In [2]:
```
# Concat

import pandas as pd
```

In [3]:
```
df1 = pd.DataFrame({
    "city" : ["delhi","mumbai","pune"],
    "temp": [40,35,30],
    "humidity": [60,65,70]
})
df1
```

Out[3]:

	city	temp	humidity
0	delhi	40	60
1	mumbai	35	65
2	pune	30	70

In [4]:
```
df2 = pd.DataFrame({
    "city" : ["new york","mumbai","banlore"],
    "temp": [50,45,40],
    "humidity": [70,75,60]
})
df2
```

Out[4]:

	city	temp	humidity
0	new york	50	70
1	mumbai	45	75
2	banlore	40	60

In [5]:
```
df3 = pd.DataFrame({
    "city" : ["new york","mumbai","banlore"],
    "temp": [70,35,30],
    "humidity": [30,25,10]
})
df3
```

Out[5]:

	city	temp	humidity
0	new york	70	30
1	mumbai	35	25
2	banlore	30	10

In [6]:
```
df = pd.concat([df1,df2,df3])
df
```

Out[6]:

	city	temp	humidity
0	delhi	40	60
1	mumbai	35	65
2	pune	30	70
0	new york	50	70
1	mumbai	45	75
2	banlore	40	60
0	new york	70	30
1	mumbai	35	25
2	banlore	30	10

In [7]:
```
df = pd.concat([df1,df2,df3],ignore_index=True)
df
```

Out[7]:

	city	temp	humidity
0	delhi	40	60
1	mumbai	35	65
2	pune	30	70
3	new york	50	70
4	mumbai	45	75
5	banlore	40	60
6	new york	70	30
7	mumbai	35	25
8	banlore	30	10

In [8]:
```
df = pd.concat([df1,df2,df3],ignore_index=True,axis=0)
df
```

Out[8]:

	city	temp	humidity
0	delhi	40	60
1	mumbai	35	65
2	pune	30	70
3	new york	50	70
4	mumbai	45	75
5	banlore	40	60
6	new york	70	30
7	mumbai	35	25
8	banlore	30	10

In [9]:
```
df = pd.concat([df1,df2,df3],axis=1) # columnn wise concat
df
```

Out[9]:

	city	temp	humidity	city	temp	humidity	city	temp	humidity
0	delhi	40	60	new york	50	70	new york	70	30
1	mumbai	35	65	mumbai	45	75	mumbai	35	25
2	pune	30	70	banlore	40	60	banlore	30	10

In [10]:
```
df = pd.concat([df1,df2,df3],ignore_index=True) # default row wise merge
df
```

Out[10]:

	city	temp	humidity
0	delhi	40	60
1	mumbai	35	65
2	pune	30	70
3	new york	50	70
4	mumbai	45	75
5	banlore	40	60
6	new york	70	30
7	mumbai	35	25
8	banlore	30	10

Time Series

In [11]:
```
# creating a DatetimeIndex from a list of strings
import warnings;
```

```
warnings.filterwarnings('ignore')

ls = ["25aug,2025","25th august, 2025","25-08-2025","25/08/2025"]
df_date = pd.to_datetime(ls)
df_date
```

Out[11]:
```
DatetimeIndex(['2025-08-25', '2025-08-25', '2025-08-25', '2025-08-25'], dtype
='datetime64[ns]', freq=None)
```

In [12]:
```
df_date[0].year
```

Out[12]:
```
2025
```

In [13]:
```
df_date[0].month
```

Out[13]:
```
8
```

In [14]:
```
df_date[0].day
```

Out[14]:
```
25
```

In [15]:
```
df_date[0].hour
```

Out[15]:
```
0
```

In [16]:
```
# timedelta
```

In [17]:
```
df_date + pd.Timedelta('-10 days 5 hours 10 minutes')
```

Out[17]:
```
DatetimeIndex(['2025-08-14 18:50:00', '2025-08-14 18:50:00',
               '2025-08-14 18:50:00', '2025-08-14 18:50:00'],
              dtype='datetime64[ns]', freq=None)
```

In [18]:
```
df_date + pd.Timedelta('+ 5 hours')
```

Out[18]:
```
DatetimeIndex(['2025-08-25 05:00:00', '2025-08-25 05:00:00',
               '2025-08-25 05:00:00', '2025-08-25 05:00:00'],
              dtype='datetime64[ns]', freq=None)
```

In [19]:
```
df_date + pd.Timedelta('+ 60 days')
```

Out[19]:
```
DatetimeIndex(['2025-10-24', '2025-10-24', '2025-10-24', '2025-10-24'], dtype
='datetime64[ns]', freq=None)
```

Date_range

freq

In [20]:
```
pd.date_range("2023-08-15","2025-08-25",freq='M')
```

Out[20]:
```
DatetimeIndex(['2023-08-31', '2023-09-30', '2023-10-31', '2023-11-30',
               '2023-12-31', '2024-01-31', '2024-02-29', '2024-03-31',
               '2024-04-30', '2024-05-31', '2024-06-30', '2024-07-31',
               '2024-08-31', '2024-09-30', '2024-10-31', '2024-11-30',
               '2024-12-31', '2025-01-31', '2025-02-28', '2025-03-31',
               '2025-04-30', '2025-05-31', '2025-06-30', '2025-07-31'],
              dtype='datetime64[ns]', freq='ME')
```

In [21]:
```
pd.date_range("2023-08-15","2025-08-25",freq='Y')
```

Out[21]:
```
DatetimeIndex(['2023-12-31', '2024-12-31'], dtype='datetime64[ns]', freq='YE-DE
C')
```

In [22]:
```
pd.date_range("2023-08-15","2025-08-25",freq='D')
```

Out[22]:
```
DatetimeIndex(['2023-08-15', '2023-08-16', '2023-08-17', '2023-08-18',
               '2023-08-19', '2023-08-20', '2023-08-21', '2023-08-22',
               '2023-08-23', '2023-08-24',
               ...
               '2025-08-16', '2025-08-17', '2025-08-18', '2025-08-19',
               '2025-08-20', '2025-08-21', '2025-08-22', '2025-08-23',
               '2025-08-24', '2025-08-25'],
              dtype='datetime64[ns]', length=742, freq='D')
```

periods

In [23]:
```
pd.date_range("2025-08-15",periods=5)
```

Out[23]:
```
DatetimeIndex(['2025-08-15', '2025-08-16', '2025-08-17', '2025-08-18',
               '2025-08-19'],
              dtype='datetime64[ns]', freq='D')
```

In [24]:
```
pd.date_range("2025-08-15",periods=5,freq="Y")
```

Out[24]:
```
DatetimeIndex(['2025-12-31', '2026-12-31', '2027-12-31', '2028-12-31',
               '2029-12-31'],
              dtype='datetime64[ns]', freq='YE-DEC')
```

In [25]:
```
pd.date_range("2025-08-15",periods=5,freq="M")
```

Out[25]:
```
DatetimeIndex(['2025-08-31', '2025-09-30', '2025-10-31', '2025-11-30',
               '2025-12-31'],
              dtype='datetime64[ns]', freq='ME')
```

In [26]:
```
pd.date_range("2025-08-15",periods=5,freq="H")
```

Out[26]:
```
DatetimeIndex(['2025-08-15 00:00:00', '2025-08-15 01:00:00',
               '2025-08-15 02:00:00', '2025-08-15 03:00:00',
               '2025-08-15 04:00:00'],
              dtype='datetime64[ns]', freq='h')
```

In [28]:
```
## load dataset
```

In [27]:
```
air = pd.read_csv("air_quality_no2.csv")
```

In [33]:
```
air.tail(20)
```

Out[33]:

	datetime	station_antwerp	station_paris	station_london
1015	2019-06-18 09:00:00	NaN	52.6	NaN
1016	2019-06-18 10:00:00	NaN	49.6	NaN
1017	2019-06-18 21:00:00	NaN	15.3	NaN
1018	2019-06-18 22:00:00	NaN	17.0	NaN
1019	2019-06-18 23:00:00	NaN	23.1	NaN
1020	2019-06-19 00:00:00	NaN	39.3	NaN
1021	2019-06-19 11:00:00	NaN	27.3	NaN
1022	2019-06-19 12:00:00	NaN	26.6	NaN
1023	2019-06-20 15:00:00	NaN	19.4	NaN
1024	2019-06-20 16:00:00	NaN	20.1	NaN
1025	2019-06-20 17:00:00	NaN	19.3	NaN
1026	2019-06-20 18:00:00	NaN	19.0	NaN
1027	2019-06-20 19:00:00	NaN	23.2	NaN
1028	2019-06-20 20:00:00	NaN	23.9	NaN
1029	2019-06-20 21:00:00	NaN	25.3	NaN
1030	2019-06-20 22:00:00	NaN	21.4	NaN
1031	2019-06-20 23:00:00	NaN	24.9	NaN
1032	2019-06-21 00:00:00	NaN	26.5	NaN
1033	2019-06-21 01:00:00	NaN	21.8	NaN
1034	2019-06-21 02:00:00	NaN	20.0	NaN

In [ ]: