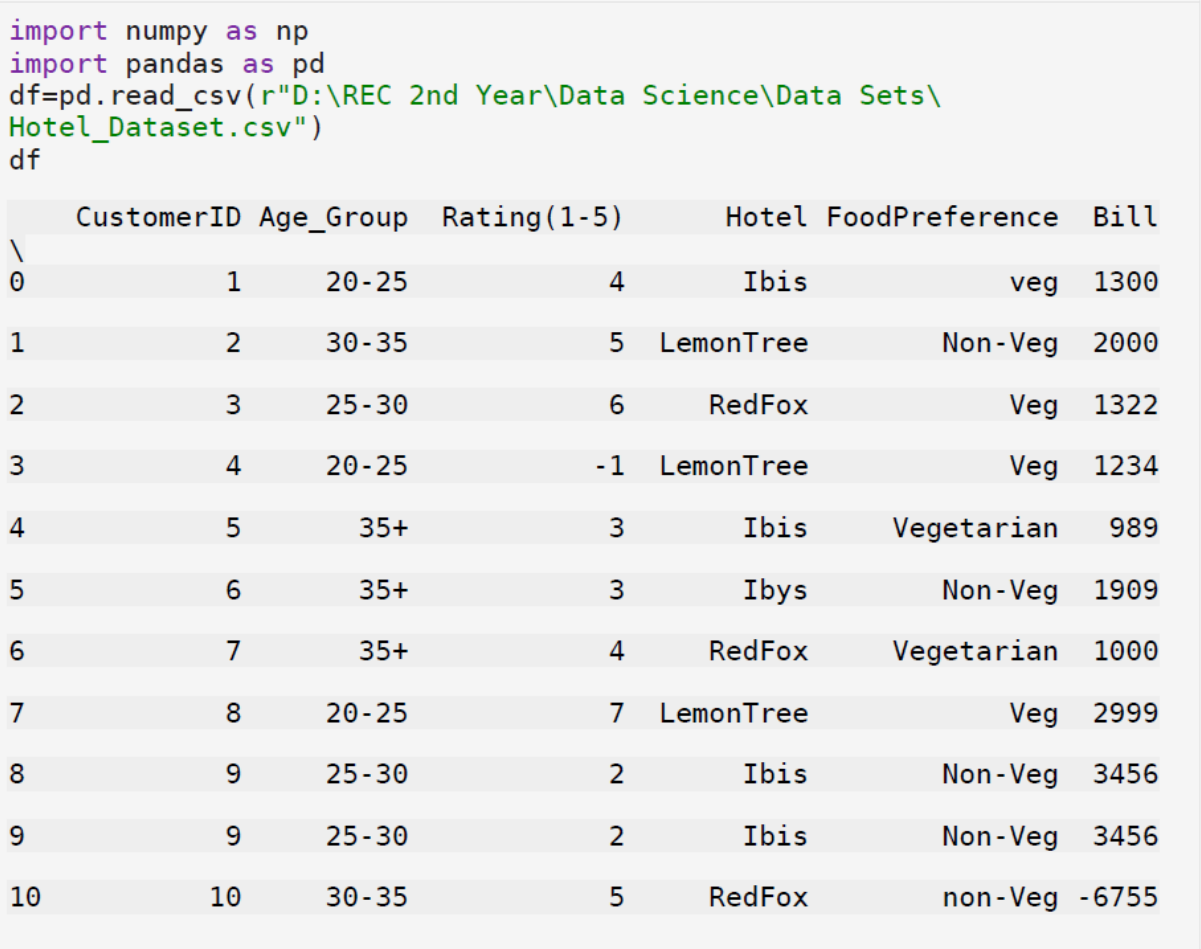
Food: Categorical Data

Bill: Numerical Continuous data

NoOfPax: Numerical Discrete

EstimatedSalary: Numerical Continuous data

Code with Output:



```
import numpy as np
import pandas as pd
df=pd.read_csv(r"D:\REC 2nd Year\Data Science\Data Sets\
Hotel_Dataset.csv")
df
```

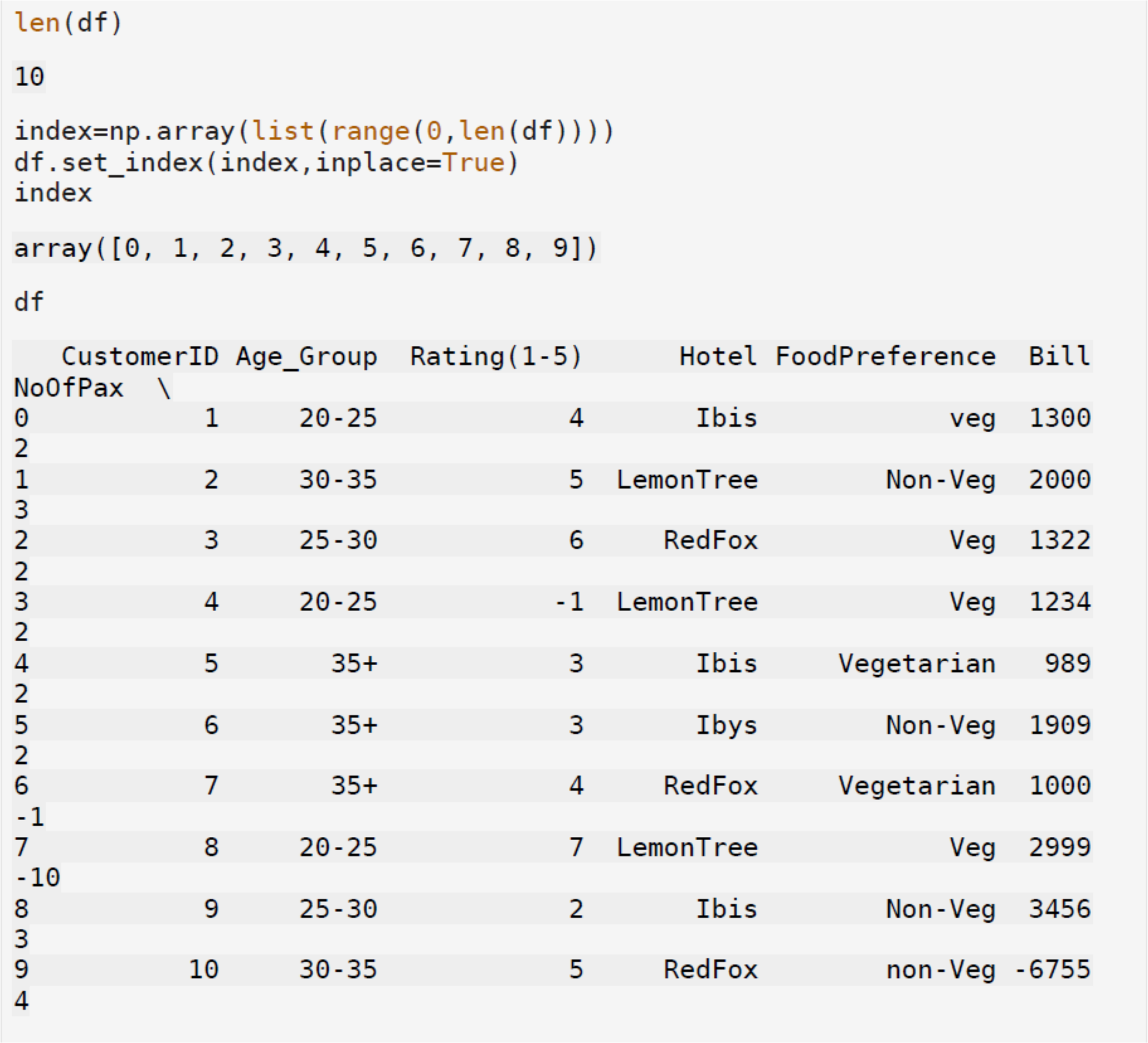
```
    CustomerID Age_Group  Rating(1-5)      Hotel FoodPreference  Bill
\
0            1     20-25            4       Ibis            veg  1300

1            2     30-35            5  LemonTree        Non-Veg  2000

2            3     25-30            6     RedFox            Veg  1322

3            4     20-25           -1  LemonTree            Veg  1234

4            5       35+            3       Ibis     Vegetarian   989

5            6       35+            3       Ibys        Non-Veg  1909

6            7       35+            4     RedFox     Vegetarian  1000

7            8     20-25            7  LemonTree            Veg  2999

8            9     25-30            2       Ibis        Non-Veg  3456

9            9     25-30            2       Ibis        Non-Veg  3456

10          10     30-35            5     RedFox        non-Veg -6755
```

```
df.duplicated()

0     False
1     False
2     False
3     False
4     False
```

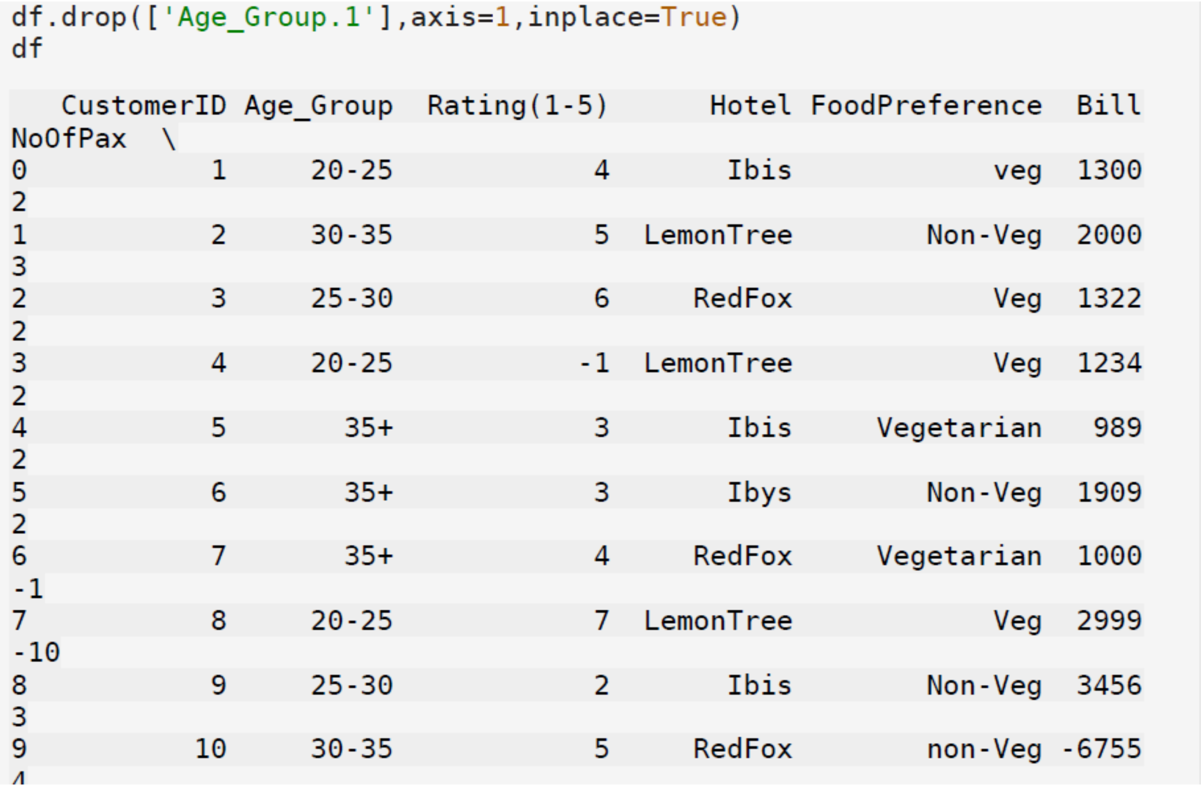
```
5     False
6     False
7     False
8     False
9      True
10    False
dtype: bool
```

```
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
\
0            1     20-25            4       Ibis            veg  1300

1            2     30-35            5  LemonTree        Non-Veg  2000

2            3     25-30            6     RedFox            Veg  1322

3            4     20-25           -1  LemonTree            Veg  1234

4            5       35+            3       Ibis     Vegetarian   989

5            6       35+            3       Ibys        Non-Veg  1909

6            7       35+            4     RedFox     Vegetarian  1000

7            8     20-25            7  LemonTree            Veg  2999

8            9     25-30            2       Ibis        Non-Veg  3456

10          10     30-35            5     RedFox        non-Veg -6755
```



```
len(df)

10

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  \
0           1     20-25            4       Ibis             veg  1300
2
1           2     30-35            5  LemonTree         Non-Veg  2000
3
2           3     25-30            6     RedFox             Veg  1322
2
3           4     20-25           -1  LemonTree             Veg  1234
2
4           5       35+            3       Ibis      Vegetarian   989
2
5           6       35+            3       Ibys         Non-Veg  1909
2
6           7       35+            4     RedFox      Vegetarian  1000
-1
7           8     20-25            7  LemonTree             Veg  2999
-10
8           9     25-30            2       Ibis         Non-Veg  3456
3
9          10     30-35            5     RedFox         non-Veg -6755
4
```



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

   CustomerID Age_Group  Rating(1-5)      Hotel  FoodPreference  Bill
NoOfPax  \
0           1     20-25            4       Ibis             veg  1300
2
1           2     30-35            5  LemonTree         Non-Veg  2000
3
2           3     25-30            6     RedFox             Veg  1322
2
3           4     20-25           -1  LemonTree             Veg  1234
2
4           5       35+            3       Ibis      Vegetarian   989
2
5           6       35+            3       Ibys         Non-Veg  1909
2
6           7       35+            4     RedFox      Vegetarian  1000
-1
7           8     20-25            7  LemonTree             Veg  2999
-10
8           9     25-30            2       Ibis         Non-Veg  3456
3
9          10     30-35            5     RedFox         non-Veg -6755
4
```

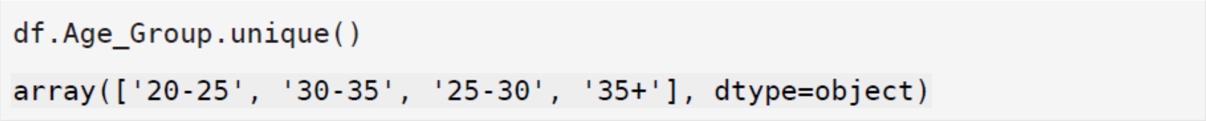
```
df.CustomerID.loc[df.CustomerID<0]=np.nan
df.Bill.loc[df.Bill<0]=np.nan
```

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

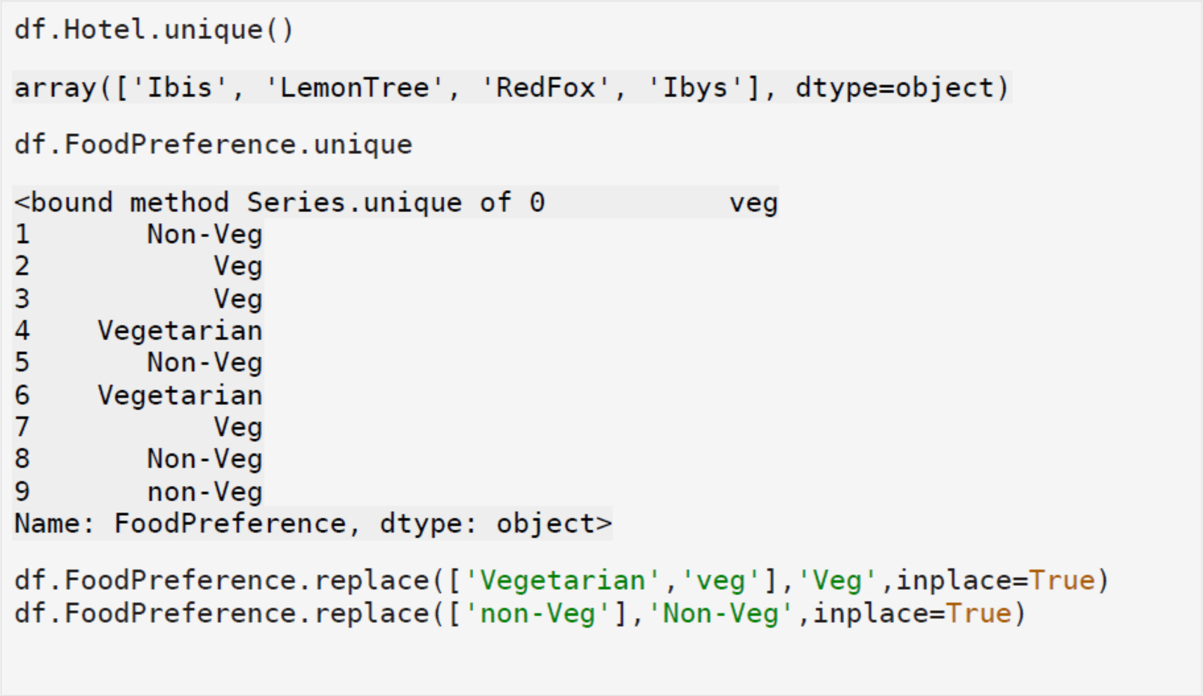
```
   CustomerID Age_Group  Rating(1-5)      Hotel FoodPreference    Bill  \
0         1.0     20-25            4       Ibis            veg  1300.0   
1         2.0     30-35            5  LemonTree        Non-Veg  2000.0   
2         3.0     25-30            6     RedFox            Veg  1322.0   
3         4.0     20-25           -1  LemonTree            Veg  1234.0   
4         5.0       35+            3       Ibis     Vegetarian   989.0   
5         6.0       35+            3       Ibys        Non-Veg  1909.0   
6         7.0       35+            4     RedFox     Vegetarian  1000.0   
7         8.0     20-25            7  LemonTree            Veg  2999.0   
8         9.0     25-30            2       Ibis        Non-Veg  3456.0   
9        10.0     30-35            5     RedFox        non-Veg     NaN   
```

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

```
   CustomerID Age_Group  Rating(1-5)      Hotel FoodPreference    Bill  \
0         1.0     20-25            4       Ibis            veg  1300.0   
1         2.0     30-35            5  LemonTree        Non-Veg  2000.0   
2         3.0     25-30            6     RedFox            Veg  1322.0   
3         4.0     20-25           -1  LemonTree            Veg  1234.0   
4         5.0       35+            3       Ibis     Vegetarian   989.0   
5         6.0       35+            3       Ibys        Non-Veg  1909.0   
6         7.0       35+            4     RedFox     Vegetarian  1000.0   
7         8.0     20-25            7  LemonTree            Veg  2999.0   
8         9.0     25-30            2       Ibis        Non-Veg  3456.0   
9        10.0     30-35            5     RedFox        non-Veg     NaN   
```



```
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.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)
```

Result:

Thus the process of missing data values handling is carried out using pandas library in Python.

3.B Data Preprocessig In Data Science

Aim:

To understand the data preprocessing in Data Science and understand the importance of data preprocessing in data science.

Algorithm:

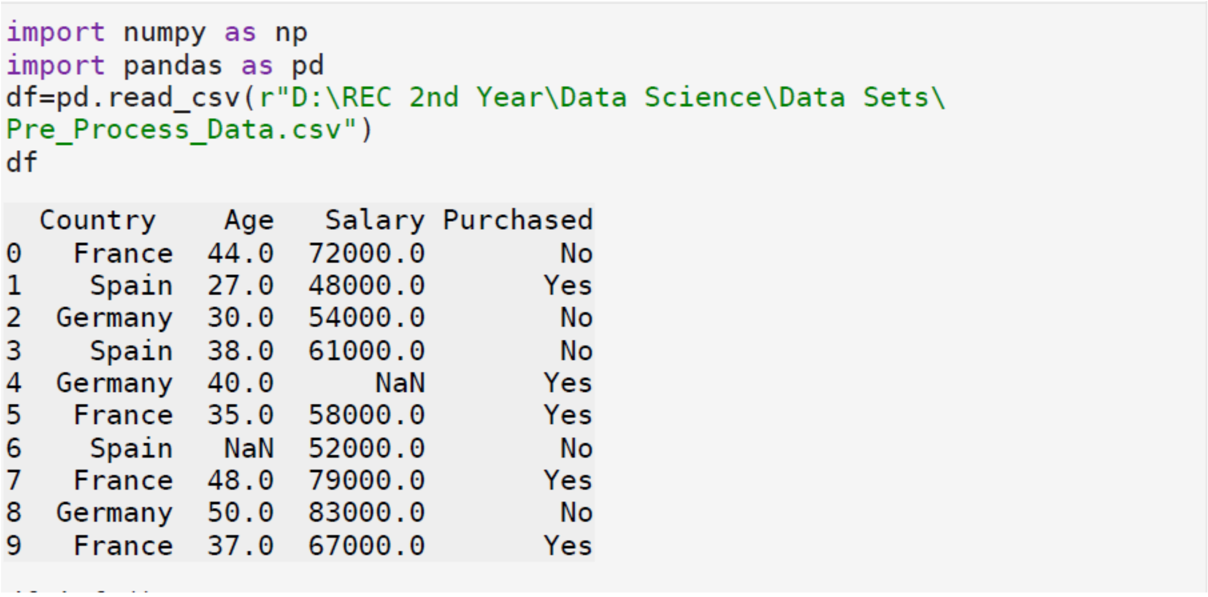
Step 1: Data Cleaning

Step 2: Data Transformation

Step 3: Feature Engineering

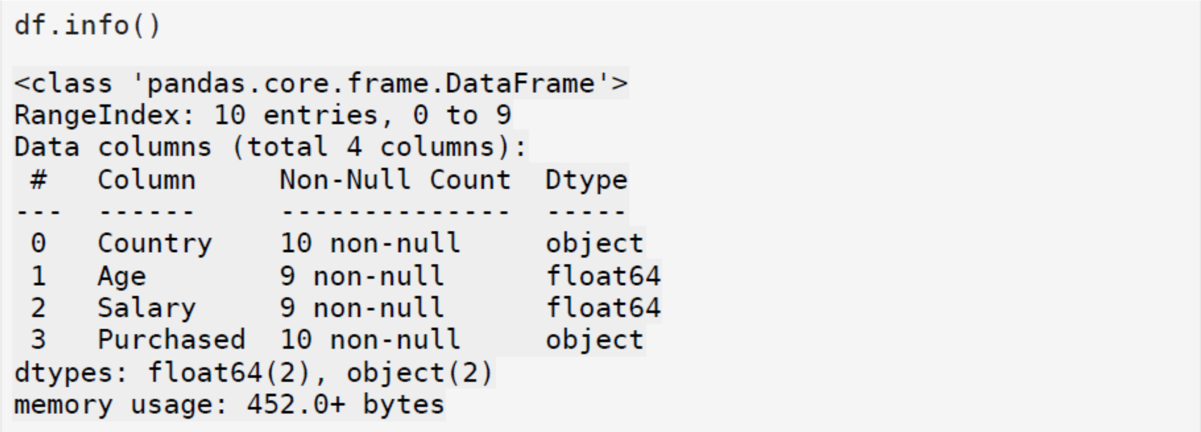
Step 4: Data Scaling and Encoding

Code With Output:

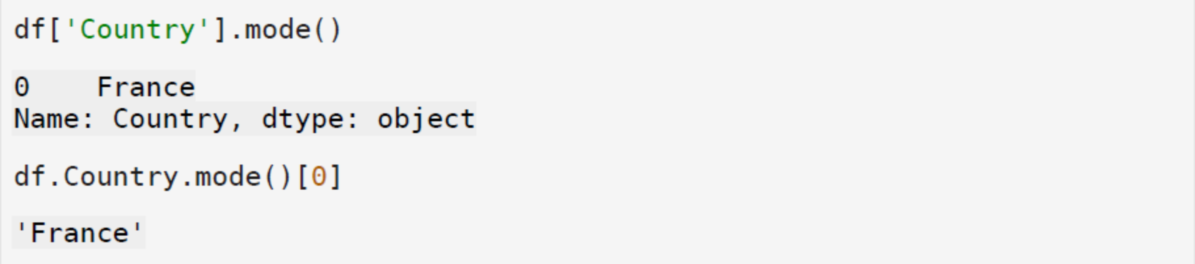


```
import numpy as np
import pandas as pd
df=pd.read_csv(r"D:\REC 2nd Year\Data Science\Data Sets\
Pre_Process_Data.csv")
df
```

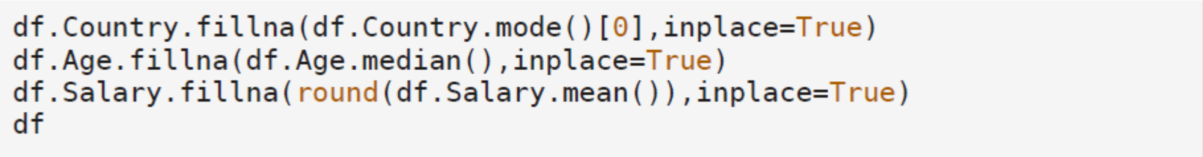
```
  Country   Age   Salary Purchased
0   France  44.0  72000.0        No
1    Spain  27.0  48000.0       Yes
2  Germany  30.0  54000.0        No
3    Spain  38.0  61000.0        No
4  Germany  40.0      NaN       Yes
5   France  35.0  58000.0       Yes
6    Spain   NaN  52000.0        No
7   France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



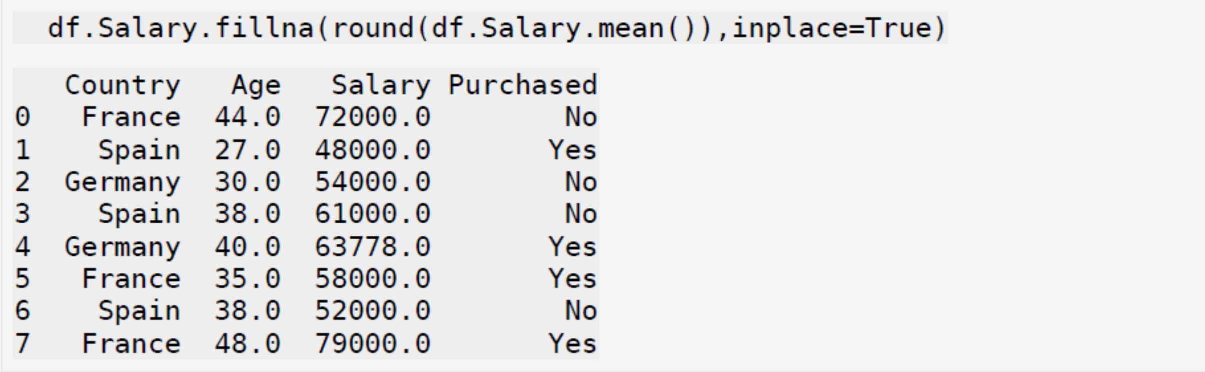
```
df.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to 9
Data columns (total 4 columns):
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   Country    10 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: 452.0+ bytes
```



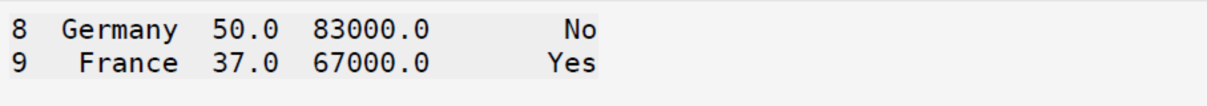
```
df['Country'].mode()

0    France
Name: Country, dtype: object

df.Country.mode()[0]

'France'
```



```
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
```



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

   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  Germany  50.0  83000.0        No
9   France  37.0  67000.0       Yes
```

```
pd.get_dummies(df.Country)

   France  Germany  Spain
0    True    False  False
1   False    False   True
2   False     True  False
3   False    False   True
4   False     True  False
5    True    False  False
6   False    False   True
7    True    False  False
8   False     True  False
9    True    False  False
```

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

   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   False     True  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: 452.0+ 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   False     True  False  50.0  83000.0          0
9    True    False  False  37.0  67000.0          1
```

3.C. Create And Save a CSV file Using Pandas

Aim:

To create a CSV File and save the file using Pandas Library in python

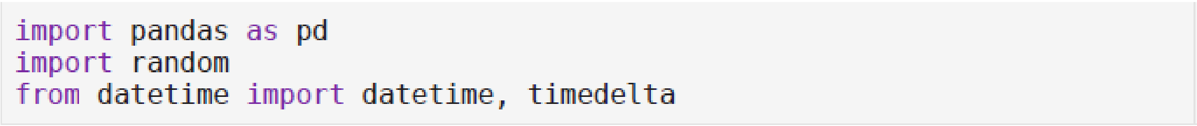
Algorithm:

1. Import Pandas
2. Prepare Data
3. Create a Dataframe
4. Save to CSV File

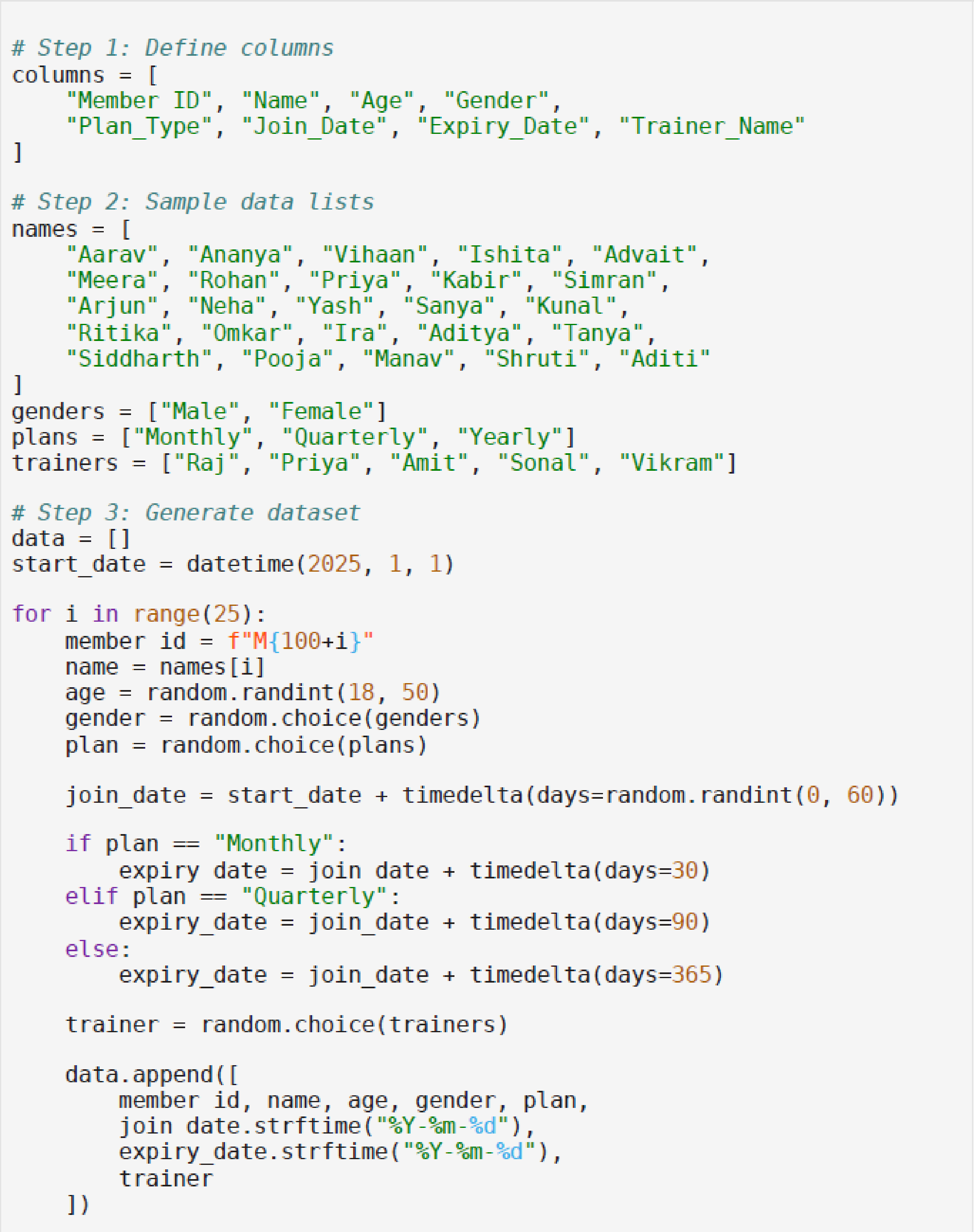
Description:

Follow Steps to create and save a file a CSV File using Pandas Library

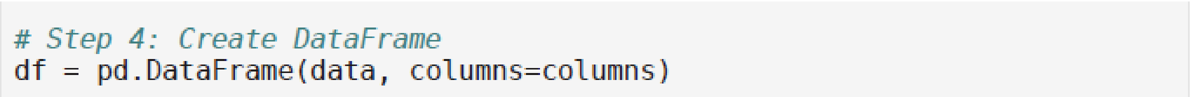
Code With Output:



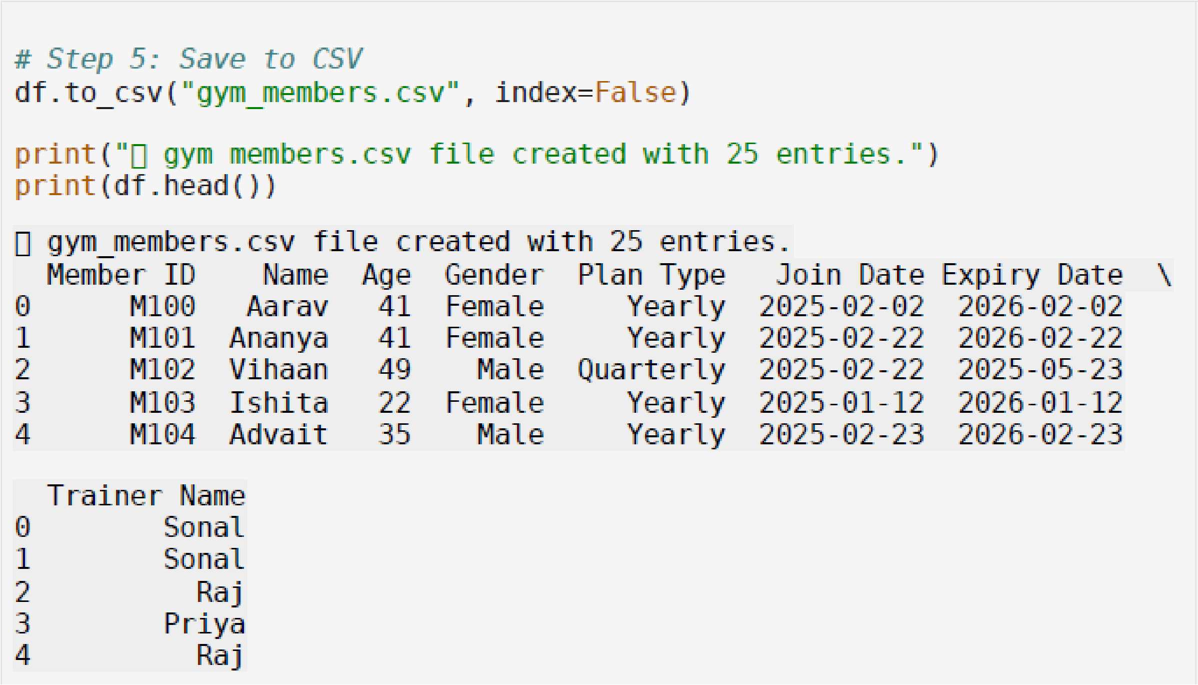
```
import pandas as pd
import random
from datetime import datetime, timedelta
```



```
# Step 1: Define columns
columns = [
    "Member_ID", "Name", "Age", "Gender",
    "Plan_Type", "Join_Date", "Expiry_Date", "Trainer_Name"
]

# Step 2: Sample data lists
names = [
    "Aarav", "Ananya", "Vihaan", "Ishita", "Advait",
    "Meera", "Rohan", "Priya", "Kabir", "Simran",
    "Arjun", "Neha", "Yash", "Sanya", "Kunal",
    "Ritika", "Omkar", "Ira", "Aditya", "Tanya",
    "Siddharth", "Pooja", "Manav", "Shruti", "Aditi"
]
genders = ["Male", "Female"]
plans = ["Monthly", "Quarterly", "Yearly"]
trainers = ["Raj", "Priya", "Amit", "Sonal", "Vikram"]

# Step 3: Generate dataset
data = []
start_date = datetime(2025, 1, 1)

for i in range(25):
    member_id = f"M{100+i}"
    name = names[i]
    age = random.randint(18, 50)
    gender = random.choice(genders)
    plan = random.choice(plans)

    join_date = start_date + timedelta(days=random.randint(0, 60))

    if plan == "Monthly":
        expiry_date = join_date + timedelta(days=30)
    elif plan == "Quarterly":
        expiry_date = join_date + timedelta(days=90)
    else:
        expiry_date = join_date + timedelta(days=365)

    trainer = random.choice(trainers)

    data.append([
        member_id, name, age, gender, plan,
        join_date.strftime("%Y-%m-%d"),
        expiry_date.strftime("%Y-%m-%d"),
        trainer
    ])
```



```
# Step 4: Create DataFrame
df = pd.DataFrame(data, columns=columns)
```



```
# Step 5: Save to CSV
df.to_csv("gym_members.csv", index=False)

print("□ gym members.csv file created with 25 entries.")
print(df.head())

□ gym_members.csv file created with 25 entries.
  Member ID     Name  Age  Gender  Plan Type   Join Date Expiry Date  \
0      M100    Aarav   41  Female     Yearly  2025-02-02  2026-02-02
1      M101   Ananya   41  Female     Yearly  2025-02-22  2026-02-22
2      M102   Vihaan   49    Male  Quarterly  2025-02-22  2025-05-23
3      M103   Ishita   22  Female     Yearly  2025-01-12  2026-01-12
4      M104   Advait   35    Male     Yearly  2025-02-23  2026-02-23

  Trainer Name
0        Sonal
1        Sonal
2          Raj
3        Priya
4          Raj
```

Result:

Thus a dataset is created in CSV format and saved using Pandas Library