What is Pandas ?

- Pandas is a Python library used for working with data sets.
- Tool source
- A fast and efficient Data-Frame object for data manipulation.
- It has functions for analyzing, cleaning, exploring, and manipulating data.
- Reading and writing data structures and different format: CSV (comma separated value), TSV (Tab separated value), txt, XML, JSON, ZIP etc.

Why use Pandas ?

- Pandas allows us to analyze big data and make conclusions based on statistical theories.
- Pandas can clean messy data sets, and make them readable and relevant.
- Relevant data is very important in data science.

What can Pandas Do ?

Pandas gives you answers about the data. Like:

- Is there a correlation between two or more columns ?
- What is average value ?
- Max value ?
- Min value ?

Pandas are also able to delete rows that are not relevant, or contains wrong values, like empty or NULL values. This is called cleaning the data.

Pandas VS NumPy

NumPy array is used for implementatin of pandas data objects.

Pandas getting started:

Import Pandas

Once Pandas is installed, import it in your applications by adding the import keyword:

In [1]:
```
import pandas
```

Now Pandas is imported and ready to use.

Pandas as pd

- Pandas is usually imported under the pd alias.
- In python alias are an alternate name for referring to the same thing.

Create an alias with the as keyword while importing:

In [2]:
```
import pandas as pd
```

Now the Pandas package can be referred to as pd instead of Pandas.

Checking Pandas version:

The version string is stored under __version__ attribute.

In [3]:
```
import pandas as pd
print(pd.__version__)
```

```
1.1.3
```

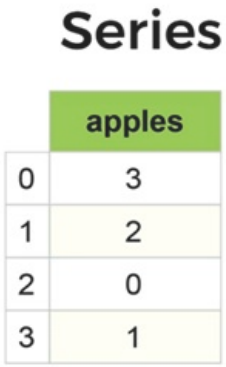
Pandas Data structures

Pandas can read and write three types of data Structured

- Series
- DataFrame
- Panel

Series:

- A pandas Series is like a column in a table.



Series

	apples
0	3
1	2
2	0
3	1

- It is a one-dimensional array holding data of any type.

Create Series

We can create a series in Pandas by using the Series() function

In [4]:
```
import pandas as pd
# Create a list
a = [1,7,2]

# Create a series
series_1 = pd.Series(a)

print(series_1)
```

```
0    1
1    7
2    2
dtype: int64
```

S is capital in series syntax

You can create the series **with different data types:**

In [5]:
```
import pandas as pd

# Create a list with different data types
list_s = [2,-3,6.3,'Mrunal']

series_2 = pd.Series(list_s)

print(series_2)
```

```
0         2
1        -3
2       6.3
3    Mrunal
```

```
dtype: object
```

Create a series by short Method:

In [6]:
```
import pandas as pd

series_3 = pd.Series(['apple','banana','Orange','Grapes'])
print(series_3)
```

```
0     apple
1    banana
2    Orange
3    Grapes
dtype: object
```

Create series by Dictionary:

In [7]:
```
import pandas as pd
dict_s = pd.Series({'Football':'Ronaldo','Cricket':'Virat Kohli','Tennis':'Novak. Djokovic'})
print(dict_s)
```

```
Football            Ronaldo
Cricket         Virat Kohli
Tennis      Novak. Djokovic
dtype: object
```

NOTE: If you want to find the syntax or parameter used in Series() function, just click in parenthesis of Series() function and click Shift + Tab

Labels/Index

If nothing else is specified, the values are labeled with their index number.First value has index 0, second value has index 1 etc. This label can be used to access a specified value.

In [8]:
```
import pandas as pd
a = [10,20,30]
series_3 = pd.Series(a)

#Access the first index and put into a variable index_number
index_number = series_3[0]
print(index_number)
```

```
10
```

Create Labels:

With the index arguments, you can name your own labels.
Index value should be equal to data value

In [9]:
```
import pandas as pd
list_s = [10,20,30,40]

series_4 = pd.Series(list_s, index = ['A','B','C','D'])
print(series_4)
```

```
A    10
B    20
C    30
D    40
dtype: int64
```

You can provide different types of Data types for index.

Access the values

To access the value use syntax:Series_name[Index value]

In [10]:
```
import pandas as pd
dict_s = pd.Series({'A':10,'B':20,'C':30,'D':40})

# Access the value.
value_1 = dict_s['B']
print(value_1)
```

```
20
```

Slicing

- Slicing is used when you want some part of the series.
- We pass slice instead of index like this: [start:end]
- We can also define the step, like this: [start:end:step]

.

In [11]:
```
import pandas as pd
series_5 = pd.Series([10,20,30,40,50])

# Slice the values from 0 to 3
print(series_5[0:4])
```

```
0    10
1    20
2    30
3    40
dtype: int64
```

To change the Data type

To change the data type use dtype function.

In [12]:
```
import pandas as pd
series_6 = pd.Series([10,20,30,40],index = ['A','B','C','D'], dtype = float)
print(series_6)
```

```
A    10.0
B    20.0
C    30.0
D    40.0
dtype: float64
```

Column Name

With the help of name parameter we can give the name to the column.

In [13]:
```
import pandas as pd
series_6 = pd.Series([10,20,30,40],index = ['A','B','C','D'], dtype = float, name = 'data values')
print(series_6)
```

```
A    10.0
B    20.0
C    30.0
D    40.0
Name: data values, dtype: float64
```

Arithmetic Operations

Adding the two series with equal data.

In [14]:
```
# Create two series
```

```
series_1 =pd.Series([10,20,30,40])
series_2 =pd.Series([1,2,3,4])

# add both the series
add_series = series_1 + series_2

print(add_series)
```

```
0    11
1    22
2    33
3    44
dtype: int64
```

Like this you can perform different types of operation also like devision, multiplication, subtractin etc

Adding the two series with unequal data.

In [15]:
```
series_1 =pd.Series([10,20,30,40])
series_2 =pd.Series([1,2,3]) # we provide only three values

# add both the series
add_series = series_1 + series_2

print(add_series)
```

```
0    11.0
1    22.0
2    33.0
3     NaN
dtype: float64
```

In Pandas there is feature to handle the missing values.

DataFrame

- **In Pandas DataFrame is mostly used.**
- **A Pandas DataFrame is a 2-dimensional data structure, like a 2 dimensional array, or a table with rows and columns.**

Create DataFrame

Pandas have a DataFrame() function to create a DataFrame.

Empty DataFrame:

In [16]:
```
import pandas as pd
empty_df = pd.DataFrame()
print(empty_df)
```

```
Empty DataFrame
Columns: []
Index: []
```

Create DataFrame with list:

In [17]:
```
import pandas as pd

# Create a list
list_df = ['Apple','Mango','Orange','Banana']

# Create a DataFrame
df_1 = pd.DataFrame(list_df)
print(df_1)
```

```
        0
0   Apple
1   Mango
2  Orange
3  Banana
```

Create DataFrame with more columns:

Pandas for that we have to make list of list:

In [18]:
```
import pandas as pd

# Create a list of list
lst_df = [[11,12,13],[21,22,23],[31,32,33]]

df_2 = pd.DataFrame(lst_df)
print(df_2)
```

```
    0   1   2
0  11  12  13
1  21  22  23
2  31  32  33
```

Create DataFrame with Dictionary:

In [19]:
```
import pandas as pd
dict_4 = {'Customer Name':['Alex','Bumble','Kat','Kevin'],'ID':[101,102,103,104]}
df_4 = pd.DataFrame(dict_4)
print(df_4)
```

```
  Customer Name   ID
0          Alex  101
1        Bumble  102
2           Kat  103
3         Kevin  104
```

NOTE: Value of the all array contain in the dictionary have to be same.

Create DataFrame with list of Dictionary:

In [20]:
```
import pandas as pd
dict_6 = [{'a':1,'b':2},{'a':3,'b':4}]
df_6 = pd.DataFrame(dict_6)
print(df_6)
```

```
   a  b
0  1  2
1  3  4
```

Create DataFrame with Dictionary of Series:

In [21]:
```
import pandas as pd
dict_7 = {'ID':pd.Series(['A','B','C']),'SN':pd.Series([11,22,33])}
df_7 = pd.DataFrame(dict_7)
print(df_7)
```

```
  ID  SN
0  A  11
1  B  22
2  C  33
```

NOTE: There are also other way to create DataFrame like zip function, list of tuple etc.

Locate Row

- **As you can see from the result above, the DataFrame is like a table with rows and columns.**
- **Pandas use the loc attribute to return one or more specified rows.**

In [22]:
```
import pandas as pd
data = {
    'Calories':[430,420,390,376],
    'Duration':[50,45,40,38]
}

#Load data into a DataFrame object
data_df = pd.DataFrame(data)

# Print only first two rows of the DataFrame
print(data_df.loc[[0,1]])    # Notice there is double square bracket.
```

```
   Calories  Duration
0       430        50
1       420        45
```

Named Indexes

With the index argument, you can name your own indexes.

In [23]:
```
# Add a list of names to give each roww a name:
import pandas as pd
data = {
    'Calories':[430,420,390,376],
    'Duration':[50,45,40,38]
}
data_df = pd.DataFrame(data, index = ['Day 1','Day 2','Day 3','Day 4'])
print(data_df)
```

```
       Calories  Duration
Day 1       430        50
Day 2       420        45
Day 3       390        40
Day 4       376        38
```

Locate row by Index

Use the named index in the loc attribute to return the specified rows.

In [24]:
```
import pandas as pd
data = {
    'Calories':[430,420,390,376],
    'Duration':[50,45,40,38]
}
data_df = pd.DataFrame(data, index = ['Day 1','Day 2','Day 3','Day 4'])
print(data_df.loc['Day 2'])
```

```
Calories    420
Duration     45
Name: Day 2, dtype: int64
```

Pandas Read CSV

- **'Comma separated value'**
- **A simple way to store big data sets is to use CSV files (Comma separated files)**
- **CSV files contains plain text and is a well know format that can be read by ereryone including Pandas.**

Advantages of CSV file

Advantages of CSV file

- Universal
- Easy to understand
- Quick to create.

In our example we will be using a CSV file called 'data.csv'

	A	B	C	D
1	Duration	Pulse	Maxpulse	Calories
2	60	110	130	409.1
3	60	117	145	479
4	60	103	135	340
5	45	109	175	282.4
6	45	117	148	406
7	60	102	127	300
8	60	110	136	374
9	45	104	134	253.3
10	30	109	133	195.1
11	60	98	124	269
12	60	103	147	329.3
13	60	100	120	250.7
14	60	106	128	345.3
15	60	104	132	379.3
16	60	98	123	275
17	60	98	120	215.2
18	60	100	120	300
19	45	90	112	
20	60	103	123	323
21	45	97	125	243

The above image is some part of that CSV file.

You can download above CSV file from below link.
https://www.w3schools.com/python/pandas/data.csv

How to read CSV file

Syntax: pd.read_csv(file_path)

In [25]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\data.csv')
# Put double slash during path
print(df)
```

```
     Duration  Pulse  Maxpulse  Calories
0          60    110       130     409.1
1          60    117       145     479.0
2          60    103       135     340.0
3          45    109       175     282.4
4          45    117       148     406.0
..        ...    ...       ...       ...
164        60    105       140     290.8
165        60    110       145     300.0
166        60    115       145     310.2
167        75    120       150     320.4
168        75    125       150     330.4

[169 rows x 4 columns]
```

By default, when you print a DataFrame, you will only get the first 5 rows, and the last 5 rows.
But for entire data you can use to_string()

In [26]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\data.csv')
print(df.to_string())
```

```
     Duration  Pulse  Maxpulse  Calories
0          60    110       130     409.1
1          60    117       145     479.0
2          60    103       135     340.0
3          45    109       175     282.4
```

4	45	117	148	406.0
5	60	102	127	300.0
6	60	110	136	374.0
7	45	104	134	253.3
8	30	109	133	195.1
9	60	98	124	269.0
10	60	103	147	329.3
11	60	100	120	250.7
12	60	106	128	345.3
13	60	104	132	379.3
14	60	98	123	275.0
15	60	98	120	215.2
16	60	100	120	300.0
17	45	90	112	NaN
18	60	103	123	323.0
19	45	97	125	243.0
20	60	108	131	364.2
21	45	100	119	282.0
22	60	130	101	300.0
23	45	105	132	246.0
24	60	102	126	334.5
25	60	100	120	250.0
26	60	92	118	241.0
27	60	103	132	NaN
28	60	100	132	280.0
29	60	102	129	380.3
30	60	92	115	243.0
31	45	90	112	180.1
32	60	101	124	299.0
33	60	93	113	223.0
34	60	107	136	361.0
35	60	114	140	415.0
36	60	102	127	300.0
37	60	100	120	300.0
38	60	100	120	300.0
39	45	104	129	266.0
40	45	90	112	180.1
41	60	98	126	286.0
42	60	100	122	329.4
43	60	111	138	400.0
44	60	111	131	397.0
45	60	99	119	273.0
46	60	109	153	387.6
47	45	111	136	300.0
48	45	108	129	298.0
49	60	111	139	397.6
50	60	107	136	380.2
51	80	123	146	643.1
52	60	106	130	263.0
53	60	118	151	486.0
54	30	136	175	238.0
55	60	121	146	450.7
56	60	118	121	413.0
57	45	115	144	305.0
58	20	153	172	226.4
59	45	123	152	321.0
60	210	108	160	1376.0
61	160	110	137	1034.4
62	160	109	135	853.0
63	45	118	141	341.0
64	20	110	130	131.4
65	180	90	130	800.4
66	150	105	135	873.4
67	150	107	130	816.0
68	20	106	136	110.4
69	300	108	143	1500.2
70	150	97	129	1115.0
71	60	109	153	387.6
72	90	100	127	700.0
73	150	97	127	953.2
74	45	114	146	304.0
75	90	98	125	563.2
76	45	105	134	251.0
77	45	110	141	300.0
78	120	100	130	500.4
79	270	100	131	1729.0
80	30	159	182	319.2
81	45	149	169	344.0
82	30	103	139	151.1
83	120	100	130	500.0
84	45	100	120	225.3
85	30	151	170	300.0
86	45	102	136	234.0

87	120	100	157	1000.1
88	45	129	103	242.0
89	20	83	107	50.3
90	180	101	127	600.1
91	45	107	137	NaN
92	30	90	107	105.3
93	15	80	100	50.5
94	20	150	171	127.4
95	20	151	168	229.4
96	30	95	128	128.2
97	25	152	168	244.2
98	30	109	131	188.2
99	90	93	124	604.1
100	20	95	112	77.7
101	90	90	110	500.0
102	90	90	100	500.0
103	90	90	100	500.4
104	30	92	108	92.7
105	30	93	128	124.0
106	180	90	120	800.3
107	30	90	120	86.2
108	90	90	120	500.3
109	210	137	184	1860.4
110	60	102	124	325.2
111	45	107	124	275.0
112	15	124	139	124.2
113	45	100	120	225.3
114	60	108	131	367.6
115	60	108	151	351.7
116	60	116	141	443.0
117	60	97	122	277.4
118	60	105	125	NaN
119	60	103	124	332.7
120	30	112	137	193.9
121	45	100	120	100.7
122	60	119	169	336.7
123	60	107	127	344.9
124	60	111	151	368.5
125	60	98	122	271.0
126	60	97	124	275.3
127	60	109	127	382.0
128	90	99	125	466.4
129	60	114	151	384.0
130	60	104	134	342.5
131	60	107	138	357.5
132	60	103	133	335.0
133	60	106	132	327.5
134	60	103	136	339.0
135	20	136	156	189.0
136	45	117	143	317.7
137	45	115	137	318.0
138	45	113	138	308.0
139	20	141	162	222.4
140	60	108	135	390.0
141	60	97	127	NaN
142	45	100	120	250.4
143	45	122	149	335.4
144	60	136	170	470.2
145	45	106	126	270.8
146	60	107	136	400.0
147	60	112	146	361.9
148	30	103	127	185.0
149	60	110	150	409.4
150	60	106	134	343.0
151	60	109	129	353.2
152	60	109	138	374.0
153	30	150	167	275.8
154	60	105	128	328.0
155	60	111	151	368.5
156	60	97	131	270.4
157	60	100	120	270.4
158	60	114	150	382.8
159	30	80	120	240.9
160	30	85	120	250.4
161	45	90	130	260.4
162	45	95	130	270.0
163	45	100	140	280.9
164	60	105	140	290.8
165	60	110	145	300.0
166	60	115	145	310.2
167	75	120	150	320.4
168	75	125	150	330.4

Above code print your whole CSV file.

Pandas write CSV:

To write CSV file means make some chnages in CSV file or do some modifications

Access the columns

To find the Columns and there names.

In [111…
```
import  pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\data.csv')
# To print columns name only
print(df.columns)
```

```
Index(['Duration', 'Pulse', 'Maxpulse', 'Calories'], dtype='object')
```

To print the number of columns, for that we have usecols parameter and give index arguments to print the columns.

In [28]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\data.csv', usecols = [0,1])
print(df)
```

```
     Duration  Pulse
0          60    110
1          60    117
2          60    103
3          45    109
4          45    117
..        ...    ...
164        60    105
165        60    110
166        60    115
167        75    120
168        75    125

[169 rows x 2 columns]
```

To create a column as a Index column.

In [29]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\data.csv', index_col = 'Dura
print(df)
```

```
          Pulse  Maxpulse  Calories
Duration
60          110       130     409.1
60          117       145     479.0
60          103       135     340.0
45          109       175     282.4
45          117       148     406.0
...         ...       ...       ...
60          105       140     290.8
60          110       145     300.0
60          115       145     310.2
75          120       150     320.4
75          125       150     330.4

[169 rows x 3 columns]
```

Access the Rows

To print the number of rows use nrows parameter. It take arguments as a number like 1,2,5 etc. and print that much rows.

In [30]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\data.csv',nrows = 3)
print(df)
```

```
   Duration  Pulse  Maxpulse  Calories
```

```
   Duration  Pulse  Maxpulse  Calories
0        60    110       130     409.1
1        60    117       145     479.0
2        60    103       135     340.0
```

You can skip the rows by using skiprows parameter.

In [31]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\data.csv', skiprows = [0])
print(df)
```

```
     60  110  130  409.1
0    60  117  145  479.0
1    60  103  135  340.0
2    45  109  175  282.4
3    45  117  148  406.0
4    60  102  127  300.0
..   ..  ...  ...    ...
163  60  105  140  290.8
164  60  110  145  300.0
165  60  115  145  310.2
166  75  120  150  320.4
167  75  125  150  330.4

[168 rows x 4 columns]
```

It skip the first row that is our columns name.

Parameters of Pandas read_csv() function

Header

Chnage the header according to Index

In [32]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\data.csv',header = 2)
print(df)
```

```
     60  117  145  479.0
0    60  103  135  340.0
1    45  109  175  282.4
2    45  117  148  406.0
3    60  102  127  300.0
4    60  110  136  374.0
..   ..  ...  ...    ...
162  60  105  140  290.8
163  60  110  145  300.0
164  60  115  145  310.2
165  75  120  150  320.4
166  75  125  150  330.4

[167 rows x 4 columns]
```

It set our second row as a header.
NOTE:If you want no header then type header = None

Prefix

- Prefix parameter is use to give the Header to the columns.
- It looks only one strngs.
- To use prefix it is required to use header = None

In [33]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\data.csv', header = None, pr
print(df)
```

```
     Data0  Data1  Data2  Data3
0       60    110    130  409.1
```

```
1       60    117    145  479.0
2       60    103    135  340.0
3       45    109    175  282.4
4       45    117    148  406.0
..     ...    ...    ...    ...
164     60    105    140  290.8
165     60    110    145  300.0
166     60    115    145  310.2
167     75    120    150  320.4
168     75    125    150  330.4

[169 rows x 4 columns]
```

names

- In prefix we can't give the individuals names to the columns.
- names parameter can provide to that to give individuals names to the columns.

In [34]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\data.csv',skiprows =[0],name
print(df)
```

```
      A    B    C      D
0    60  110  130  409.1
1    60  117  145  479.0
2    60  103  135  340.0
3    45  109  175  282.4
4    45  117  148  406.0
..   ..  ...  ...    ...
164  60  105  140  290.8
165  60  110  145  300.0
166  60  115  145  310.2
167  75  120  150  320.4
168  75  125  150  330.4

[169 rows x 4 columns]
```

Pandas Methods

head()

To print first rows.By default it print first 5 rows.

In [35]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\data.csv')
print(df.head())
```

```
   Duration  Pulse  Maxpulse  Calories
0        60    110       130     409.1
1        60    117       145     479.0
2        60    103       135     340.0
3        45    109       175     282.4
4        45    117       148     406.0
```

You can aslo give the parameters to the head() function.

In [36]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\data.csv')
print(df.head(3))
```

```
   Duration  Pulse  Maxpulse  Calories
0        60    110       130     409.1
1        60    117       145     479.0
2        60    103       135     340.0
```

tail()

Same as head parameter it print rows but from bottom.

In [37]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\data.csv')
print(df.tail(3))
```

```
     Duration  Pulse  Maxpulse  Calories
166        60    115       145     310.2
167        75    120       150     320.4
168        75    125       150     330.4
```

dtype()

To change the type of columns

Syntax: dtype = {'Column_name':'data_type'}

In [38]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\data.csv',dtype = {'Duration
print(df)
```

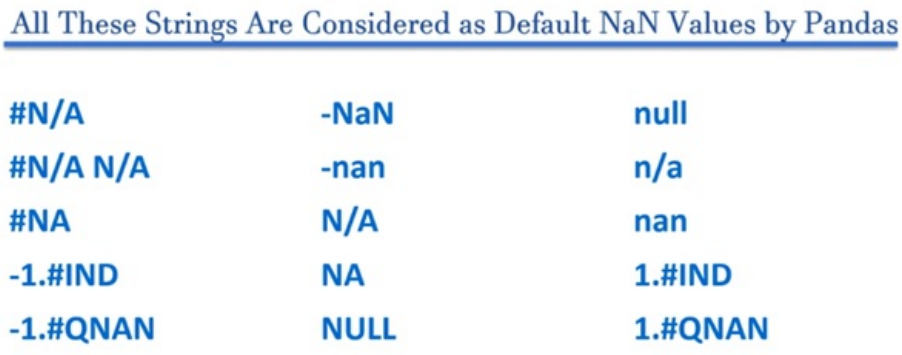
```
     Duration  Pulse  Maxpulse  Calories
0        60.0    110       130     409.1
1        60.0    117       145     479.0
2        60.0    103       135     340.0
3        45.0    109       175     282.4
4        45.0    117       148     406.0
..        ...    ...       ...       ...
164      60.0    105       140     290.8
165      60.0    110       145     300.0
166      60.0    115       145     310.2
167      75.0    120       150     320.4
168      75.0    125       150     330.4

[169 rows x 4 columns]
```

we changed the data type of column 'Duration' int to float

Handling missing values

In pandas there is a functionality to print missing values as NaN.(Not a number)

Panda also consider different types of strings as a NaN, like



We will use different data set for next parameters. You can download that data set from below link.

https://www.w3schools.com/python/pandas/dirtydata.csv

In [114…
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0       60.0  '2020/12/01'  110.0     130.0     409.1
1       60.0  '2020/12/02'  117.0     145.0     479.0
2       60.0  '2020/12/03'  103.0       NaN     340.0
3       45.0  '2020/12/04'  109.0     175.0     282.4
4       45.0  '2020/12/05'  117.0     148.0     406.0
5        NaN  '2020/12/05'  102.0     127.0       NaN
```

```
6       60.0  '2020/12/07'  110.0     136.0     374.0
7      450.0  '2020/12/08'    NaN     134.0     253.3
8       30.0  '2020/12/09'  109.0       NaN     195.1
9        NaN  '2020/12/10'   98.0     124.0     269.0
10      60.0  '2020/12/11'  103.0     147.0     329.3
11      60.0  '2020/12/12'  100.0     120.0     250.7
12      60.0  '2020/12/12'    NaN     120.0     250.7
13      60.0  '2020/12/13'  106.0     128.0     345.3
```

na_values = 'string'

If you want some string in your CSV file as consider NaN, then use na_values = 'string'

In [113…
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv',na_values ='N
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0       60.0  '2020/12/01'  110.0     130.0     409.1
1       60.0  '2020/12/02'  117.0     145.0     479.0
2       60.0  '2020/12/03'  103.0       NaN     340.0
3       45.0  '2020/12/04'  109.0     175.0     282.4
4       45.0  '2020/12/05'  117.0     148.0     406.0
5        NaN  '2020/12/05'  102.0     127.0       NaN
6       60.0  '2020/12/07'  110.0     136.0     374.0
7      450.0  '2020/12/08'    NaN     134.0     253.3
8       30.0  '2020/12/09'  109.0       NaN     195.1
9        NaN  '2020/12/10'   98.0     124.0     269.0
10      60.0  '2020/12/11'  103.0     147.0     329.3
11      60.0  '2020/12/12'  100.0     120.0     250.7
12      60.0  '2020/12/12'    NaN     120.0     250.7
13      60.0  '2020/12/13'  106.0     128.0     345.3
```

This code find the string 'Not available' in your CSV file and change that string into 'NaN'

keep_default_na = False

If you want to not change the NaN values, keep as it is as default, suppose in your CSV there is N/A, null strings. But you want to keep that as it is, then use keep_default_na=False

In [41]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv',keep_default_
print(df)
```

```
   Duration          Date Pulse Maxpulse Calories
0        60  '2020/12/01'   110      130    409.1
1        60  '2020/12/02'   117      145      479
2        60  '2020/12/03'   103      NaN      340
3        45  '2020/12/04'   109      175    282.4
4        45  '2020/12/05'   117      148      406
5            '2020/12/05'   102      127
6        60  '2020/12/07'   110      136      374
7       450  '2020/12/08'   NaN      134    253.3
8        30  '2020/12/09'   109             195.1
9            '2020/12/10'    98      124      269
10       60  '2020/12/11'   103      147    329.3
11       60  '2020/12/12'   100      120    250.7
12       60  '2020/12/12'              120    250.7
13       60  '2020/12/13'   106      128    345.3
```

Methods and Functions in Pandas

isnull()

To check the missing values.

In [115…
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
```

```
print(df.isnull())
```

```
    Duration   Date  Pulse  Maxpulse  Calories
0      False  False  False     False     False
1      False  False  False     False     False
2      False  False  False      True     False
3      False  False  False     False     False
4      False  False  False     False     False
5       True  False  False     False      True
6      False  False  False     False     False
7      False  False   True     False     False
8      False  False  False      True     False
9       True  False  False     False     False
10     False  False  False     False     False
11     False  False  False     False     False
12     False  False   True     False     False
13     False  False  False     False     False
```

False= Value
True= Null value

NOTE: notnull() is opposite of the isnull(). It shows the True if there is no null value and false for null value.

If you want to find the how many total number of null value in the column, then use sum()

In [43]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
print(df.isnull().sum())
```

```
Duration    2
Date        0
Pulse       2
Maxpulse    2
Calories    1
dtype: int64
```

It is showing the null values per column.

If you want to find that the total Null values in whole data set then use DataFrame.isnull.sum().sum()

In [44]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
print(df.isnull().sum().sum())
```

```
7
```

You can use isnull() for series. Use following syntax for series series_name.isnull()

dropna()

- One way to deal with empty cells is to remove rows that contain empty cells.
- This is usually Ok, since data set can be very big, and removing a feww rows will not have a big impact on the result.
- For that we have dropna() method. This method removes the rows or column that contain the Null values.

Let's print our original Data set.

In [45]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0       60.0  '2020/12/01'  110.0     130.0     409.1
1       60.0  '2020/12/02'  117.0     145.0     479.0
2       60.0  '2020/12/03'  103.0       NaN     340.0
3       45.0  '2020/12/04'  109.0     175.0     282.4
4       45.0  '2020/12/05'  117.0     148.0     406.0
5        NaN  '2020/12/05'  102.0     127.0       NaN
6       60.0  '2020/12/07'  110.0     136.0     374.0
7      450.0  '2020/12/08'    NaN     134.0     253.3
8       30.0  '2020/12/09'  109.0       NaN     195.1
```

```
9        NaN  '2020/12/10'   98.0     124.0     269.0
10      60.0  '2020/12/11'  103.0     147.0     329.3
11      60.0  '2020/12/12'  100.0     120.0     250.7
12      60.0  '2020/12/12'    NaN     120.0     250.7
13      60.0  '2020/12/13'  106.0     128.0     345.3
```

See, there are 2,5,7,8,9 rows that contain the null vales

In [46]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
new_df = df.dropna()
print(new_df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0       60.0  '2020/12/01'  110.0     130.0     409.1
1       60.0  '2020/12/02'  117.0     145.0     479.0
3       45.0  '2020/12/04'  109.0     175.0     282.4
4       45.0  '2020/12/05'  117.0     148.0     406.0
6       60.0  '2020/12/07'  110.0     136.0     374.0
10      60.0  '2020/12/11'  103.0     147.0     329.3
11      60.0  '2020/12/12'  100.0     120.0     250.7
13      60.0  '2020/12/13'  106.0     128.0     345.3
```

2,5,7,8,9 rows are dropped.

NOTE: By default, the dropna() method returns a new DataFrame, and will not change the original.

Parameters of drpna()

- axis=0,1
- how='any',
- thresh=None,
- subset=None,
- inplace=False

axis

- axis parameter removes the row or column that contain the Null values.
- It take the 2 arguments {0,1}.
- 0 = Row (By default value is 0)
- 1 = Column
- syntax: DataFrame.drpna(axis = 1,0)
- Pass tuple or list to drop on multiple axes.

In [47]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
new_df = df.dropna(axis = 1)
print(new_df)
```

```
           Date
0   '2020/12/01'
1   '2020/12/02'
2   '2020/12/03'
3   '2020/12/04'
4   '2020/12/05'
5   '2020/12/05'
6   '2020/12/07'
7   '2020/12/08'
8   '2020/12/09'
9   '2020/12/10'
10  '2020/12/11'
11  '2020/12/12'
12  '2020/12/12'
13  '2020/12/13'
```

Because we give argument 1, it drop all the columns that contain the Null value

how

- Determine if row or column is removed from DataFrame, when we have at least one NA or all NA.
- arguments = {'any','all'}
- 'any' = If any NA values are present, drop that row or column.
- 'all' = If all values are NA, drop that row or column.

In [48]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
new_df = df.dropna(how = 'any')
print(new_df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0       60.0  '2020/12/01'  110.0     130.0     409.1
1       60.0  '2020/12/02'  117.0     145.0     479.0
3       45.0  '2020/12/04'  109.0     175.0     282.4
4       45.0  '2020/12/05'  117.0     148.0     406.0
6       60.0  '2020/12/07'  110.0     136.0     374.0
10      60.0  '2020/12/11'  103.0     147.0     329.3
11      60.0  '2020/12/12'  100.0     120.0     250.7
13      60.0  '2020/12/13'  106.0     128.0     345.3
```

See, it removes the all rows that contain the null value.

thresh

- Whenever we want specific row that contain specific Not null value.Like suppose we want all rows that contain only 2 Null values, that's where we can use the thresh parameter.
- arguments: intergers (1,2,3,5 etc)

Let's print the rows that contain 5 Not null values.

In [49]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
new_df = df.dropna(thresh = 5)
print(new_df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0       60.0  '2020/12/01'  110.0     130.0     409.1
1       60.0  '2020/12/02'  117.0     145.0     479.0
3       45.0  '2020/12/04'  109.0     175.0     282.4
4       45.0  '2020/12/05'  117.0     148.0     406.0
6       60.0  '2020/12/07'  110.0     136.0     374.0
10      60.0  '2020/12/11'  103.0     147.0     329.3
11      60.0  '2020/12/12'  100.0     120.0     250.7
13      60.0  '2020/12/13'  106.0     128.0     345.3
```

subset

- subset parameter drop the rows that contain Null value of specific columns.
- arguments: Column name (It take a arguments in square bracket)

EXAMPLE: Drop the rows that contain the null value of 'Maxpulse' column.

In [50]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
new_df = df.dropna(subset = ['Maxpulse'])
print(new_df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0       60.0  '2020/12/01'  110.0     130.0     409.1
1       60.0  '2020/12/02'  117.0     145.0     479.0
3       45.0  '2020/12/04'  109.0     175.0     282.4
4       45.0  '2020/12/05'  117.0     148.0     406.0
5        NaN  '2020/12/05'  102.0     127.0       NaN
6       60.0  '2020/12/07'  110.0     136.0     374.0
7      450.0  '2020/12/08'    NaN     134.0     253.3
```

```
9        NaN  '2020/12/10'   98.0     124.0     269.0
10      60.0  '2020/12/11'  103.0     147.0     329.3
11      60.0  '2020/12/12'  100.0     120.0     250.7
12      60.0  '2020/12/12'    NaN     120.0     250.7
13      60.0  '2020/12/13'  106.0     128.0     345.3
```

It drop the 2 and 8 row, because in that row the maxpulse column contain the Null values.

inplace

If you want to change the original DataFrame, use the inplace = True argument.

In [51]:
```
# Remove all rows with null values
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
df.dropna(inplace = True)
print(df.to_string())
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0       60.0  '2020/12/01'  110.0     130.0     409.1
1       60.0  '2020/12/02'  117.0     145.0     479.0
3       45.0  '2020/12/04'  109.0     175.0     282.4
4       45.0  '2020/12/05'  117.0     148.0     406.0
6       60.0  '2020/12/07'  110.0     136.0     374.0
10      60.0  '2020/12/11'  103.0     147.0     329.3
11      60.0  '2020/12/12'  100.0     120.0     250.7
13      60.0  '2020/12/13'  106.0     128.0     345.3
```

fillna()

- **Fillna fills the NaN values with given values (input)**
- **Syntax: DataFrame.fillna()**

Parameters of fillna()

- **value**
- **method**
- **axis**
- **inplace**
- **limit**

value

- **By using the value parameter you fill the Null value with a specified Number, string.**
- **arguments: {scalar, dict, Series, or DataFrame}**

In [52]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
update_df = df.fillna(0.0)
print(update_df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0       60.0  '2020/12/01'  110.0     130.0     409.1
1       60.0  '2020/12/02'  117.0     145.0     479.0
2       60.0  '2020/12/03'  103.0       0.0     340.0
3       45.0  '2020/12/04'  109.0     175.0     282.4
4       45.0  '2020/12/05'  117.0     148.0     406.0
5        0.0  '2020/12/05'  102.0     127.0       0.0
6       60.0  '2020/12/07'  110.0     136.0     374.0
7      450.0  '2020/12/08'    0.0     134.0     253.3
8       30.0  '2020/12/09'  109.0       0.0     195.1
9        0.0  '2020/12/10'   98.0     124.0     269.0
10      60.0  '2020/12/11'  103.0     147.0     329.3
11      60.0  '2020/12/12'  100.0     120.0     250.7
12      60.0  '2020/12/12'    0.0     120.0     250.7
13      60.0  '2020/12/13'  106.0     128.0     345.3
```

It fills the all the Null Spaces with 0.0

method

- To fill the previous and next value in null space.
- arguments:{'ffill','bfill'}
- ffill: To fill the forward value.
- bfill: To fill the backward value.
- Syntax: DataFrame.fillna(method = 'ffill')

In [53]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
update_df = df.fillna(method = 'ffill')
print(update_df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0       60.0  '2020/12/01'  110.0     130.0     409.1
1       60.0  '2020/12/02'  117.0     145.0     479.0
2       60.0  '2020/12/03'  103.0     145.0     340.0
3       45.0  '2020/12/04'  109.0     175.0     282.4
4       45.0  '2020/12/05'  117.0     148.0     406.0
5       45.0  '2020/12/05'  102.0     127.0     406.0
6       60.0  '2020/12/07'  110.0     136.0     374.0
7      450.0  '2020/12/08'  110.0     134.0     253.3
8       30.0  '2020/12/09'  109.0     134.0     195.1
9       30.0  '2020/12/10'   98.0     124.0     269.0
10      60.0  '2020/12/11'  103.0     147.0     329.3
11      60.0  '2020/12/12'  100.0     120.0     250.7
12      60.0  '2020/12/12'  100.0     120.0     250.7
13      60.0  '2020/12/13'  106.0     128.0     345.3
```

It fills the Null value with previous values.

NOTE: You can use 'pad' instead of 'ffill'

axis

- By using axis we can make changes according to the rows(0) and columns(1).
- To use the axis it is required to use method or value.

In [54]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
update_df = df.fillna(method = 'ffill',axis = 1)
print(update_df)
```

```
   Duration          Date         Pulse Maxpulse Calories
0        60  '2020/12/01'           110      130    409.1
1        60  '2020/12/02'           117      145      479
2        60  '2020/12/03'           103      103      340
3        45  '2020/12/04'           109      175    282.4
4        45  '2020/12/05'           117      148      406
5       NaN  '2020/12/05'           102      127      127
6        60  '2020/12/07'           110      136      374
7       450  '2020/12/08'  '2020/12/08'      134    253.3
8        30  '2020/12/09'           109      109    195.1
9       NaN  '2020/12/10'            98      124      269
10       60  '2020/12/11'           103      147    329.3
11       60  '2020/12/12'           100      120    250.7
12       60  '2020/12/12'  '2020/12/12'      120    250.7
13       60  '2020/12/13'           106      128    345.3
```

It fills the value from forward Column(1 represents the column).

limit

If there is 4 cell empty in one column but you want to fill only first 2 cell, there we can use limit.

With limit parameter it is required to use value or method

In [55]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\dirtydata.csv')
update_df = df.fillna(1000, limit = 1)
print(update_df)
```

```
    Duration          Date   Pulse  Maxpulse  Calories
0       60.0  '2020/12/01'   110.0     130.0     409.1
1       60.0  '2020/12/02'   117.0     145.0     479.0
2       60.0  '2020/12/03'   103.0    1000.0     340.0
3       45.0  '2020/12/04'   109.0     175.0     282.4
4       45.0  '2020/12/05'   117.0     148.0     406.0
5     1000.0  '2020/12/05'   102.0     127.0    1000.0
6       60.0  '2020/12/07'   110.0     136.0     374.0
7      450.0  '2020/12/08'  1000.0     134.0     253.3
8       30.0  '2020/12/09'   109.0       NaN     195.1
9        NaN  '2020/12/10'    98.0     124.0     269.0
10      60.0  '2020/12/11'   103.0     147.0     329.3
11      60.0  '2020/12/12'   100.0     120.0     250.7
12      60.0  '2020/12/12'     NaN     120.0     250.7
13      60.0  '2020/12/13'   106.0     128.0     345.3
```

It fills only first cell of empty cell of every column.

inplace

We already learn about inplace, with use of inplace parameter we can directly change the original DataFrame.
arguments:{'True','False'}

replace()

- It replace the values of DataFrame with other values dynamically.
- Syntax: DataFrame.replace()

We will use another Data set, you can download from given link.

https://indianaiproduction.com/wp-content/uploads/2019/06/Fortune_10.csv

In [56]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\fortune_10.csv')
print(df)
```

```
   ID             Name             Industry    Profit Growth
0   1          Lamtone          IT Services         0    30%
1   2        Stripfind   Financial Services         0    20%
2   3  Canecorporation               Health         0     7%
3   4         Mattouch          IT Services   6597557    26%
4   5        Techdrill               Health   3138627     8%
5   6         Techline               Health   8427816    23%
6   7          Cityace               Health   3005116     6%
7   8   Kayelectronics               Health   5573830     4%
8   9          Ganzlax          IT Services  11901180    18%
9  10      Trantraxlax  Government Services   5453060     7%
```

This is our data set 'Fortune_10'

Parameters of replace()

- to_replace=None,
- value =None,
- inplace=False,
- limit=None,
- regex=False,
- method='pad',

to_replace or value

to_replace or value

- To replace from string1 to value
- arguments: {str, regex, list, dict, Series, int, float, or None}
- Syntax: DartaFrame.replace(to_replace = 'string_1', value='string_2')
- You can use directly also like this syntax.
- DartaFrame.replace('string_1', 'string_2')

In [57]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\fortune_10.csv')
update_fortune_10 = df.replace('Health','Finance')
print(update_fortune_10)
```

```
   ID             Name             Industry    Profit Growth
0   1          Lamtone          IT Services         0    30%
1   2        Stripfind   Financial Services         0    20%
2   3  Canecorporation              Finance         0     7%
3   4         Mattouch          IT Services   6597557    26%
4   5        Techdrill              Finance   3138627     8%
5   6         Techline              Finance   8427816    23%
6   7          Cityace              Finance   3005116     6%
7   8   Kayelectronics              Finance   5573830     4%
8   9          Ganzlax          IT Services  11901180    18%
9  10      Trantraxlax  Government Services   5453060     7%
```

It changed string 'Health' with 'Finance'.

You can change multiple values by using list:

In [58]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\fortune_10.csv')
update_fortune_10 = df.replace([1,2,3,4,5,6,7,8,9,10],['a','b','c','d','e','f','h','i','j','k'])
print(update_fortune_10)
```

```
  ID             Name             Industry    Profit Growth
0  a          Lamtone          IT Services         0    30%
1  b        Stripfind   Financial Services         0    20%
2  c  Canecorporation               Health         0     7%
3  d         Mattouch          IT Services   6597557    26%
4  e        Techdrill               Health   3138627     8%
5  f         Techline               Health   8427816    23%
6  h          Cityace               Health   3005116     6%
7  i   Kayelectronics               Health   5573830     4%
8  j          Ganzlax          IT Services  11901180    18%
9  k      Trantraxlax  Government Services   5453060     7%
```

We changed the whole 'ID' column.

If you want to changed the specific value in specific column, then use dictionary.

In [59]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\fortune_10.csv')
update_fortune_10 = df.replace({'Industry':'Health'}, 'none')
print(update_fortune_10)
```

```
   ID             Name             Industry    Profit Growth
0   1          Lamtone          IT Services         0    30%
1   2        Stripfind   Financial Services         0    20%
2   3  Canecorporation                 none         0     7%
3   4         Mattouch          IT Services   6597557    26%
4   5        Techdrill                 none   3138627     8%
5   6         Techline                 none   8427816    23%
6   7          Cityace                 none   3005116     6%
7   8   Kayelectronics                 none   5573830     4%
8   9          Ganzlax          IT Services  11901180    18%
9  10      Trantraxlax  Government Services   5453060     7%
```

We changed the "Health" with "none" string in 'Industry' column.

regex

- To convert String into int.
- Syntax: DataFrame.replace('[A-Za-z]', 0)
- Above code convert all strings into 0.
- To convert only for specific column:
- Syntax: DataFrame.replace('Column_Name':'[A-Za-z]', 0, regex = True)

In [60]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\fortune_10.csv')
update_fortune_10 = df.replace({'Industry':'[A-Za-z]'},0,regex= True)
print(update_fortune_10)
```

```
   ID             Name  Industry    Profit Growth
0   1          Lamtone         0         0    30%
1   2        Stripfind         0         0    20%
2   3  Canecorporation         0         0     7%
3   4         Mattouch         0   6597557    26%
4   5        Techdrill         0   3138627     8%
5   6         Techline         0   8427816    23%
6   7          Cityace         0   3005116     6%
7   8   Kayelectronics         0   5573830     4%
8   9          Ganzlax         0  11901180    18%
9  10      Trantraxlax         0   5453060     7%
```

method

- To replace with forward and backward words
- arguments:{'ffill','bfill'}
- ffill: To fill the forward value.
- bfill: To fill the backward value.
- Syntax: DataFramef.replace('Value_name' , method = 'ffill')

In [61]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\fortune_10.csv')
update_fortune_10 = df.replace('Health', method='ffill')
print(update_fortune_10)
```

```
   ID             Name             Industry    Profit Growth
0   1          Lamtone          IT Services         0    30%
1   2        Stripfind   Financial Services         0    20%
2   3  Canecorporation   Financial Services         0     7%
3   4         Mattouch          IT Services   6597557    26%
4   5        Techdrill          IT Services   3138627     8%
5   6         Techline          IT Services   8427816    23%
6   7          Cityace          IT Services   3005116     6%
7   8   Kayelectronics          IT Services   5573830     4%
8   9          Ganzlax          IT Services  11901180    18%
9  10      Trantraxlax  Government Services   5453060     7%
```

limit

- How many values you want to replace
- arguments:integers (1,2,3,4 etc)
- Syntax:DataFramef.replace(limit = 1,2 etc)
- With limit parameter it is required to use to_replace or method

In [62]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\fortune_10.csv')
update_fortune_10 = df.replace( 0, method='bfill',limit=3)
print(update_fortune_10)
```

```
   ID             Name             Industry    Profit Growth
0   1          Lamtone          IT Services   6597557    30%
1   2        Stripfind   Financial Services   6597557    20%
2   3  Canecorporation               Health   6597557     7%
3   4         Mattouch          IT Services   6597557    26%
4   5        Techdrill               Health   3138627     8%
5   6         Techline               Health   8427816    23%
6   7          Cityace               Health   3005116     6%
7   8   Kayelectronics               Health   5573830     4%
8   9          Ganzlax          IT Services  11901180    18%
```

```
9  10      Trantraxlax  Government Services   5453060     7%
```

We replace all three zero in the profit column with backward value.

interpolate()

- Pandas interpolate() function is basically used to fill NaN values in dataframe or series.
- It fill only numeric value, not string.
- Syntax: DataFrame.interpolate()

But we have already fillna() function to fill the values then why interpolate(), because:

- Very powerful function
- Uses various interpolation techniques.

We will take our previous Data set 'dirtydata'
Let's print the Fortune_10 Data set

Parameters of interpolate()

- method: str = 'linear',
- axis: Union[str, int] = 0,
- limit: Union[int, NoneType] = None,
- inplace: bool = False,
- limit_direction: Union[str, NoneType] = None,
- limit_area: Union[str, NoneType] = None,
- downcast: Union[str, NoneType] = None,

loc()

- Access a group of rows and columns by label(s) or a boolean array.
- Basically it return the desired output according what type of input we give.
- Syntax:DataFrame.loc[]

We will use different data set "Student_result", lets print that data set.

In [63]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')
print(df)
```

```
   Student ID  Class  Study hrs  Sleeping hrs  Percentage
0        1001     10          2             9          50
1        1002     10          6             8          80
2        1003     10          6             8          91
3        1004     11          0             8          82
4        1005     11          4             7          60
5        1006     11          6             7          96
6        1007     12          4             6          80
7        1008     12         10             6          90
8        1009     12          2             8          60
9        1010     12          6             9          85
```

Parameters of loc[ ]

- A single label
- A list or array of labels
- A slice object with labels

A single label

- It return the rows of given index.
- arguments: Index number like 1,2,3,etc
- Syntax: DataFrame.loc[Index]

In [64]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')
loc_df = df.loc[2]
print(loc_df)
```

```
Student ID      1003
Class             10
Study hrs          6
Sleeping hrs       8
Percentage        91
Name: 2, dtype: int64
```

It return the 2 row.

A list of array of labels

- It can take a multiple index at one time and gives all that rows.
- Syntax: DataFrame.loc[[Multiple Index]]

In [65]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')
loc_df = df.loc[[2,4]]
print(loc_df)
```

```
   Student ID  Class  Study hrs  Sleeping hrs  Percentage
2        1003     10          6             8          91
4        1005     11          4             7          60
```

If we want a specific value from speciffic column, then use following syntax:
DataFrame.loc[index number, Column name]

In [66]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')
loc_df = df.loc[4,"Class"]
print(loc_df)
```

```
11
```

A slice object with labels

- It gives you some part of DataFrame.
- Syntax:DataFrame.loc[initial value:End value, Column name]

In [67]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')
loc_df = df.loc[0:3,"Class"]
print(loc_df)
```

```
0    10
1    10
2    10
3    11
Name: Class, dtype: int64
```

We can use conditional operator also with loc[ ] method

In [68]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')
loc_df = df.loc[df['Class'] < 60]
print(loc_df)
```

```
   Student ID  Class  Study hrs  Sleeping hrs  Percentage
0        1001     10          2             9          50
1        1002     10          6             8          80
```

```
2        1003     10          6             8          91
3        1004     11          0             8          82
4        1005     11          4             7          60
5        1006     11          6             7          96
6        1007     12          4             6          80
7        1008     12         10             6          90
8        1009     12          2             8          60
9        1010     12          6             9          85
```

As we can see it print the rows that contain value less than 11.

And if you want to print above values only for specific column, then use:

In [69]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')
loc_df = df.loc[df['Class'] < 11, ['Percentage']]
print(loc_df)
```

```
   Percentage
0          50
1          80
2          91
```

iloc[ ]

- Integer location-based indexing
- Syntax: DataFrame.iloc[ ]

Parameters of iloc[ ]

- An integer
- A list or array of integers
- A slice object with ints
- A boolean array

An integer

In [70]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')
loc_df = df.iloc[0]
print(loc_df)
```

```
Student ID      1001
Class             10
Study hrs          2
Sleeping hrs       9
Percentage        50
Name: 0, dtype: int64
```

A list or array of integers

In [71]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')
loc_df = df.iloc[[2,1]]
print(loc_df)
```

```
   Student ID  Class  Study hrs  Sleeping hrs  Percentage
2        1003     10          6             8          91
1        1002     10          6             8          80
```

A slice object with ints

In [72]:
```
import pandas as pd
```

```
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')
loc_df = df.iloc[: , 0]
print(loc_df)
```

```
0    1001
1    1002
2    1003
3    1004
4    1005
5    1006
6    1007
7    1008
8    1009
9    1010
Name: Student ID, dtype: int64
```

In [73]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')
loc_df = df.iloc[[0,1]]
print(loc_df)
```

```
   Student ID  Class  Study hrs  Sleeping hrs  Percentage
0        1001     10          2             9          50
1        1002     10          6             8          80
```

groupby()

- Pandas groupby function is used to split the data into groups based on some criteria.
- Syntax:DataFrame.groupby()
- Any groupby operation involves one of the following operations on the original object:
  - Splitting the object
  - Applying a function
  - Combining the result

Our Original Data set

In [74]:
```
import pandas as pd
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')
print(df)
```

```
   Student ID  Class  Study hrs  Sleeping hrs  Percentage
0        1001     10          2             9          50
1        1002     10          6             8          80
2        1003     10          6             8          91
3        1004     11          0             8          82
4        1005     11          4             7          60
5        1006     11          6             7          96
6        1007     12          4             6          80
7        1008     12         10             6          90
8        1009     12          2             8          60
9        1010     12          6             9          85
```

Parameters of groupby()

- by=None,
- axis=0,
- level=None,
- as_index: bool = True,
- sort: bool = True,
- group_keys: bool = True,
- squeeze: bool = <object object at 0x000001B633BA87F0>,
- observed: bool = False,
- dropna: bool = True,

by

- Used to determine the groups for the groupby.

- arguments:{mapping, function, label, or list of labels}

In [75]:
```
import pandas as pda
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')

# Make a groups for 'Study hrs' column
groupby_df = df.groupby(by = 'Study hrs')

# Print that groups
print(groupby_df.groups)
```

```
{0: [3], 2: [0, 8], 4: [4, 6], 6: [1, 2, 5, 9], 10: [7]}
```

It made a group according to study hrs, like 0 hrs have 3 index, 2 hrs have 0 and 8 index etc.

Let's try more than one labels with shortcut method.

In [76]:
```
import pandas as pda
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')

# Make a groups for 'Study hrs' column
groupby_df = df.groupby(['Study hrs','Class'])

# Print that groups
print(groupby_df.groups)
```

```
{(0, 11): [3], (2, 10): [0], (2, 12): [8], (4, 11): [4], (4, 12): [6], (6, 10): [1, 2], (6, 11): [5], (6, 12): [9
], (10, 12): [7]}
```

It made a group according to class and srudy hrs

We can split our data by using the get_group() function.

Example: Print the data that contain only class 11 student.

In [77]:
```
import pandas as pda
df = pd.read_csv('C:\\Users\\Mrunal Wankhede\\Desktop\\Study Material\\Excel Sheets\\student_results.csv')

# Make a groups for 'Study hrs' column
groupby_df = df.groupby('Class').get_group(11)

# Print that groups
print(groupby_df)
```

```
   Student ID  Class  Study hrs  Sleeping hrs  Percentage
3        1004     11          0             8          82
4        1005     11          4             7          60
5        1006     11          6             7          96
```

As we can see it print data only for class 11.

merge()

- Pandas merge connects columns or indexes in DataFrame based on one or more keys.
- With the help of pandas merge() function we can connect multiple DataFrame.

Let's create the two DataFrame

In [78]:
```
# Create 1st dataframe
import pandas as pd
df_1 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ]})
print(df_1)
```

```
   ID  Class
0   1      9
1   2     10
2   3     11
3   4     12
```

In [79]:
```
# Create 2nd dataframe
import pandas as pd
df_2 = pd.DataFrame({'ID':[1,2,3,4],'Name':['A','B','C','D']})
print(df_2)
```

```
   ID Name
0   1    A
1   2    B
2   3    C
3   4    D
```

Parameters of merge()

- **left**,
- **right**,
- **how**= 'inner',
- **on**=None,
- **left_on**=None,
- **right_on**=None,
- **left_index**= False,
- **right_index**= False,
- **sort**= False,
- **suffixes**=('_x', '_y'),
- **copy: bool** = True,
- **indicator**= False,
- **validate**=None,

left,right

In [80]:
```
import pandas as pd
df_1 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ]})
df_2 = pd.DataFrame({'ID':[1,2,3,4],'Name':['A','B','C','D']})

merge_1 = pd.merge(df_1,df_2)

print(merge_1)
```

```
   ID  Class Name
0   1      9    A
1   2     10    B
2   3     11    C
3   4     12    D
```

Because we put df_1 on left side that's why the 'Class' column shows first.
If we put the df_2 on left side the 'Name' column will appear first, let's try

In [81]:
```
import pandas as pd
df_1 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ]})
df_2 = pd.DataFrame({'ID':[1,2,3,4],'Name':['A','B','C','D']})

merge_1 = pd.merge(df_2,df_1)

print(merge_1)
```

```
   ID Name  Class
0   1    A      9
1   2    B     10
2   3    C     11
3   4    D     12
```

Sometimes in DataFrames there are same Column and we don't need to print that column two times, that's where parameter on can use.

on

- **on** parameter is used to join the same column or index and print only onces time.
- arguments:{label or list}

- label: If there is only one column same then give only that column name.
- list: If there are more than one column same then make a list and put all that column name in that list.

In [82]:
```
import pandas as pd
df_1 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ],'Div':['A','b','C','D']})
df_2 = pd.DataFrame({'ID':[1,2,3,4],'Name':['A','B','C','D'],'Div':['A','b','C','D']})

merge_1 = pd.merge(df_2,df_1, on = ['ID','Div'])

print(merge_1)
```

```
   ID Name Div  Class
0   1    A   A      9
1   2    B   b     10
2   3    C   C     11
3   4    D   D     12
```

It print only one time 'ID' and 'Div' column.

If there are not similar values in column,like

In [83]:
```
import pandas as pd
df_1 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ]})

# we change the last value in 'Id' column
df_2 = pd.DataFrame({'ID':[1,2,3,5],'Name':['A','B','C','D']})

merge_1 = pd.merge(df_2,df_1, on = 'ID')

print(merge_1)
```

```
   ID Name  Class
0   1    A      9
1   2    B     10
2   3    C     11
```

It print only similar value, but we want all vlaues that's where how parameter came.

how

- It print the all the values even if there are not similar values.
- arguments:{'left', 'right', 'outer', 'inner'}, default 'inner'}
  - 'left': It print all the values from left DataFrame
  - 'right': It print all the values from right DataFrame
  - 'outer': It print all the values from both DataFrame
  - 'inner': It print only similar values.

Example: Print all the values from left DataFrame.

In [84]:
```
import pandas as pd
df_1 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ]})

# we change the last value in 'Id' column
df_2 = pd.DataFrame({'ID':[1,2,3,5],'Name':['A','B','C','D']})

merge_1 = pd.merge(df_2,df_1, on = 'ID',how = 'left')

print(merge_1)
```

```
   ID Name  Class
0   1    A    9.0
1   2    B   10.0
2   3    C   11.0
3   5    D    NaN
```

It print the all values from left DataFrame, It print the 5 which is present in left DataFrame.

Example: Print all the values from right DataFrame.

In [85]:
```
import pandas as pd
```

```
df_1 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ]})

# we change the last value in 'Id' column
df_2 = pd.DataFrame({'ID':[1,2,3,5],'Name':['A','B','C','D']})

merge_1 = pd.merge(df_2,df_1, on = 'ID',how = 'right')

print(merge_1)
```

```
   ID Name  Class
0   1    A      9
1   2    B     10
2   3    C     11
3   4  NaN     12
```

It print the 4 in 'ID' column.

If we want to know which value is belongs from which column, then use indicator parameter.

indicator

- It shows the which value is belogs from which parameter.
- arguments:{bool or str, default False}
  - If True, adds a column to the output DataFrame called "_merge" with information on the source of each row

In [86]:
```
import pandas as pd
df_1 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ]})

# we change the last value in 'Id' column
df_2 = pd.DataFrame({'ID':[1,2,3,5],'Name':['A','B','C','D']})

merge_1 = pd.merge(df_2,df_1, on = 'ID',how = 'outer', indicator = True)

print(merge_1)
```

```
   ID Name  Class      _merge
0   1    A    9.0        both
1   2    B   10.0        both
2   3    C   11.0        both
3   5    D    NaN   left_only
4   4  NaN   12.0  right_only
```

If suppose all the values are differnt in 'ID' column, like

In [87]:
```
import pandas as pd
df_1 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ]})
print(df_1)
# we change all the values in 'ID' column
df_2 = pd.DataFrame({'ID':[5,6,7,8],'Name':['A','B','C','D']})
print(df_2)
```

```
   ID  Class
0   1      9
1   2     10
2   3     11
3   4     12
   ID Name
0   5    A
1   6    B
2   7    C
3   8    D
```

Let's try to merge them

In [88]:
```
import pandas as pd
df_1 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ]})

# we change all the values in 'ID' column
df_2 = pd.DataFrame({'ID':[5,6,7,8],'Name':['A','B','C','D']})

merge_1 = pd.merge(df_2,df_1)
print(merge_1)
```

```
Empty DataFrame
Columns: [ID, Name, Class]
```

```
Index: []
```

It did'nt show any output, then we can use left_index, right_index parameters to merge that both dataframe.

left_index, right_index

- It merge the DataFrme even if there are not similar values in the DataFrames.
- arguments:{bool, default False}
  - 'True': It print the
- It is required to use both left_index, right_index parameters together.

In [89]:
```
import pandas as pd
df_1 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ]})

# we change all the values in 'ID' column
df_2 = pd.DataFrame({'ID':[5,6,7,8],'Name':['A','B','C','D']})

merge_1 = pd.merge(df_2,df_1,left_index = True, right_index = True)
print(merge_1)
```

```
   ID_x Name  ID_y  Class
0     5    A     1      9
1     6    B     2     10
2     7    C     3     11
3     8    D     4     12
```

If we have same column name not a 'ID', like suppose we have same 'Class' name column,like

In [90]:
```
import pandas as pd
df_1 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ]})

# We took same column in both DataFrame 'Class'
df_2 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ]})

merge_1 = pd.merge(df_2,df_1, on ='ID')
print(merge_1)
```

```
   ID  Class_x  Class_y
0   1        9        9
1   2       10       10
2   3       11       11
3   4       12       12
```

It print them with different name, but if you want to give different name to that columns, then use suffixes parameter.

suffixes

- If there is same columns in different DataFrame then it helps you to give different names to them.
- arguments:{list-like, default is ("_x", "_y")}
  - 'list-like'- Means you can give them different name in the list.

In [91]:
```
import pandas as pd
df_1 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ]})

# We took same column in both DataFrame 'Class'
df_2 = pd.DataFrame({'ID':[1,2,3,4],'Class':[9,10,11,12 ]})

merge_1 = pd.merge(df_2,df_1, on ='ID', suffixes = ['_Higher','_Middle'])
print(merge_1)
```

```
   ID  Class_Higher  Class_Middle
0   1             9             9
1   2            10            10
2   3            11            11
3   4            12            12
```

Concat()

- Pandas provides various facilities for easily comnining togehter Series, DataFrame and Panel Objects.
- Syntax: Pandas.concate()

Parameters of concat()

- objs
- axis=0,
- join='outer',
- ignore_index= False,
- keys=None,
- levels=None,
- names=None,
- verify_integrity= False,
- sort= False,
- copy= True,

Firstly create the two series to concate:

In [92]:
```
import pandas as pd
sr_1 = pd.Series([0,1,2])
sr_2 = pd.Series([3,4,5])

print(sr_1)
print(sr_2)
```

```
0    0
1    1
2    2
dtype: int64
0    3
1    4
2    5
dtype: int64
```

Let's concat the series:

In [93]:
```
import pandas as pd
sr_1 = pd.Series([0,1,2])
sr_2 = pd.Series([3,4,5])

concat_sr = pd.concat([sr_1,sr_2])
print(concat_sr)
```

```
0    0
1    1
2    2
0    3
1    4
2    5
dtype: int64
```

We concat the series that's same, let's concat the different sizes series.

In [94]:
```
import pandas as pd
sr_1 = pd.Series([0,1,2])
sr_2 = pd.Series([3,4,5,6,7,8])

concat_sr = pd.concat([sr_1,sr_2])
print(concat_sr)
```

```
0    0
1    1
2    2
0    3
1    4
2    5
3    6
4    7
5    8
dtype: int64
```

Let's use concat for DataFrame

Firstly we make two DataFrame for Concat with Dictionary.

In [95]:
```
df_1 = pd.DataFrame({'ID':[1,2,3,4],
                     'Name':['A','B','C','D'],
                     'Class':[5,6,7,8]})
df_2 = pd.DataFrame({'ID':[5,6,7,8],
                     'Name':['E','F','G','H'],
                     'Class':[9,10,11,12]})

print(df_1)
print(df_2)
```

```
   ID Name  Class
0   1    A      5
1   2    B      6
2   3    C      7
3   4    D      8
   ID Name  Class
0   5    E      9
1   6    F     10
2   7    G     11
3   8    H     12
```

Let's concat the both DataFrame

In [96]:
```
df_1 = pd.DataFrame({'ID':[1,2,3,4],
                     'Name':['A','B','C','D'],
                     'Class':[5,6,7,8]})
df_2 = pd.DataFrame({'ID':[5,6,7,8],
                     'Name':['E','F','G','H'],
                     'Class':[9,10,11,12]})

concat_df = pd.concat([df_1,df_2])
print(concat_df)
```

```
   ID Name  Class
0   1    A      5
1   2    B      6
2   3    C      7
3   4    D      8
0   5    E      9
1   6    F     10
2   7    G     11
3   8    H     12
```

If you want to change the position of DataFrame like suppose you want print df_2 above, then just switch there name in concat function.

We concat the both DataFrame but the index are not in sequence, they start from 0 when 2nd DataFrame start. If you want to solve that prolem then use ignore_index parameter.

ignore_index

- ignore_index parameter use for print the index sequence wise.
- arguments:{bool, default False}

In [97]:
```
df_1 = pd.DataFrame({'ID':[1,2,3,4],
                     'Name':['A','B','C','D'],
                     'Class':[5,6,7,8]})
df_2 = pd.DataFrame({'ID':[5,6,7,8],
                     'Name':['E','F','G','H'],
                     'Class':[9,10,11,12]})

concat_df = pd.concat([df_1,df_2],ignore_index = True)
print(concat_df)
```

```
   ID Name  Class
0   1    A      5
1   2    B      6
2   3    C      7
3   4    D      8
4   5    E      9
5   6    F     10
```

```
6   7    G     11
7   8    H     12
```

If you wan to concat() by column wise then use axis parameter.

axis

- axis parameter is used to concat the DataFrame, Series column wise.
- arguments:{0/'index', 1/'columns'}, default 0

In [98]:
```
df_1 = pd.DataFrame({'ID':[1,2,3,4],
                     'Name':['A','B','C','D'],
                     'Class':[5,6,7,8]})
df_2 = pd.DataFrame({'ID':[5,6,7,8],
                     'Name':['E','F','G','H'],
                     'Class':[9,10,11,12]})

concat_df = pd.concat([df_1,df_2],axis = 1)
print(concat_df)
```

```
   ID Name  Class  ID Name  Class
0   1    A      5   5    E      9
1   2    B      6   6    F     10
2   3    C      7   7    G     11
3   4    D      8   8    H     12
```

join

- It gives the unioun or intersection of DataFrames.
- arguments : {'inner', 'outer'}, default 'outer'
  - 'inner': Interection
  - 'outer': Union

In [99]:
```
df_1 = pd.DataFrame({'ID':[1,2,3,4],
                     'Name':['A','B','C','D'],
                     'Class':[5,6,7,8]})
df_2 = pd.DataFrame({'ID':[3,4],
                     'Name':['C','D'],
                     'Class':[7,8]})

concat_df = pd.concat([df_1,df_2],axis = 1 ,join = 'inner')
print(concat_df)
```

```
   ID Name  Class  ID Name  Class
0   1    A      5   3    C      7
1   2    B      6   4    D      8
```

It print only the union values, the there first values of 'ID' column is same.

keys

- With the help of keys parameter we can give the label to the DataFrame.
- arguments:{sequence, default None}

In [100…
```
df_1 = pd.DataFrame({'ID':[1,2,3,4],
                     'Name':['A','B','C','D'],
                     'Class':[5,6,7,8]})
df_2 = pd.DataFrame({'ID':[5,6,7,8],
                     'Name':['E','F','G','H'],
                     'Class':[9,10,11,12]})

concat_df = pd.concat([df_1,df_2],keys = ['First_df','Second_df'])
print(concat_df)
```

```
              ID Name  Class
First_df  0   1    A      5
          1   2    B      6
          2   3    C      7
          3   4    D      8
Second_df 0   5    E      9
          1   6    F     10
```

```
2   7    G     11
3   8    H     12
```

let's use with axis parameter.

In [101…
```
df_1 = pd.DataFrame({'ID':[1,2,3,4],
                     'Name':['A','B','C','D'],
                     'Class':[5,6,7,8]})
df_2 = pd.DataFrame({'ID':[5,6,7,8],
                     'Name':['E','F','G','H'],
                     'Class':[9,10,11,12]})

concat_df = pd.concat([df_1,df_2],axis = 1, keys = ['First_df','Second_df'])
print(concat_df)
```

```
  First_df            Second_df
        ID Name Class        ID Name Class
0        1    A     5         5    E     9
1        2    B     6         6    F    10
2        3    C     7         7    G    11
3        4    D     8         8    H    12
```

sort

- sort parameter used to concat the DataFrame of different columns.
- arguments:{ bool, default False}

In [102…
```
df_1 = pd.DataFrame({'ID':[1,2,3,4],
                     'Name':['A','B','C','D'],
                     'Class':[5,6,7,8]})
df_2 = pd.DataFrame({"Marks":[40,63,91,34]})

concat_df = pd.concat([df_1,df_2], sort = False )
print(concat_df)
```

```
    ID Name  Class  Marks
0  1.0    A    5.0    NaN
1  2.0    B    6.0    NaN
2  3.0    C    7.0    NaN
3  4.0    D    8.0    NaN
0  NaN  NaN    NaN   40.0
1  NaN  NaN    NaN   63.0
2  NaN  NaN    NaN   91.0
3  NaN  NaN    NaN   34.0
```

join()

- DataFrame join is a convenient method for combining the columns of two potentially differently-indexed.
- Syntax: DataFrame.join()

Parameters of join()

other,
on=None,
how='left',
lsuffix='',
rsuffix='',
sort=False

In [103…
```
# Create two DataFrame
df_1 = pd.DataFrame({'A':[1,2,3,],
                     'B':[10,20,30,]})
df_2 = pd.DataFrame({"C":[4,5,6],
                     'D':[40,50,60]})

# Join them by using join function

join_df = df_1.join(df_2)
```

```
print(join_df)
```

```
   A   B  C   D
0  1  10  4  40
1  2  20  5  50
2  3  30  6  60
```

To join the DataFrame it is required that the index must be same of the both DataFrame.

how

- **It print the all the values even if there are not similar values.**
- **arguments:{'left', 'right', 'outer', 'inner'}, default 'left'}**
  - **'left': It print all the values from left DataFrame**
  - **'right': It print all the values from right DataFrame**
  - **'outer': It print all the values from both DataFrame**
  - **'inner': It print only similar values.**

In [104…
```
df_1 = pd.DataFrame({'A':[1,2,3,],
                     'B':[10,20,30,]},
                     index = ['a','b','c'])

df_2 = pd.DataFrame({"C":[4,5],
                     'D':[40,50]},
                    index = ['a','b'])


join_df = df_1.join(df_2, how = 'right')

print(join_df)
```

```
   A   B  C   D
a  1  10  4  40
b  2  20  5  50
```

In [105…
```
df_1 = pd.DataFrame({'A':[1,2,3,],
                     'B':[10,20,30,]},
                     index = ['a','b','c'])

df_2 = pd.DataFrame({"C":[4,5],
                     'D':[40,50]},
                    index = ['a','b'])


join_df = df_1.join(df_2, how = 'inner')

print(join_df)
```

```
   A   B  C   D
a  1  10  4  40
b  2  20  5  50
```

lsuffix, rsuffix

- **This parameter is used to give the name of the Column if there are similar columns in DataFrame.**
- **lsuffix: To change the left DataFrame name.**
- **rsuffix: To change the right DataFrmae name**
- **arguments:{str, default ''}**

In [106…
```
df_1 = pd.DataFrame({'A':[1,2,3,],
                     'B':[10,20,30,]},
                     index = ['a','b','c'])

# We make a same columnn name 'A'
df_2 = pd.DataFrame({"A":[4,5],
                     'D':[40,50]},
                    index = ['a','b'])


join_df = df_1.join(df_2, lsuffix = '_1')

print(join_df)
```

```
   A_1   B    A     D
a    1  10  4.0  40.0
b    2  20  5.0  50.0
c    3  30  NaN   NaN
```

In [107…
```
df_1 = pd.DataFrame({'A':[1,2,3,],
                     'B':[10,20,30,]},
                     index = ['a','b','c'])

# We make a same columnn name 'A'
df_2 = pd.DataFrame({"A":[4,5],
                     'D':[40,50]},
                    index = ['a','b'])


join_df = df_1.join(df_2, rsuffix = '_1')

print(join_df)
```

```
   A   B  A_1     D
a  1  10  4.0  40.0
b  2  20  5.0  50.0
c  3  30  NaN   NaN
```

append()

- Pandas append function is used to append rows of other DataFrame to the end of the given DataFrame, returning a new DataFrame object.
- Syntax: DataFrame.append()

Parameters of append()

- other,
- ignore_index=False,
- verify_integrity=False,
- sort=False

In [108…
```
df_1 = pd.DataFrame({'A':[1,2,3,],
                     'B':[10,20,30]})

df_2 = pd.DataFrame({"A":[4,5,6],
                     'B':[40,50,60]})


append_df = df_1.append(df_2)

print(append_df)
```

```
   A   B
0  1  10
1  2  20
2  3  30
0  4  40
1  5  50
2  6  60
```

ignore_index

- ignore_index parameter use for print the index sequence wise.
- arguments:{bool, default False}

In [109…
```
df_1 = pd.DataFrame({'A':[1,2,3,],
                     'B':[10,20,30]})

df_2 = pd.DataFrame({"A":[4,5,6],
                     'B':[40,50,60]})


append_df = df_1.append(df_2, ignore_index = True)
```

```
print(append_df)
```

```
   A   B
0  1  10
1  2  20
2  3  30
3  4  40
4  5  50
5  6  60
```

sort

- **sort parameter used to concat the DataFrame of different columns.**
- **arguments:{ bool, default False}**

In [110…

```
df_1 = pd.DataFrame({'A':[1,2,3,],
                     'B':[10,20,30]})

df_2 = pd.DataFrame({"C":[4,5,6],
                     'B':[40,50,60]})


append_df = df_1.append(df_2, ignore_index = True, sort = False)

print(append_df)
```

```
     A   B    C
0  1.0  10  NaN
1  2.0  20  NaN
2  3.0  30  NaN
3  NaN  40  4.0
4  NaN  50  5.0
5  NaN  60  6.0
```

In [ ]: