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Section: CPE22S3

```
import pandas as pd

df = pd.read_csv('/content/nyc_temperatures.csv')
df.head()
```

	date	datatype	station	attributes	value
0	2018-10-01T00:00:00	TAVG	GHCND:USW00014732	H,,S,	21.2
1	2018-10-01T00:00:00	TMAX	GHCND:USW00014732	,,W,2400	25.6
2	2018-10-01T00:00:00	TMIN	GHCND:USW00014732	,,W,2400	18.3
3	2018-10-02T00:00:00	TAVG	GHCND:USW00014732	H,,S,	22.7
4	2018-10-02T00:00:00	TMAX	GHCND:USW00014732	,,W,2400	26.1

Next steps: View recommended plots

```
df.columns
```

```
Index(['date', 'datatype', 'station', 'attributes', 'value'], dtype='object')
```

```
df.rename(
    columns ={
        'value' : 'temp_C',
        'attributes' : 'flags'
    }, inplace = True
)
```

```
df.columns
```

```
Index(['date', 'datatype', 'station', 'flags', 'temp_C'], dtype='object')
```

```
df.rename(str.upper, axis ='columns'). columns
```

```
Index(['DATE', 'DATATYPE', 'STATION', 'FLAGS', 'TEMP_C'], dtype='object')
```

```
df.dtypes
```

```
date         object
datatype     object
```

```
     station      object
     flags        object
     temp_C      float64
     dtype: object
```

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```
df.loc[:,'date'] = pd.to_datetime(df.date)
df.dtypes
```

```
     <ipython-input-13-80606e5f8dec>:1: DeprecationWarning: In a future version, `df.iloc[:, i] = newvals` will attempt to set the values inplace instead of always setting
       df.loc[:,'date'] = pd.to_datetime(df.date)
     date        datetime64[ns]
     datatype            object
     station             object
     flags               object
     temp_C             float64
     dtype: object
```

```
df.date.describe()
```

```
     <ipython-input-16-f7d3fa946723>:1: FutureWarning: Treating datetime data as categorical rather than numeric in `.describe` is deprecated and will be removed in a futur
       df.date.describe()
     count                       93
     unique                      31
     top       2018-10-01 00:00:00
     freq                         3
     first     2018-10-01 00:00:00
     last      2018-10-31 00:00:00
     Name: date, dtype: object
```

```
pd.date_range(start='2018-10-25', periods=2, freq='D').tz_localize("EST")
```

```
     DatetimeIndex(['2018-10-25 00:00:00-05:00', '2018-10-26 00:00:00-05:00'], dtype='datetime64[ns, EST]', freq=None)
```

```
eastern = pd.read_csv(
    '/content/nyc_temperatures.csv', index_col = 'date', parse_dates = True
).tz_localize('EST')
eastern.head()
```

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	datatype	station	attributes	value
date				
2018-10-01 00:00:00-05:00	TAVG	GHCND:USW00014732	H,,S,	21.2
2018-10-01 00:00:00-05:00	TMAX	GHCND:USW00014732	,,W,2400	25.6
2018-10-01 00:00:00-05:00	TMIN	GHCND:USW00014732	,,W,2400	18.3
2018-10-02 00:00:00-05:00	TAVG	GHCND:USW00014732	H,,S,	22.7
2018-10-02 00:00:00-05:00	TMAX	GHCND:USW00014732	,,W,2400	26.1

Next steps: View recommended plots

```
eastern.tz_convert('UTC').head()
```

	datatype	station	attributes	value
date				
2018-10-01 05:00:00+00:00	TAVG	GHCND:USW00014732	H,,S,	21.2
2018-10-01 05:00:00+00:00	TMAX	GHCND:USW00014732	,,W,2400	25.6
2018-10-01 05:00:00+00:00	TMIN	GHCND:USW00014732	,,W,2400	18.3
2018-10-02 05:00:00+00:00	TAVG	GHCND:USW00014732	H,,S,	22.7
2018-10-02 05:00:00+00:00	TMAX	GHCND:USW00014732	,,W,2400	26.1

```
eastern.to_period('M').index
```

```
<ipython-input-30-34a82283fe40>:1: UserWarning: Converting to PeriodArray/Index representation will drop timezone information.
  eastern.to_period('M').index
PeriodIndex(['2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10', '2018-10', '2018-10', '2018-10',
             '2018-10', '2018-10', '2018-10'],
            dtype='period[M]', name='date')
```

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```
eastern.to_period('M').to_timestamp().index
```

```
     <ipython-input-31-22abc5f95bfc>:1: UserWarning: Converting to PeriodArray/Index representation will drop timezone information.
       eastern.to_period('M').to_timestamp().index
     DatetimeIndex(['2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01', '2018-10-01', '2018-10-01', '2018-10-01',
                    '2018-10-01'],
                   dtype='datetime64[ns]', name='date', freq=None)
```

```
df = pd.read_csv('/content/nyc_temperatures.csv').rename(
    columns={
        'value' : 'temp_C',
        'attributes' : 'flags'
    }
)

new_df = df.assign(
    date=pd.to_datetime(df.date),
    temp_F=(df.temp_C * 9/5) + 32
)
new_df.dtypes
```

```
     date        datetime64[ns]
     datatype            object
     station             object
     flags               object
     temp_C             float64
```

```
    temp_F              float64
    dtype: object
```

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```
new_df.head()
```

	date	datatype	station	flags	temp_C	temp_F
0	2018-10-01	TAVG	GHCND:USW00014732	H,,S,	21.2	70.16
1	2018-10-01	TMAX	GHCND:USW00014732	,,W,2400	25.6	78.08
2	2018-10-01	TMIN	GHCND:USW00014732	,,W,2400	18.3	64.94
3	2018-10-02	TAVG	GHCND:USW00014732	H,,S,	22.7	72.86
4	2018-10-02	TMAX	GHCND:USW00014732	,,W,2400	26.1	78.98

Next steps: View recommended plots

```
df = df.assign(
    date = pd.to_datetime(df.date),
    temp_C_whole = df.temp_C.astype('int'),
    temp_F = (df.temp_C * 9/5) + 32,
    temp_F_whole = lambda x: x.temp_F.astype('int')
)

df.head()
```

	date	datatype	station	flags	temp_C	temp_C_whole	temp_F	temp_F_whole
0	2018-10-01	TAVG	GHCND:USW00014732	H,,S,	21.2	21	70.16	70
1	2018-10-01	TMAX	GHCND:USW00014732	,,W,2400	25.6	25	78.08	78
2	2018-10-01	TMIN	GHCND:USW00014732	,,W,2400	18.3	18	64.94	64
3	2018-10-02	TAVG	GHCND:USW00014732	H,,S,	22.7	22	72.86	72
4	2018-10-02	TMAX	GHCND:USW00014732	,,W,2400	26.1	26	78.98	78

Next steps: View recommended plots

```
df_with_categories = df.assign(
    station = df.station.astype('category'),
    datatype = df.datatype.astype('category')
)
df_with_categories.dtypes
```

```
    date              datetime64[ns]
    datatype                category
```

```
station                category
flags                    object
temp_C                  float64
temp_C_whole              int64
temp_F                  float64
temp_F_whole              int64
dtype: object
```

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```
pd.Categorical(
    ['med', 'med', 'low', 'high'],
    categories = ['low' , 'med', 'high'],
    ordered = True
)
```

```
['med', 'med', 'low', 'high']
Categories (3, object): ['low' < 'med' < 'high']
```

```
df.sort_values(by='temp_C', ascending = False).head(10)
```

	date	datatype	station	flags	temp_C	temp_C_whole	temp_F	temp_F_whole
19	2018-10-07	TMAX	GHCND:USW00014732	,,W,2400	27.8	27	82.04	82
28	2018-10-10	TMAX	GHCND:USW00014732	,,W,2400	27.8	27	82.04	82
31	2018-10-11	TMAX	GHCND:USW00014732	,,W,2400	26.7	26	80.06	80
4	2018-10-02	TMAX	GHCND:USW00014732	,,W,2400	26.1	26	78.98	78
10	2018-10-04	TMAX	GHCND:USW00014732	,,W,2400	26.1	26	78.98	78
25	2018-10-09	TMAX	GHCND:USW00014732	,,W,2400	25.6	25	78.08	78
1	2018-10-01	TMAX	GHCND:USW00014732	,,W,2400	25.6	25	78.08	78
7	2018-10-03	TMAX	GHCND:USW00014732	,,W,2400	25.0	25	77.00	77
27	2018-10-10	TAVG	GHCND:USW00014732	H,,S,	23.8	23	74.84	74
30	2018-10-11	TAVG	GHCND:USW00014732	H,,S,	23.4	23	74.12	74

```
df.sort_values(by=['temp_C', 'date'], ascending = False).head(10)
```

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	date	datatype	station	flags	temp_C	temp_C_whole	temp_F	temp_F_whole
28	2018-10-10	TMAX	GHCND:USW			27	82.04	82
19	2018-10-07	TMAX	GHCND:USW00014732	,,W,2400	27.8	27	82.04	82
31	2018-10-11	TMAX	GHCND:USW00014732	,,W,2400	26.7	26	80.06	80
10	2018-10-04	TMAX	GHCND:USW00014732	,,W,2400	26.1	26	78.98	78
4	2018-10-02	TMAX	GHCND:USW00014732	,,W,2400	26.1	26	78.98	78
25	2018-10-09	TMAX	GHCND:USW00014732	,,W,2400	25.6	25	78.08	78
1	2018-10-01	TMAX	GHCND:USW00014732	,,W,2400	25.6	25	78.08	78
7	2018-10-03	TMAX	GHCND:USW00014732	,,W,2400	25.0	25	77.00	77
27	2018-10-10	TAVG	GHCND:USW00014732	H,,S,	23.8	23	74.84	74
30	2018-10-11	TAVG	GHCND:USW00014732	H,,S,	23.4	23	74.12	74

```
df.nlargest(n=5, columns = 'temp_C')
```

	date	datatype	station	flags	temp_C	temp_C_whole	temp_F	temp_F_whole
19	2018-10-07	TMAX	GHCND:USW00014732	,,W,2400	27.8	27	82.04	82
28	2018-10-10	TMAX	GHCND:USW00014732	,,W,2400	27.8	27	82.04	82
31	2018-10-11	TMAX	GHCND:USW00014732	,,W,2400	26.7	26	80.06	80
4	2018-10-02	TMAX	GHCND:USW00014732	,,W,2400	26.1	26	78.98	78
10	2018-10-04	TMAX	GHCND:USW00014732	,,W,2400	26.1	26	78.98	78

```
df.nsmallest(n=5, columns = ['temp_C', 'date'])
```

	date	datatype	station	flags	temp_C	temp_C_whole	temp_F	temp_F_whole
65	2018-10-22	TMIN	GHCND:USW00014732	,,W,2400	5.6	5	42.08	42
77	2018-10-26	TMIN	GHCND:USW00014732	,,W,2400	5.6	5	42.08	42
62	2018-10-21	TMIN	GHCND:USW00014732	,,W,2400	6.1	6	42.98	42
74	2018-10-25	TMIN	GHCND:USW00014732	,,W,2400	6.1	6	42.98	42
53	2018-10-18	TMIN	GHCND:USW00014732	,,W,2400	6.7	6	44.06	44

```
df.sample(5, random_state = 0).index
```

```
    Int64Index([2, 30, 55, 16, 13], dtype='int64')
```

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```
df.sample(5, random_state = 0).sort_index
```

```
    Int64Index([2, 13, 16, 30, 55], dtype='int64')
```

```
df.sort_index(axis=1).head()
```

	datatype	date	flags	station	temp_C	temp_C_whole	temp_F	temp_F_whole
0	TAVG	2018-10-01	H,,S,	GHCND:USW00014732	21.2	21	70.16	70
1	TMAX	2018-10-01	,,W,2400	GHCND:USW00014732	25.6	25	78.08	78
2	TMIN	2018-10-01	,,W,2400	GHCND:USW00014732	18.3	18	64.94	64
3	TAVG	2018-10-02	H,,S,	GHCND:USW00014732	22.7	22	72.86	72
4	TMAX	2018-10-02	,,W,2400	GHCND:USW00014732	26.1	26	78.98	78

```
df.sort_index(axis=1).head().loc[:,'temp_C': 'temp_F_whole']
```

	temp_C	temp_C_whole	temp_F	temp_F_whole
0	21.2	21	70.16	70
1	25.6	25	78.08	78
2	18.3	18	64.94	64
3	22.7	22	72.86	72
4	26.1	26	78.98	78

```
df.equals(df.sort_values(by='temp_C'))
```

```
    False
```

```
df.equals(df.sort_values(by='temp_C').sort_index())
```

```
    True
```

```
df[df.datatype == 'TAVG'].head().reset_index()
```

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	index	date	datatype	station	flags	temp_C	temp_C_whole	temp_F	temp_F_whole
0	0	2018-10-01	TAVG	GHCN		1.2	21	70.16	70
1	3	2018-10-02	TAVG	GHCND:USW00014732	H,,S,	22.7	22	72.86	72
2	6	2018-10-03	TAVG	GHCND:USW00014732	H,,S,	21.8	21	71.24	71
3	9	2018-10-04	TAVG	GHCND:USW00014732	H,,S,	21.3	21	70.34	70
4	12	2018-10-05	TAVG	GHCND:USW00014732	H,,S,	20.3	20	68.54	68

```
df.set_index('date', inplace=True)
df.head()
```

	datatype	station	flags	temp_C	temp_C_whole	temp_F	temp_F_whole
date							
2018-10-01	TAVG	GHCND:USW00014732	H,,S,	21.2	21	70.16	70
2018-10-01	TMAX	GHCND:USW00014732	,,W,2400	25.6	25	78.08	78
2018-10-01	TMIN	GHCND:USW00014732	,,W,2400	18.3	18	64.94	64
2018-10-02	TAVG	GHCND:USW00014732	H,,S,	22.7	22	72.86	72
2018-10-02	TMAX	GHCND:USW00014732	,,W,2400	26.1	26	78.98	78

Next steps: View recommended plots

```
df['2018-10-11' : '2018-10-12']
```

	datatype	station	flags	temp_C	temp_C_whole	temp_F	temp_F_whole
date							
2018-10-11	TAVG	GHCND:USW00014732	H,,S,	23.4	23	74.12	74
2018-10-11	TMAX	GHCND:USW00014732	,,W,2400	26.7	26	80.06	80
2018-10-11	TMIN	GHCND:USW00014732	,,W,2400	21.7	21	71.06	71
2018-10-12	TAVG	GHCND:USW00014732	H,,S,	18.3	18	64.94	64
2018-10-12	TMAX	GHCND:USW00014732	,,W,2400	22.2	22	71.96	71
2018-10-12	TMIN	GHCND:USW00014732	,,W,2400	12.2	12	53.96	53

```
sp = pd.read_csv(
    '/content/sp500.csv', index_col = 'date' , parse_dates = True
).drop(columns=['adj_close'])

sp.head(10).assign(
    day_of_week=lambda x: x.index.day_name()
)
```

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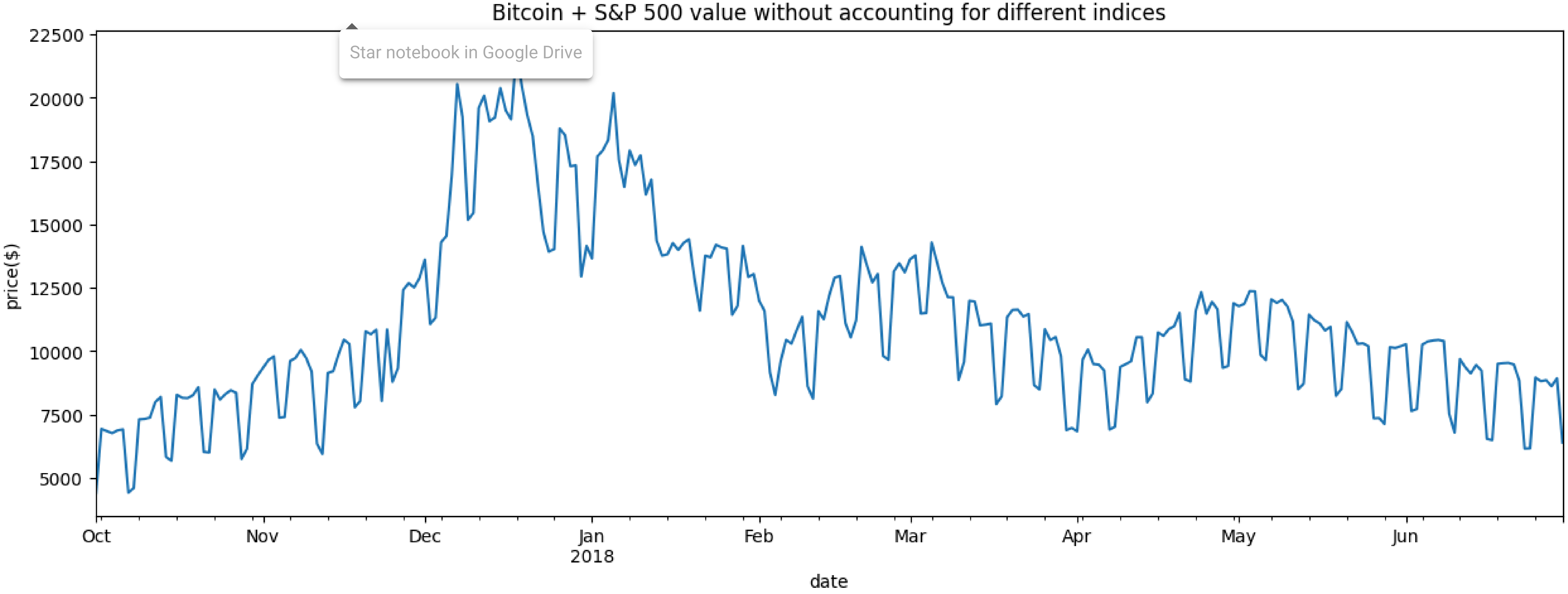
date	high	low	open	close	volume	day_of_week
2017-01-03	2263.879883	2245.129883	2251.570068	2257.830078	3770530000	Tuesday
2017-01-04	2272.820068	2261.600098	2261.600098	2270.750000	3764890000	Wednesday
2017-01-05	2271.500000	2260.449951	2268.179932	2269.000000	3761820000	Thursday
2017-01-06	2282.100098	2264.060059	2271.139893	2276.979980	3339890000	Friday
2017-01-09	2275.489990	2268.899902	2273.590088	2268.899902	3217610000	Monday
2017-01-10	2279.270020	2265.270020	2269.719971	2268.899902	3638790000	Tuesday
2017-01-11	2275.320068	2260.830078	2268.600098	2275.320068	3620410000	Wednesday
2017-01-12	2271.780029	2254.250000	2271.139893	2270.439941	3462130000	Thursday
2017-01-13	2278.679932	2271.510010	2272.739990	2274.639893	3081270000	Friday
2017-01-17	2272.080078	2262.810059	2269.139893	2267.889893	3584990000	Tuesday

```
bitcoin = pd.read_csv(
    '/content/bitcoin.csv', index_col='date', parse_dates = True
).drop(columns=['market_cap'])

#every day's closing price = S&P 500 close + Bitcoin close (same for other metrics)
portfolio = pd.concat(
    [sp,bitcoin], sort = False
).groupby(pd.Grouper(freq='D')).sum()

portfolio.head(10).assign(
    day_of_week=lambda x: x.index.day_name()
)
```

	high	low	open	close	volume	day_of_week
date						
2017-01-01	1003.080000	958.700000	963.660000	998.330000	147775008	Sunday
2017-01-02	1031.390000	996.700000	998.620000	1021.750000	222184992	Monday
2017-01-03	3307.959883	3266.729883	3273.170068	3301.670078	3955698000	Tuesday
2017-01-04	3432.240068	3306.000098	3306.000098	3425.480000	4109835984	Wednesday
2017-01-05	3462.600000	3170.869951	3424.909932	3282.380000	4272019008	Thursday
2017-01-06	3328.910098	3148.000059	3285.379893	3179.179980	3691766000	Friday
2017-01-07	908.590000	823.560000	903.490000	908.590000	279550016	Saturday
2017-01-08	942.720000	887.250000	908.170000	911.200000	158715008	Sunday
2017-01-09	3189.179990	3148.709902	3186.830088	3171.729902	3359486992	Monday
2017-01-10	3194.140020	3166.330020	3172.159971	3176.579902	3754598000	Tuesday

```
import matplotlib.pyplot as plt #we use this module for plotting
```

```
portfolio['2017-Q4':'2018-Q2'].plot(
    y='close', figsize = (15,5), legend=False,
    title = 'Bitcoin + S&P 500 value without accounting for different indices'
)#PLOT the closing price from Q4 2017 through Q2 2018
plt.ylabel('price($)')#label the Y-Axis
plt.show()#SHOW the plot
```



```
sp.reindex(bitcoin.index).head(10).assign(
    day_of_week=lambda x: x.index.day_name()
)
```

	high	low	open	close	volume	day_of_week
date						
2017-01-01	NaN	NaN	NaN	NaN	NaN	Sunday
2017-01-02	NaN	NaN	NaN	NaN	NaN	Monday
2017-01-03	2263.879883	2245.129883	2251.570068	2257.830078	3.770530e+09	Tuesday
2017-01-04	2272.820068	2261.600098	2261.600098	2270.750000	3.764890e+09	Wednesday
2017-01-05	2271.500000	2260.449951	2268.179932	2269.000000	3.761820e+09	Thursday
2017-01-06	2282.100098	2264.060059	2271.139893	2276.979980	3.339890e+09	Friday
2017-01-07	NaN	NaN	NaN	NaN	NaN	Saturday
2017-01-08	NaN	NaN	NaN	NaN	NaN	Sunday
2017-01-09	2275.489990	2268.899902	2273.590088	2268.899902	3.217610e+09	Monday
2017-01-10	2279.270020	2265.270020	2269.719971	2268.899902	3.638790e+09	Tuesday

```
sp.reindex(
    bitcoin.index, method ='ffill'
).head(10).assign(
    day_of_week=lambda x: x.index.day_name()
)
```

	high	low	open	close	volume	day_of_week
date						
2017-01-01	NaN	NaN	NaN	NaN	NaN	Sunday
2017-01-02	NaN	NaN	NaN	NaN	NaN	Monday
2017-01-03	2263.879883	2245.129883	2251.570068	2257.830078	3.770530e+09	Tuesday
2017-01-04	2272.820068	2261.600098	2261.600098	2270.750000	3.764890e+09	Wednesday
2017-01-05	2271.500000	2260.449951	2268.179932	2269.000000	3.761820e+09	Thursday
2017-01-06	2282.100098	2264.060059	2271.139893	2276.979980	3.339890e+09	Friday
2017-01-07	2282.100098	2264.060059	2271.139893	2276.979980	3.339890e+09	Saturday
2017-01-08	2282.100098	2264.060059	2271.139893	2276.979980	3.339890e+09	Sunday
2017-01-09	2275.489990	2268.899902	2273.590088	2268.899902	3.217610e+09	Monday
2017-01-10	2279.270020	2265.270020	2269.719971	2268.899902	3.638790e+09	Tuesday

Star notebook in Google Drive

```
import numpy as np

sp_reindexed = sp.reindex(
    bitcoin.index
).assign(
    volume = lambda x: x.volume.fillna(0), #Put 0 when market is cl osed
    close = lambda x: x.close.fillna(method='ffill'), #Carry this forward
    #take the closing price if these aren't avaiable
    open = lambda x: np.where(x.open.isnull(), x.close, x.open),
    high = lambda x: np.where(x.high.isnull(), x.close, x.high),
    low = lambda x: np.where(x.low.isnull(), x.close, x.low)

)
sp_reindexed.head(10).assign(
    day_of_week = lambda x: x.index.day_name()
)
```

	high	low	open	close	volume	day_of_week
date						
2017-01-01	NaN	NaN	NaN	NaN	0.000000e+00	Sunday
2017-01-02	NaN	NaN	NaN	NaN	0.000000e+00	Monday
2017-01-03	2263.879883	2245.129883	2251.570068	2257.830078	3.770530e+09	Tuesday
2017-01-04	2272.820068	2261.600098	2261.600098	2270.750000	3.764890e+09	Wednesday
2017-01-05	2271.500000	2260.449951	2268.179932	2269.000000	3.761820e+09	Thursday