Courses Unit Assignment Checklist Stats Take Exams

PART-TIME DATA SCIENCE - DATA VISUALIZATION

Data Visualization V...

Custom Formats and Errors

Learning Objectives:

- Troubleshoot errors when converting to time series

In the previous lesson, pandas was easily able to recognize the original date column as a date and was able to convert the values to the appropriate datetime values. (It recognized year as year, month as month, etc.) While pd.to_datetime is clever, it can still need help interpreting rare formats.

Using pd.to_datetime with custom date formats

- While Pandas is *usually* able to automatically infer the format of the dates to convert, it doesn't always work properly.
- In these scenarios, we can add the "format" argument to pd.to_datetime and create a date format string that represents the form of the current date column.

Let's take a look at a new dataset with a unique format for the datetime, the London Weather data set from Kaggle. We will call this one "demo", and will return to our original "df" after this.

```
demo = pd.read_csv('https://docs.google.com/spreadsheets/d/e/2PACX-
1vT_jChgNsQbHbg4TGepzIqk8XC9DTIKmyyxb1upo5cfZCgbfIUQc2ZC0YMzuU5uApP140Ob49KBjdqh/p
ub?gid=1198589591&single=true&output=csv', usecols=[0,1])
demo.info()
demo
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 15341 entries, 0 to 15340
Data columns (total 2 columns):
#   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
0   date         15341 non-null  int64  
1   cloud_cover  15322 non-null  float64
dtypes: float64(1), int64(1)
memory usage: 239.8 KB
```

	date	cloud_cover
0	19790101	2.0
1	19790102	6.0
2	19790103	5.0
3	19790104	8.0
4	19790105	6.0
...	...	...
15336	20201227	1.0
15337	20201228	7.0
15338	20201229	7.0
15339	20201230	6.0
15340	20201231	7.0

15341 rows × 2 columns

- Notice how the date is an integer, not a string.
- Let's try using pd.to_datetime without any arguments (as we did in the previous lesson):

```
pd.to_datetime(demo['date'])
```

```
0        1970-01-01 00:00:00.019790101
1        1970-01-01 00:00:00.019790102
2        1970-01-01 00:00:00.019790103
3        1970-01-01 00:00:00.019790104
4        1970-01-01 00:00:00.019790105
                     ...
15336    1970-01-01 00:00:00.020201227
15337    1970-01-01 00:00:00.020201228
15338    1970-01-01 00:00:00.020201229
15339    1970-01-01 00:00:00.020201230
15340    1970-01-01 00:00:00.020201231
Name: date, Length: 15341, dtype: datetime64[ns]
```

What happened? What did we get?

- Pandas was confused and tried to interpret the integer dates as Unix times.
- Unix times are a way of expressing date and time with just numbers. However, the earliest possible unix date is January 01, 1970.
- As you can see above, it assigned the date of 1970-01-01 to every date. And then used the integer date as the number of milliseconds AFTER 12:00AM on 01/01/1970.

The main thing to notice here is: This is not what we wanted!! It is essential that you check the results of anything you ask Python to do to make sure it is working how you expect it to! If not, you need to investigate further and figure out what the issue is.

In this case, python needs a little help from us humans! Let's examine our original date format and see if we can decipher it!

```
## displaying random sample
demo['date'].sample(n=10).sort_index()
```

```
890      19810609
1093     19811229
3612     19881121
8450     20020219
9312     20040630
10707    20080425
11082    20090505
12029    20111208
12550    20130512
14341    20180407
Name: date, dtype: int64
```

(Your random sample will be different because we did not set a seed here).

- It looks like we have 4-digit years (%Y), followed by the 2-digit month (%m) followed by 2-digit day (%d).
- Once we identify the format of our original column, we can create the format string that Pandas will need to properly parse these dates.
- The combined format code to use is "%Y%m%d". Let's try using this as the format argument for to_datetime:

```
pd.to_datetime(demo['date'], format='%Y%m%d')
```

```
0        1979-01-01
1        1979-01-02
2        1979-01-03
3        1979-01-04
4        1979-01-05
            ...
15336    2020-12-27
15337    2020-12-28
15338    2020-12-29
15339    2020-12-30
15340    2020-12-31
Name: date, Length: 15341, dtype: datetime64[ns]
```

- That looks MUCH better. Remember, when pd.to_datetime doesn't return what you would expect, you will need to figure out the format code that is appropriate for your current date formatting.

Handling pd.to_datetime Errors

We will use another dataset for this demonstration

- We will be working with crime data taken directly from the city of Baltimore via Baltimore's Open Data website: https://data.baltimorecity.gov/search?q=crime data
    - The exact data we want is "Part 1 Crime Data"
    - It is large file and will take some time to download.

```
url = "https://docs.google.com/spreadsheets/d/e/2PACX-
1vQ4lekzpYpo0pA9h1d3KYObIb3lQtAqz289c7jpwckioXvxm4xykz6ZSJpnDwjKTxJ4iqpG0seNJdSZ/p
ub?gidass=>=312387697&single=true&output=csv"
demo = pd.read_csv(url)
demo.head(3)
```

	CrimeDateTime	Description	District	Latitude	Longitude
0	2022/07/09 09:30:00+00	ROBBERY - RESIDENCE	NORTHEAST	39.3223	-76.5467
1	2022/07/09 16:00:00+00	COMMON ASSAULT	SOUTHERN	39.2821	-76.6355
2	2022/07/09 00:34:28+00	SHOOTING	SOUTHWEST	39.2884	-76.6569

If you try to convert the "CrimeDateTime" column to datetime with pd.to_datetime, you will get an error!

```
# This will give an error
pd.to_datetime(demo['CrimeDateTime'])
```

Error!

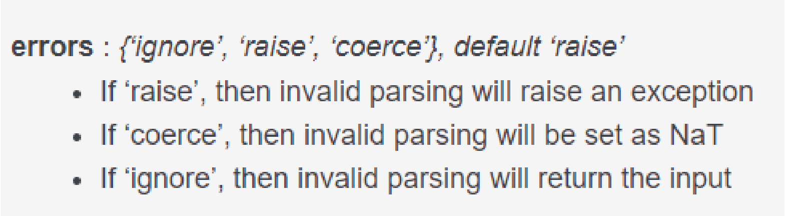
(We are not displaying the whole huge error message here to save space)

However, here is a way to try something and get a little insight into what is causing the problem:

```
try:
        display(pd.to_datetime(demo['CrimeDateTime']))
except Exception as e:
        print(e)
```

```
Out of bounds nanosecond timestamp: 1202-05-22 10:56:02
```

- Sometimes there may be some "bad" values that are not compatible with the other dates in the column.
- In this case, we can leverage the "errors" argument of pd.to_datetime.
- According to to the docstring for pd.to_datetime:



errors : *{'ignore', 'raise', 'coerce'}, default 'raise'*

- If 'raise', then invalid parsing will raise an exception
- If 'coerce', then invalid parsing will be set as NaT
- If 'ignore', then invalid parsing will return the input

- We can see that if we use errors='coerce', it will replace incompatible values will NaT (Not a Time).

```
demo['CrimeDateTime'] = pd.to_datetime(demo['CrimeDateTime'], errors='coerce')
demo['CrimeDateTime'].isna().sum()
```

```
1
```

- Make sure to drop or impute any null values for time. In this case we will just drop the one value.

```
demo = demo.dropna(subset=['CrimeDateTime'])
demo.head()
```

	CrimeDateTime	Description	District	Latitude	Longitude
0	2022-07-09 09:30:00+00:00	ROBBERY - RESIDENCE	NORTHEAST	39.3223	-76.5467
1	2022-07-09 16:00:00+00:00	COMMON ASSAULT	SOUTHERN	39.2821	-76.6355
2	2022-07-09 00:34:28+00:00	SHOOTING	SOUTHWEST	39.2884	-76.6569
3	2022-07-09 00:34:28+00:00	SHOOTING	SOUTHWEST	39.2884	-76.6569
4	2022-07-09 18:00:00+00:00	COMMON ASSAULT	NORTHEAST	39.3188	-76.5872

Now that we have dropped the data point that was causing our error, we can try again:

```
pd.to_datetime(demo['CrimeDateTime'])
```

```
0         2022-07-09 09:30:00+00:00
1         2022-07-09 16:00:00+00:00
2         2022-07-09 00:34:28+00:00
3         2022-07-09 00:34:28+00:00
4         2022-07-09 18:00:00+00:00
                     ...
527812    2013-07-31 17:45:00+00:00
527813    2013-07-31 14:15:00+00:00
527814    2013-07-31 21:00:00+00:00
527815    2013-07-31 17:00:00+00:00
527816    2013-07-31 11:40:00+00:00
Name: CrimeDateTime, Length: 527816, dtype: datetime64[ns, UTC]
```

As you can see, now we were able to convert our feature to a Pandas datetime.

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