Pandas Joining

Learning Objectives

After this lesson, you will be able to:

- Concatenate objects with `.append()` and `.concat()`.
- Combine objects with `.join()` and `.merge()`.
- Combine timeseries objects with `.merge_ordered()`.
- Traditionally, this functionality is performed in a relational database, such as SQL.
- With Pandas, you'll be able to perform the same operations in Python! The backend is numpy, a powerful linear algebra library which helps keep things speedy.

To the Notebook!

We actually will commence this lesson directly in the Jupyter Notebook, `pandas-join.ipynb`, to walk through the what, why, and how all at once.

Here we have slides reviewing the key concepts.

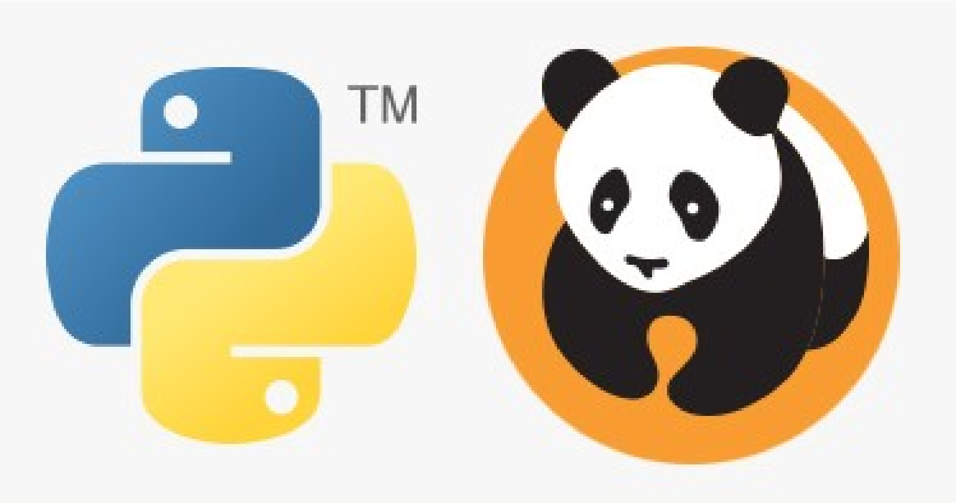
What is Joining?

- Joining is the process of taking a single dataframe and combining it with another dataframe.
- Traditionally, this would be done with SQL.
    - SQL is database designed and optimized to distribute data across many tables.

Why Join?

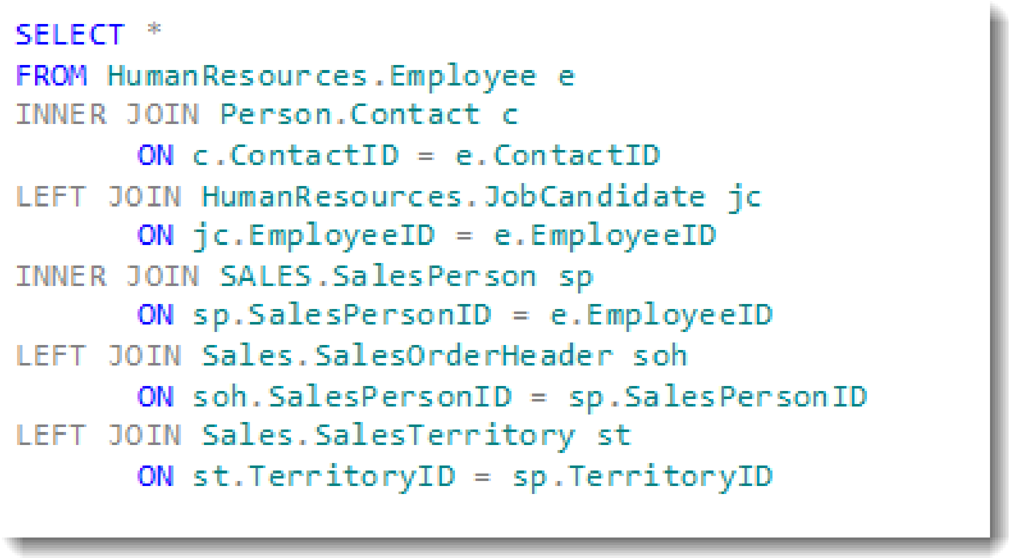
- Joining is important because:
    - It allows us to reduce the *size* of a database.
    - It allows us to *increase the speed* at which data is queried and returned.
    - It allows us to *reduce the redundancy* of the data stored in the database.
- Joining is fundamental to proper data architecture, and we'll get to do it in Pandas!

Why Use Pandas for Joining Then?



- Pandas is based upon numpy, a linear algebra library.
- Using it for joins makes sense - the algorithms are optimized and fast.
- This allows allows us to use ‘python only’ - avoiding integrations to SQL.
- This makes data analysis faster as we don’t need to switch tools.
- Longer term, code may be delegated to more specific tools (SQL, Spark, etc.).

What Does a SQL Join Look Like?



```
SELECT *
FROM HumanResources.Employee e
INNER JOIN Person.Contact c
       ON c.ContactID = e.ContactID
LEFT JOIN HumanResources.JobCandidate jc
       ON jc.EmployeeID = e.EmployeeID
INNER JOIN SALES.SalesPerson sp
       ON sp.SalesPersonID = e.EmployeeID
LEFT JOIN Sales.SalesOrderHeader soh
       ON soh.SalesPersonID = sp.SalesPersonID
LEFT JOIN Sales.SalesTerritory st
       ON st.TerritoryID = sp.TerritoryID
```

- A SQL join looks like the above.
- We can specify:
    - The tables (dataframes) to be joined to each other.
    - *How* the columns (keys) are related *to each other* in the join.
    - We can use this logic (referred to as relational algebra) to:
        - Filter out information.
        - Make one-to-many or even many-to-many joins.
- We'll be using Pandas, so our syntax will look different than above.

What Does a Pandas Join Look Like?

```
pd.merge(df1, df2, how='left', left_index=True, right_index=True, suffixes=(
```

index	letter_df1	number_df1	letter_df2	number_df2
0	a	1	e	5.0
1	b	2	f	6.0
2	c	3	NaN	NaN
3	d	4	NaN	NaN

Notes on Differences

- SQL uses `JOIN`. Pandas has *two* semi-equivalent functions:
  - `pd.join` - used for joining dataframes *on their indices only*
  - `pd.merge` - used for joining dataframes *on any column you want*
- Since `pd.merge` is more powerful and generalizes better, we'll focus on `pd.merge`
- SQL uses `UNION`. Pandas, again, has *two* semi-equivalent functions:
  - `pd.append` - stacks dataframes *on top of* each other
  - `pd.concat` - stacks dataframes *on top of* **or** *next to* each other
- Since `pd.concat` is more powerful and generalizes better, we'll focus on `pd.concat`

Additional Resources

- Pandas documentation
- DataSchool 30-video series (by a former GA instructor!)