Hands-on Activity 8.5 Aggregating Pandas DataFrames

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Section: CPE22S3

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```
import numpy as np
import pandas as pd
fb = pd.read_csv('/content/fb_2018.csv', index_col='date', parse_dates=True).assign(
 trading_volume=lambda x: pd.cut(x.volume, bins=3, labels=['low', 'med', 'high'])
) #assign new column for trading volume into low, medium, high bins
fb.head()
```

	open	high	low	close	volume	trading_volume
date						
2018-01-02	177.68	181.58	177.5500	181.42	18151903	low
2018-01-03	181.88	184.78	181.3300	184.67	16886563	low
2018-01-04	184.90	186.21	184.0996	184.33	13880896	low
2018-01-05	185.59	186.90	184.9300	186.85	13574535	low
2018-01-08	187.20	188.90	186.3300	188.28	17994726	low

Next steps: View recommended plots

```
fb['2018-10-11':'2018-10-15']
```

	open	high	low	close	volume	trading_volume
date						
2018-10-11	150.13	154.81	149.1600	153.35	35338901	low
2018-10-12	156.73	156.89	151.2998	153.74	25293492	low
2018-10-15	153.32	155.57	152.5500	153.52	15433521	low

```
fb['2018-q1'].equals(fb['2018-01':'2018-03'])
```

```
<ipython-input-3-f01e3c270a70>:1: FutureWarning: Indexing a DataFrame with a datetimelike index using a single string to slice the rows, like `frame[string]`, is deprecated and will be removed in a future version. Use `frame.loc[string]` instead.
  fb['2018-q1'].equals(fb['2018-01':'2018-03'])
True
```

```
fb.first('1W')
```

	open	high	low	close	volume	trading_volume
date						
2018-01-02	177.68	181.58	177.5500	181.42	18151903	low
2018-01-03	181.88	184.78	181.3300	184.67	16886563	low
2018-01-04	184.90	186.21	184.0996	184.33	13880896	low
2018-01-05	185.59	186.90	184.9300	186.85	13574535	low

```
fb.last('1W')
```

	open	high	low	close	volume	trading_volume
date						
2018-12-31	134.45	134.64	129.95	131.09	24625308	low

```
stock_data_per_minute = pd.read_csv(
 '/content/fb_week_of_may_20_per_minute.csv', index_col='date', parse_dates=True,
 date_parser=lambda x: pd.to_datetime(x, format='%Y-%m-%d %H-%M')
)
stock_data_per_minute.head()
```

	open	high	low	close	volume
date					
2019-05-20 09:30:00	181.6200	181.6200	181.6200	181.6200	159049.0
2019-05-20 09:31:00	182.6100	182.6100	182.6100	182.6100	468017.0
2019-05-20 09:32:00	182.7458	182.7458	182.7458	182.7458	97258.0
2019-05-20 09:33:00	182.9500	182.9500	182.9500	182.9500	43961.0
2019-05-20 09:34:00	183.0600	183.0600	183.0600	183.0600	79562.0

Next steps: View recommended plots

```
stock_data_per_minute.groupby(pd.Grouper(freq='1D')).agg({ #grouping stock data by day and aggregate columns
 'open': 'first',
 'high': 'max',
 'low': 'min',
 'close': 'last',
 'volume': 'sum'
})
```

	open	high	low	close	volume
date					
2019-05-20	181.62	184.1800	181.6200	182.72	10044838.0
2019-05-21	184.53	185.5800	183.9700	184.82	7198405.0
2019-05-22	184.81	186.5603	184.0120	185.32	8412433.0
2019-05-23	182.50	183.7300	179.7559	180.87	12479171.0
2019-05-24	182.33	183.5227	181.0400	181.06	7686030.0

```
stock_data_per_minute.at_time('9:30')
```

	open	high	low	close	volume
date					
2019-05-20 09:30:00	181.62	181.62	181.62	181.62	159049.0
2019-05-21 09:30:00	184.53	184.53	184.53	184.53	58171.0
2019-05-22 09:30:00	184.81	184.81	184.81	184.81	41585.0
2019-05-23 09:30:00	182.50	182.50	182.50	182.50	121930.0
2019-05-24 09:30:00	182.33	182.33	182.33	182.33	52681.0

```
stock_data_per_minute.between_time('15:59', '16:00')
```

	open	high	low	close	volume
date					
2019-05-20 15:59:00	182.915	182.915	182.915	182.915	134569.0
2019-05-20 16:00:00	182.720	182.720	182.720	182.720	1113672.0
2019-05-21 15:59:00	184.840	184.840	184.840	184.840	61606.0
2019-05-21 16:00:00	184.820	184.820	184.820	184.820	801080.0
2019-05-22 15:59:00	185.290	185.290	185.290	185.290	96099.0
2019-05-22 16:00:00	185.320	185.320	185.320	185.320	1220993.0
2019-05-23 15:59:00	180.720	180.720	180.720	180.720	109648.0
2019-05-23 16:00:00	180.870	180.870	180.870	180.870	1329217.0
2019-05-24 15:59:00	181.070	181.070	181.070	181.070	52994.0
2019-05-24 16:00:00	181.060	181.060	181.060	181.060	764906.0

```
shares_traded_in_first_30_min = stock_data_per_minute\ #calculate the average in first 30 min
 .between_time('9:30', '10:00')\
 .groupby(pd.Grouper(freq='1D'))\
 .filter(lambda x: (x.volume > 0).all())\
 .volume.mean()
shares_traded_in_last_30_min = stock_data_per_minute\ #calculate the average in last 30 min
 .between_time('15:30', '16:00')\
 .groupby(pd.Grouper(freq='1D'))\
 .filter(lambda x: (x.volume > 0).all())\
 .volume.mean()
shares_traded_in_first_30_min - shares_traded_in_last_30_min #calculate the difference in first 30 min
```

```
18592.967741935485
```

```
pd.DataFrame(
 dict(before=stock_data_per_minute.index, after=stock_data_per_minute.index.normalize())
).head()
```

	before	after
0	2019-05-20 09:30:00	2019-05-20
1	2019-05-20 09:31:00	2019-05-20
2	2019-05-20 09:32:00	2019-05-20
3	2019-05-20 09:33:00	2019-05-20
4	2019-05-20 09:34:00	2019-05-20

```
stock_data_per_minute.index.to_series().dt.normalize().head()
```

```
date
2019-05-20 09:30:00   2019-05-20
2019-05-20 09:31:00   2019-05-20
2019-05-20 09:32:00   2019-05-20
2019-05-20 09:33:00   2019-05-20
2019-05-20 09:34:00   2019-05-20
Name: date, dtype: datetime64[ns]
```

```
fb.assign( #assign new columns
 prior_close=lambda x: x.close.shift(),
 after_hours_change_in_price=lambda x: x.open - x.prior_close,
 abs_change=lambda x: x.after_hours_change_in_price.abs()
).nlargest(5, 'abs_change') #selects largest 5 rows
```

	open	high	low	close	volume	trading_volume	prior_close	after_hours_change_in_price	abs_change
date									
2018-07-26	174.89	180.13	173.75	176.26	169803668	high	217.50	-42.61	42.61
2018-04-26	173.22	176.27	170.80	174.16	77556934	med	159.69	13.53	13.53
2018-01-12	178.06	181.48	177.40	179.37	77551299	med	187.77	-9.71	9.71
2018-10-31	155.00	156.40	148.96	151.79	60101251	low	146.22	8.78	8.78
2018-03-19	177.01	177.17	170.06	172.56	88140060	med	185.09	-8.08	8.08

```
pd.date_range('2018-01-01', freq='D', periods=5) + pd.Timedelta('9 hours 30 minutes')
```

```
DatetimeIndex(['2018-01-01 09:30:00', '2018-01-02 09:30:00',
               '2018-01-03 09:30:00', '2018-01-04 09:30:00',
               '2018-01-05 09:30:00'],
              dtype='datetime64[ns]', freq='D')
```

```
fb['2018-09'].first_valid_index()
```

```
<ipython-input-15-d8ca41528993>:1: FutureWarning: Indexing a DataFrame with a datetimelike index using a single string to slice the rows, like `frame[string]`, is deprecated and will be removed in a future version. Use `frame.loc[string]` instead.
  fb['2018-09'].first_valid_index()
Timestamp('2018-09-04 00:00:00')
```

```
fb['2018-09'].last_valid_index()
```

```
<ipython-input-16-ef6e024573c9>:1: FutureWarning: Indexing a DataFrame with a datetimelike index using a single string to slice the rows, like `frame[string]`, is deprecated and will be removed in a future version. Use `frame.loc[string]` instead.
  fb['2018-09'].last_valid_index()
Timestamp('2018-09-28 00:00:00')
```

```
fb.index('2018-09-30')
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-21-69740c75b74a> in <cell line: 1>()
----> 1 fb.index('2018-09-30')

TypeError: 'DatetimeIndex' object is not callable
```

```
fb.asof('2018-09-30')
```

```
open                168.33
high                168.79
low                 162.56
close               164.46
volume            34265638
trading_volume         low
Name: 2018-09-30 00:00:00, dtype: object
```

```
(
 fb.drop(columns='trading_volume')
 - fb.drop(columns='trading_volume').shift()
).equals(
 fb.drop(columns='trading_volume').diff()
)
```

```
True
```

```
fb.drop(columns='trading_volume').diff().head()
```

date	open	high	low	close	volume
2018-01-02	NaN	NaN	NaN	NaN	NaN
2018-01-03	4.20	3.20	3.7800	3.25	-1265340.0
2018-01-04	3.02	1.43	2.7696	-0.34	-3005667.0
2018-01-05	0.69	0.69	0.8304	2.52	-306361.0
2018-01-08	1.61	2.00	1.4000	1.43	4420191.0

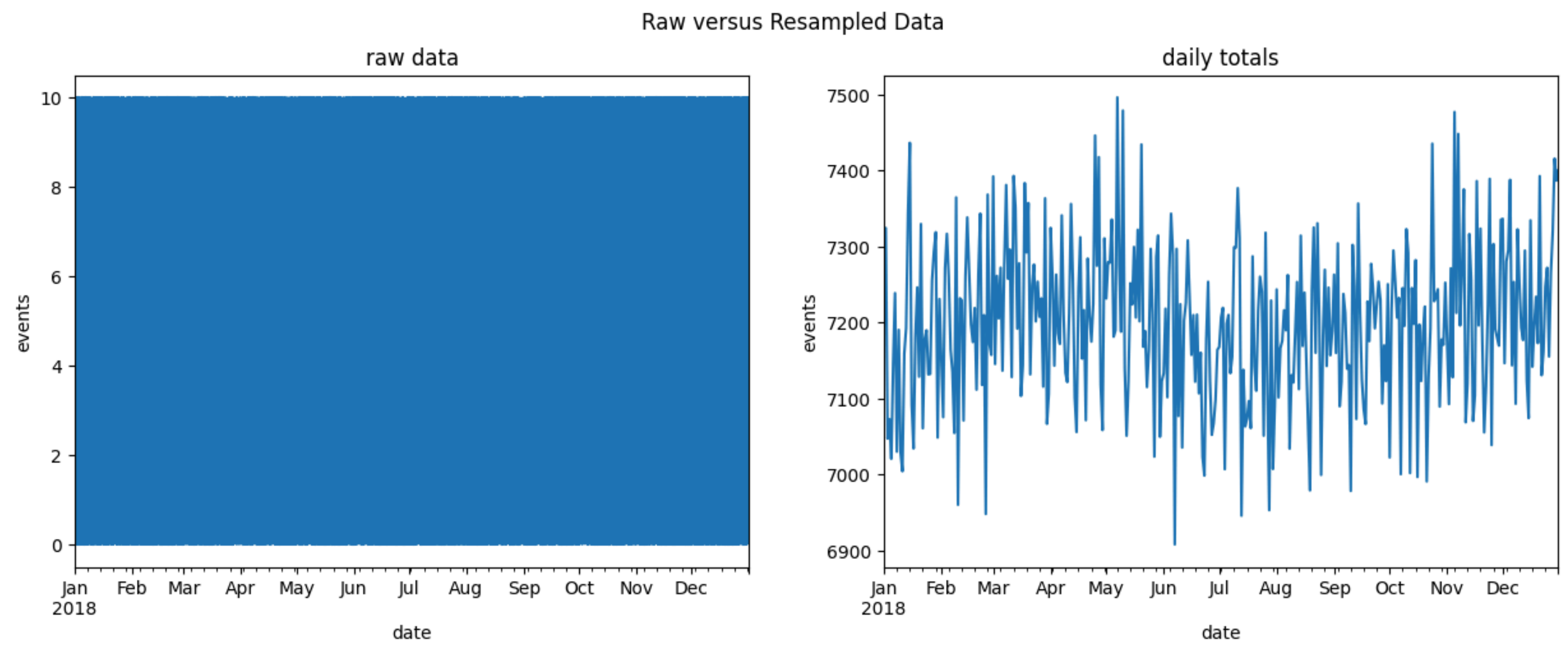
```
fb.drop(columns='trading_volume').diff(-3).head()
```

date	open	high	low	close	volume
2018-01-02	-7.91	-5.32	-7.3800	-5.43	4577368.0
2018-01-03	-5.32	-4.12	-5.0000	-3.61	-1108163.0
2018-01-04	-3.80	-2.59	-3.0004	-3.54	1487839.0
2018-01-05	-1.35	-0.99	-0.7000	-0.99	3044641.0
2018-01-08	-1.20	0.50	-1.0500	0.51	8406139.0

```
import matplotlib.pyplot as plt
```

```
np.random.seed(0)
index = pd.date_range('2018-01-01', freq='T', periods=365*24*60)
raw = pd.DataFrame(
 np.random.uniform(0, 10, size=index.shape[0]), index=index
)
fig, axes = plt.subplots(1, 2, figsize=(15, 5))
raw.plot(legend=False, ax=axes[0], title='raw data')
raw.resample('1D').sum().plot(legend=False, ax=axes[1], title='daily totals')
for ax in axes:
 ax.set_xlabel('date')
 ax.set_ylabel('events')

plt.suptitle('Raw versus Resampled Data')
plt.show()
```



```
stock_data_per_minute.head()
```

date	open	high	low	close	volume
2019-05-20 09:30:00	181.6200	181.6200	181.6200	181.6200	159049.0
2019-05-20 09:31:00	182.6100	182.6100	182.6100	182.6100	468017.0
2019-05-20 09:32:00	182.7458	182.7458	182.7458	182.7458	97258.0
2019-05-20 09:33:00	182.9500	182.9500	182.9500	182.9500	43961.0
2019-05-20 09:34:00	183.0600	183.0600	183.0600	183.0600	79562.0

Next steps: View recommended plots

```
stock_data_per_minute.resample('1D').agg({
 'open': 'first',
 'high': 'max',
 'low': 'min',
 'close': 'last',
 'volume': 'sum'
})
```

date	open	high	low	close	volume
2019-05-20	181.62	184.1800	181.6200	182.72	10044838.0
2019-05-21	184.53	185.5800	183.9700	184.82	7198405.0
2019-05-22	184.81	186.5603	184.0120	185.32	8412433.0
2019-05-23	182.50	183.7300	179.7559	180.87	12479171.0
2019-05-24	182.33	183.5227	181.0400	181.06	7686030.0

```
fb.resample('Q').mean()
```

```
<ipython-input-30-f6fd3d834d43>:1: FutureWarning: The default value of numeric_only in DataFrameGroupBy.mean is deprecated. In a future version, numeric_only will default to False. Either specify numeric_only or select only columns which should be valid for the function.
  fb.resample('Q').mean()
```

date	open	high	low	close	volume
2018-03-31	179.472295	181.794659	177.040428	179.551148	3.292640e+07
2018-06-30	180.373770	182.277689	178.595964	180.704688	2.405532e+07
2018-09-30	180.812130	182.890886	178.955229	181.028492	2.701982e+07
2018-12-31	145.272460	147.620121	142.718943	144.868730	2.697433e+07

```
fb.drop(columns='trading_volume').resample('Q').apply(
 lambda x: x.last('1D').values - x.first('1D').values
)
```

```
date
2018-03-31    [[-22.53, -20.160000000000025, -23.41000000000...
2018-06-30    [[39.50999999999999, 38.399700000000024, 39.84...
2018-09-30    [[-25.039999999999992, -28.659999999999997, -2...
2018-12-31    [[-28.580000000000013, -31.24000000000001, -31...
Freq: Q-DEC, dtype: object
```

```
melted_stock_data = pd.read_csv('/content/melted_stock_data.csv', index_col='date', parse_dates=True)
melted_stock_data.head()
```

date	price
2019-05-20 09:30:00	181.6200
2019-05-20 09:31:00	182.6100
2019-05-20 09:32:00	182.7458
2019-05-20 09:33:00	182.9500
2019-05-20 09:34:00	183.0600

Next steps: View recommended plots

```
melted_stock_data.resample('1D').ohlc()['price']
```

	open	high	low	close
date				
2019-05-20	181.62	184.1800	181.6200	182.72
2019-05-21	184.53	185.5800	183.9700	184.82
2019-05-22	184.81	186.5603	184.0120	185.32
2019-05-23	182.50	183.7300	179.7559	180.87
2019-05-24	182.33	183.5227	181.0400	181.06

```
fb.resample('6H').asfreq().head()
```

	open	high	low	close	volume	trading_volume
date						
2018-01-02 00:00:00	177.68	181.58	177.55	181.42	18151903.0	low
2018-01-02 06:00:00	NaN	NaN	NaN	NaN	NaN	NaN
2018-01-02 12:00:00	NaN	NaN	NaN	NaN	NaN	NaN
2018-01-02 18:00:00	NaN	NaN	NaN	NaN	NaN	NaN
2018-01-03 00:00:00	181.88	184.78	181.33	184.67	16886563.0	low

```
fb.resample('6H').pad().head()
```

```
<ipython-input-35-39179f05e435>:1: FutureWarning: pad is deprecated and will be removed in a future version. Use ffill instead.
  fb.resample('6H').pad().head()
```

	open	high	low	close	volume	trading_volume
date						
2018-01-02 00:00:00	177.68	181.58	177.55	181.42	18151903	low
2018-01-02 06:00:00	177.68	181.58	177.55	181.42	18151903	low
2018-01-02 12:00:00	177.68	181.58	177.55	181.42	18151903	low
2018-01-02 18:00:00	177.68	181.58	177.55	181.42	18151903	low
2018-01-03 00:00:00	181.88	184.78	181.33	184.67	16886563	low

```
fb.resample('6H').fillna('nearest').head()
```

	open	high	low	close	volume	trading_volume
date						
2018-01-02 00:00:00	177.68	181.58	177.55	181.42	18151903	low
2018-01-02 06:00:00	177.68	181.58	177.55	181.42	18151903	low
2018-01-02 12:00:00	181.88	184.78	181.33	184.67	16886563	low
2018-01-02 18:00:00	181.88	184.78	181.33	184.67	16886563	low
2018-01-03 00:00:00	181.88	184.78	181.33	184.67	16886563	low

```
fb.resample('6H').asfreq().assign(
 volume=lambda x: x.volume.fillna(0), # put 0 when market is closed
 close=lambda x: x.close.fillna(method='ffill'), # carry forward
 # take the closing price if these aren't available
 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)
).head()
```

	open	high	low	close	volume	trading_volume
date						
2018-01-02 00:00:00	177.68	181.58	177.55	181.42	18151903.0	low
2018-01-02 06:00:00	181.42	181.42	181.42	181.42	0.0	NaN
2018-01-02 12:00:00	181.42	181.42	181.42	181.42	0.0	NaN
2018-01-02 18:00:00	181.42	181.42	181.42	181.42	0.0	NaN
2018-01-03 00:00:00	181.88	184.78	181.33	184.67	16886563.0	low

```
import sqlite3
with sqlite3.connect('/content/stocks.db') as connection:
 fb_prices = pd.read_sql(
 'SELECT * FROM fb_prices', connection,
 index_col='date', parse_dates=['date']
 )
 aapl_prices = pd.read_sql(
 'SELECT * FROM aapl_prices', connection,
 index_col='date', parse_dates=['date']
 )
```

```
fb_prices.index.second.unique()
```

```
Int64Index([0], dtype='int64', name='date')
```

```
aapl_prices.index.second.unique()
```

```
Int64Index([ 0, 52, 36, 34, 55, 35,  7, 12, 59, 17,  5, 20, 26, 23, 54, 49, 19,
            53, 11, 22, 13, 21, 10, 46, 42, 38, 33, 18, 16,  9, 56, 39,  2, 50,
            31, 58, 48, 24, 29,  6, 47, 51, 40,  3, 15, 14, 25,  4, 43,  8, 32,
            27, 30, 45,  1, 44, 57, 41, 37, 28],
           dtype='int64', name='date')
```

```
pd.merge_asof(
 fb_prices, aapl_prices,
 left_index=True, right_index=True, # datetimes are in the index
 # merge with nearest minute
 direction='nearest', tolerance=pd.Timedelta(30, unit='s')
).head()
```

	FB	AAPL
date		
2019-05-20 09:30:00	181.6200	183.5200
2019-05-20 09:31:00	182.6100	NaN
2019-05-20 09:32:00	182.7458	182.8710
2019-05-20 09:33:00	182.9500	182.5000
2019-05-20 09:34:00	183.0600	182.1067

```
pd.merge_ordered(
 fb_prices.reset_index(), aapl_prices.reset_index()
).set_index('date').head()
```

	FB	AAPL
date		
2019-05-20 09:30:00	181.6200	183.520
2019-05-20 09:31:00	182.6100	NaN
2019-05-20 09:31:52	NaN	182.871
2019-05-20 09:32:00	182.7458	NaN
2019-05-20 09:32:36	NaN	182.500

```
pd.merge_ordered(
 fb_prices.reset_index(), aapl_prices.reset_index(),
 fill_method='ffill'
).set_index('date').head()
```

	FB	AAPL
date		
2019-05-20 09:30:00	181.6200	183.520
2019-05-20 09:31:00	182.6100	183.520
2019-05-20 09:31:52	182.6100	182.871
2019-05-20 09:32:00	182.7458	182.871
2019-05-20 09:32:36	182.7458	182.500