Exercise 7: Data manipulation with Pandas

Load in the dataset `renfe_trains_cleaned.csv`.

Pivot tables

1. Use a pivot table to explore how `price` differs with respect to the type of `fare` for each destination.

```
df.pivot_table(values=['price'],
               index='fare',
               columns='destination').round()
```

	price		
destination	BARCELONA	PONFERRADA	SEVILLA
fare			
Adulto ida	45.0	NaN	51.0
Básica	46.0	NaN	NaN
COD.PROMOCIONAL	68.0	NaN	NaN
Doble Familiar-Flexible	NaN	85.0	NaN
Flexible	113.0	56.0	76.0
Individual-Flexible	NaN	98.0	NaN
Mesa	200.0	NaN	NaN
Promo	79.0	35.0	55.0
Promo +	79.0	41.0	50.0
YOVOY	64.0	33.0	49.0

Working with time series

1. Convert `departure` & `arrival` to a more appropriate datatype.

```
df[['departure', 'arrival']] = df[['departure', 'arrival']].apply(lambda time: pd.to_datetime(time, format='%Y-%m-%d %H:%M:%S'))
```

2. Calculate the duration of each train journey and add it as a column called `duration`.

```
df['duration'] = df['arrival'] - df['departure']
```

3. Make `departure` the index of the DataFrame.

```
df.set_index('departure', inplace=True)
```

4. Sort the index low to high (earlier to later). This will make slicing possible later.

```
df.sort_index(inplace=True)
```

5. Select all journeys which `departed` on `07/05/19.`

```
df.loc['2019-05', :]
```

departure	company	origin	destination	arrival	vehicle_class	price	fare	price_bin	duration
2019-05-01 06:30:00	RENFE	MADRID	BARCELONA	2019-05-01 09:20:00	Turista	107.7000	Flexible	(0, 150]	0 days 02:50:00
2019-05-01 07:00:00	RENFE	MADRID	SEVILLA	2019-05-01 09:55:00	Turista	62.2000	Flexible	(0, 150]	0 days 02:55:00
2019-05-01 07:00:00	RENFE	MADRID	SEVILLA	2019-05-01 09:55:00	Turista	71.4938	Flexible	(0, 150]	0 days 02:55:00
2019-05-01 07:00:00	RENFE	MADRID	BARCELONA	2019-05-01 09:30:00	Turista	100.4000	Promo	(0, 150]	0 days 02:30:00
2019-05-01 07:00:00	RENFE	MADRID	SEVILLA	2019-05-01 09:55:00	Turista Plus	71.4938	Flexible	(0, 150]	0 days 02:55:00
...	...	...	...	...	...	...	...	...	...

6. Select all journeys which `departed` on `07/05/19` to `11/05/19.`

```
df.loc['2019-05-07':'2019-05-11', :]
```

departure	company	origin	destination	arrival	vehicle_class	price	fare	price_bin	duration
2019-05-07 06:10:00	RENFE	MADRID	BARCELONA	2019-05-07 08:40:00	Turista Plus	49.1500	Promo	(0, 150]	0 days 02:30:00
2019-05-07 06:10:00	RENFE	MADRID	BARCELONA	2019-05-07 08:40:00	Turista	58.1500	Promo	(0, 150]	0 days 02:30:00
2019-05-07 06:10:00	RENFE	MADRID	BARCELONA	2019-05-07 08:40:00	Turista Plus	80.1500	Promo	(0, 150]	0 days 02:30:00
2019-05-07 06:20:00	RENFE	MADRID	SEVILLA	2019-05-07 09:16:00	Turista	43.5500	Promo	(0, 150]	0 days 02:56:00
2019-05-07 06:20:00	RENFE	MADRID	BARCELONA	2019-05-07 14:25:00	Turista	71.4938	Promo	(0, 150]	0 days 08:05:00
...	...	...	...	...	...	...	...	...	...

7. Add one year to each date in the index of the DataFrame (but do not save it!).

```
df.index + pd.tseries.offsets.Day(365)
```

```
DatetimeIndex(['2020-04-11 07:15:00', '2020-04-11 09:00:00',
               '2020-04-11 11:05:00', '2020-04-11 12:00:00',
               '2020-04-11 12:30:00', '2020-04-11 14:30:00',
               '2020-04-11 16:30:00', '2020-04-11 18:00:00',
               '2020-04-11 19:30:00', '2020-04-11 20:00:00',
               ...
               '2021-12-01 17:30:00', '2021-12-02 07:15:00',
               '2021-12-02 10:18:00', '2021-12-02 12:30:00',
               '2021-12-02 14:30:00', '2021-12-02 16:00:00',
               '2021-12-03 09:30:00', '2021-12-03 18:30:00',
               '2021-12-03 20:30:00', '2021-12-04 06:30:00'],
              dtype='datetime64[ns]', name='departure', length=29724, freq=None)
```

8. Create a subset of the DataFrame called `madrid_to_barca` which contains only journeys with `origin` as `MADRID` and `destination` as `BARCELONA.`

```
madrid_to_barca = df[(df['origin'] == 'MADRID') & (df['destination'] == 'BARCELONA')]
```

9. Select only those tickets in `madrid_to_barca` which are in the `Promo` category for `fare` and `Turista` for `vehicle_class.` Update `madrid_to_barca` to only contain these.

```
madrid_to_barca = df[(df['fare'] == 'Promo') & (df['vehicle_class'] == 'Turista')]
```

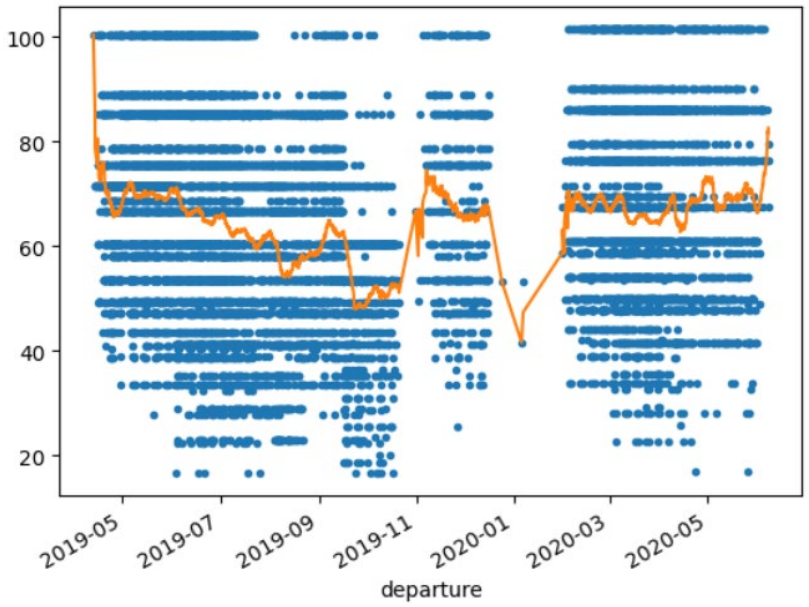
10. Compute a seven day rolling average for price for the `madrid_to_barca` DataFrame. Add it as a column called `rolling`.

```
madrid_to_barca.loc[:, 'rolling'] = madrid_to_barca['price'].rolling(window='7D').mean().round(2)
```

11. (To try after completing the combining tables section) Plot the rolling average vs. the actual values of `price.`

```
madrid_to_barca['price'].plot(style='.')
madrid_to_barca['rolling'].plot(kind='line')
```

```
<Axes: xlabel='departure'>
```



Combining tables

1. Read in the `fare_conditions.csv file`. It contains the conditions for the type of ticket that has been purchased.

```
conditions = pd.read_csv('data/fare_conditions.csv')
```

2. Add the fare conditions to the original `df` DataFrame.

```
df.merge(conditions, on='fare')
```

	company	origin	destination	arrival	vehicle_class	price	fare	price_bin	duration	Conditions
0	RENFE	MADRID	BARCELONA	2019-04-12 16:37:00	Turista	43.2500	Adulto ida	(0, 150]	0 days 09:22:00	Valid for 1 adult to return within 1 day
1	RENFE	MADRID	BARCELONA	2019-04-15 16:37:00	Turista	43.2500	Adulto ida	(0, 150]	0 days 09:22:00	Valid for 1 adult to return within 1 day
2	RENFE	MADRID	BARCELONA	2019-04-16 16:37:00	Turista	71.4938	Adulto ida	(0, 150]	0 days 09:22:00	Valid for 1 adult to return within 1 day
3	RENFE	MADRID	BARCELONA	2019-04-16 16:37:00	Turista	43.2500	Adulto ida	(0, 150]	0 days 09:22:00	Valid for 1 adult to return within 1 day
4	RENFE	MADRID	BARCELONA	2019-04-17 16:37:00	Turista	43.2500	Adulto ida	(0, 150]	0 days 09:22:00	Valid for 1 adult to return within 1 day
...	...	...	...	...	...	...	...	...	...	...
29719	RENFE	MADRID	SEVILLA	2020-09-28 18:30:00	Turista	51.6500	YOVOY	(0, 150]	0 days 02:30:00	Under 25 railcard required
29720	RENFE	MADRID	SEVILLA	2020-09-28 21:38:00	Turista	51.6500	YOVOY	(0, 150]	0 days 02:38:00	Under 25 railcard required
29721	RENFE	MADRID	SEVILLA	2020-09-29 11:38:00	Turista	51.6500	YOVOY	(0, 150]	0 days 02:38:00	Under 25 railcard required
29722	RENFE	MADRID	SEVILLA	2020-09-29 14:32:00	Turista	51.6500	YOVOY	(0, 150]	0 days 02:32:00	Under 25 railcard required
29723	RENFE	MADRID	BARCELONA	2020-09-29 23:40:00	Turista	72.9500	YOVOY	(0, 150]	0 days 03:10:00	Under 25 railcard required