

Pandas Datastructures

The primary two components of pandas are the Series and DataFrame.

Dataframes and Series

Series	Series	DataFrame
apples	oranges	apples oranges
0 3	0 0	0 3 0
1 2	1 3	1 2 3
2 0	2 7	2 0 7
3 1	3 2	3 1 2

A Series is One Dimensional Data
A DataFrame is N-Dimensional Data

Creating a DataFrame from Scratch

```
data = {
    'apples': [3, 2, 0, 1],
    'oranges': [0, 3, 7, 2]
}

purchases = pd.DataFrame(
    data)
```

Turns a Dictionary into a DataFrame

Adding an Index to a DataFrame

```
purchases = pd.DataFrame(data,
    index=['June', 'Robert', 'Lily',
    'David'])
```

A DataFrame is a (key, value) based Data Structure

Dataframe with Index Set

	apples	oranges
June	3	0
Robert	2	3
Lily	0	7
David	1	2

Understanding your Data

```
movies_df.describe()
```

rank	year	runtime	rating	votes	revenue_millions	metascore
count	1000.000000	1000.000000	1000.000000	1.000000e+03	1000.000000	936.000000
mean	500.500000	2012.740000	121.120000	6.721200	2.458000e+05	62.764871
std	288.819431	1.285962	18.819908	0.865429	1.807620e+05	86.412043
min	1.000000	2006.000000	66.000000	1.000000	6.100000e+01	9.000000
25%	276.750000	2010.000000	100.000000	6.200000	3.630000e+04	17.642000
50%	500.500000	2014.000000	111.000000	6.000000	1.107990e+05	60.376000
75%	726.250000	2016.000000	123.000000	7.400000	2.599000e+05	99.177000
max	1000.000000	2016.000000	181.000000	9.000000	1.791110e+06	936.630000

```
movies_df.describe()
```

```
# Describing individual columns
movies_df['genre'].describe()
```

movies_df['genre'].value_counts().head(10)

genre	count
Action,Adventure,Sci-Fi	50
Drama	48
Comedy,Drama,Romance	35
Comedy	32
Drama,Romance	31
Animation,Adventure,Comedy	27
Action,Adventure,Fantasy	27
Comedy,Drama	27

movies_df.corr()

```
movies_df.corr()
```

	rank	year	runtime	rating	votes	revenue_millions	metascore
rank	1.000000	-0.261605	-0.221739	-0.219555	-0.203378	-0.252096	-0.191869
year	-0.261605	1.000000	-0.164908	-0.211219	-0.411904	-0.117562	-0.079380
runtime	-0.221739	-0.164908	1.000000	0.592214	0.407042	0.247324	0.218978
rating	-0.219555	-0.211219	0.592214	1.000000	0.911517	0.189527	0.431897
votes	-0.203378	-0.411904	0.407042	0.911517	1.000000	0.607941	0.325684
revenue_millions	-0.252096	-0.117562	0.247324	0.189527	0.607941	1.000000	0.133328
metascore	-0.191869	-0.079380	0.218978	0.431897	0.325684	0.133328	1.000000

Generates a matrix describing correlation between data

Reading in Data

It's quite simple to load data from various file formats into a DataFrame. In the following examples we'll keep using our apples and oranges data, but this time it's coming from various files.

Reading CSV

```
df =
pd.read_csv('purchases.csv')
# Or with setting the index
column, needs to be set with CSV
df = pd.read_csv('purchases.csv', index_col=0)
```

Reading JSON

```
# The index is automatically set
with json
df = pd.read_json('purchases.json')
```

Reading in SQLite

```
import sqlite3
con = sqlite3.connect('database.db')
df = pd.read_sql_query("SELECT * FROM purchases", con)
```

Setting index in post

```
df = df.set_index('index')
```

Writing Data

```
df.to_csv('new_purchases.csv')
df.to_json('new_purchases.json')
df.to_sql('new_purchases', con)
```

con being a sql connection

When we save JSON and CSV files, all we have to input into those functions is our desired filename with the appropriate file extension. With SQL, we're not creating a new file but instead inserting a new table into the database using our con variable from before.



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Dataframe Slicing Extracting Selecting

Up until now we've focused on some basic summaries of our data. We've learned about simple column extraction using single brackets, and we imputed null values in a column using fillna(). Below are the other methods of slicing, selecting, and extracting you'll need to use constantly.

It's important to note that, although many methods are the same, DataFrames and Series have different attributes, so you'll need be sure to know which type you are working with or else you will receive attribute errors.

Let's look at working with columns first.

By Columns

```
genre_col = movies_df['genre']
genre_col = movies_df[['genre']]
subset = movies_df[['genre', 'rating']]
subset.head()
```

To extract data as Dataframes from a dataframe pass a list key

By Rows

```
prom =
movies_df.loc["Prometheus"]
prom = movies_df.iloc[1]
movie_subset = movies_df.loc['Prometheus': 'Sing']
movie_subset = movies_df.iloc[1:4]
```

loc and iloc can be thought of as similar to Python list slicing. To show this even further, let's select multiple rows.

Conditional Selections

```
condition =
(movies_df['director'] ==
 "Ridley Scott")
movies_df[movies_df['director'] == "Ridley Scott"].head() # Returns a
Dataframe where Director is
Ridley Scott
movies_df[movies_df['rating'] >= 8.6].head(3)
movies_df[(movies_df['director'] == 'Christopher
Nolan') | (movies_df['director'] == 'Ridley Scott')].head()
# OR Simply
movies_df[movies_df['director'].isin(['Christopher
Nolan', 'Ridley
Scott'])].head()
movies_df[
    ((movies_df['year']
 >= 2005) & (movies_df['year']
 <= 2010))
    & (movies_df['rating'] > 8.0)
    & (movies_df['revenue_millions'] < movies_
df['revenue_millions'].quantile(0.25))
]
```

Similar to isnull(), this returns a Series of True and False values: True for films directed by Ridley Scott and False for ones not directed by him.

Applying Functions to Data

```
def rating_function(x):
    if x >= 8.0:
        return "good"
    else:
        return "bad"
movies_df['rating_category'] = movies_df['rating'].apply(rating_function)
```

Viewing Data

```
movies_df.head() # Print first 5
rows
movies_df.head(10) # Print
first 10 rows
movies_df.tail() # Print last 5
Rows
movies_df.tail(2) # Print last
2 rows
```

Previews start or ends of dataframes

Getting metadata from a dataframe

```
movies_df.info() # Output info
regarding datatypes
movies_df.shape # Outputs
number of rows and columns
```

Dataframe Info

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 500 entries, Guardians of the Galaxy to Nine Lives
Data columns (total 12 columns):
#   Column          Non-Null Count  Dtype
---  -
0   rank            1000 non-null   int64
1   genre           1000 non-null   object
2   description     1000 non-null   object
3   director        1000 non-null   object
4   actors          1000 non-null   object
5   year            1000 non-null   int64
6   runtime         1000 non-null   int64
7   rating          1000 non-null   float64
8   votes           1000 non-null   int64
9   revenue_millions 1000 non-null   float64
10  metacritic      955 non-null    float64
11  rating_category  1000 non-null   object
dtypes: float64(3), int64(4), object(5)
memory usage: 155.4+ KB
```

df.info()



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Cleaning Data

```
### Duplicate Data Handling
temp_df = temp_df.drop_duplicates() # Drops duplicate data
# Or
temp_df.drop_duplicates(inplace=True)
# Keeping duplicate data
temp_df.drop_duplicates(inplace=True, keep=True)
### Renaming Columns
movies_df.rename(columns={
    'Runtime': 'Runtime',
    'Revenue (Millions)': 'Revenue_millions'
}, inplace=True)
# Can also be set directly
movies_df.columns = ['rank', 'genre', 'description', 'director', 'actors', 'year', 'runtime', 'rating', 'votes', 'revenue_millions', 'metascore']
# Setting column names lowercase
movies_df.columns = [col.lower() for col in movies_df]
### Handling Null Values
movies_df.isnull() # Returns a column with either True or False for null or not
movies_df.isnull().sum() # Returns a count of all null entries
# Removing Nulls
```

Cleaning Data (cont)

```
> movies_df.dropna()
# Specify the axis to drop against
movies_df.dropna(axis=1)
```

Plotting with Matplotlib

Another great thing about pandas is that it integrates with Matplotlib, so you get the ability to plot directly off DataFrames and Series. To get started we need to import Matplotlib (pip install matplotlib):

Scatter plot

```
import matplotlib.pyplot as plt
plt.rcParams.update({'font.size': 20, 'figure.figsize': (10, 8)}) # set font and plot size to be larger
movies_df.plot(kind='scatter', x='rating', y='revenue_millions', title='Revenue (millions) vs Rating');
```

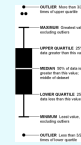
Histogram plot

```
movies_df['rating'].plot(kind='hist', title='Rating');
```

Boxplot

```
movies_df['rating'].plot(kind="box")
```

Boxplot



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