Inner join

JOINING DATA WITH PANDAS

Aaren Stubberfield
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datacamp

For clarity

Tables = DataFrames

Merging = Joining

[1] Photo by David Travis on Unsplash

Chicago data portal dataset

[1] Photo by Pedro Lastra on Unsplash

Datasets for example

United States® Census Bureau

[1] Ward image By Alissapump, Own work, CC BY-SA 3.0

The ward data

```
wards = pd.read_csv('Ward_Offices.csv')
print(wards.head())
print(wards.shape)
```

```
  ward  alderman          address          zip
0 1     Proco "Joe" ...   2058 NORTH W...  60647
1 2     Brian Hopkins     1400 NORTH  ...  60622
2 3     Pat Dowell        5046 SOUTH S...  60609
3 4     William D. B...   435 EAST 35T...  60616
4 5     Leslie A. Ha...   2325 EAST 71...  60649
(50, 4)
```

Census data

```
census = pd.read_csv('Ward_Census.csv')
print(census.head())
print(census.shape)
```

```
  ward  pop_2000  pop_2010  change  address          zip
0 1     52951     56149     6%      2765 WEST SA...  60647
1 2     54361     55805     3%      WM WASTE MAN...  60622
2 3     40385     53039     31%     17 EAST 38TH...  60653
3 4     51953     54589     5%      31ST ST HARB...  60653
4 5     55302     51455     -7%     JACKSON PARK...  60637
(50, 6)
```

Merging tables

```
  ward  alderman          address          zip
0 1     Proco "Joe" ...   2058 NORTH W...  60647
1 2     Brian Hopkins     1400 NORTH  ...  60622
2 3     Pat Dowell        5046 SOUTH S...  60609
3 4     William D. B...   435 EAST 35T...  60616
4 5     Leslie A. Ha...   2325 EAST 71...  60649
```

```
  ward  pop_2000  pop_2010  change  address          zip
0 1     52951     56149     6%      2765 WEST SA...  60647
1 2     54361     55805     3%      WM WASTE MAN...  60622
2 3     40385     53039     31%     17 EAST 38TH...  60653
3 4     51953     54589     5%      31ST ST HARB...  60653
4 5     55302     51455     -7%     JACKSON PARK...  60637
```

Inner join

```
wards_census = wards.merge(census, on='ward')
print(wards_census.head(4))
```

```
  ward  alderman         address_x        zip_x  pop_2000  pop_2010  change  address_y        zip_y
0 1     Proco "Joe" ...  2058 NORTH W...  60647  52951     56149     6%      2765 WEST SA...  60647
1 2     Brian Hopkins    1400 NORTH  ...  60622  54361     55805     3%      WM WASTE MAN...  60622
2 3     Pat Dowell       5046 SOUTH S...  60609  40385     53039     31%     17 EAST 38TH...  60653
3 4     William D. B...  435 EAST 35T...  60616  51953     54589     5%      31ST ST HARB...  60653
```

```
print(wards_census.shape)
```

```
(50, 9)
```

Inner join

Suffixes

```
print(wards_census.columns)
```

```
Index(['ward', 'alderman', 'address_x', 'zip_x', 'pop_2000', 'pop_2010', 'change',
       'address_y', 'zip_y'],
      dtype='object')
```

Suffixes

```
wards_census = wards.merge(census, on='ward', suffixes=('_ward','_cen'))
print(wards_census.head())
print(wards_census.shape)
```

```
  ward  alderman         address_ward     zip_ward  pop_2000  pop_2010  change  address_cen      zi
0 1     Proco "Joe" ...  2058 NORTH W...  60647     52951     56149     6%      2765 WEST SA...  60
1 2     Brian Hopkins    1400 NORTH  ...  60622     54361     55805     3%      WM WASTE MAN...  60
2 3     Pat Dowell       5046 SOUTH S...  60609     40385     53039     31%     17 EAST 38TH...  60
3 4     William D. B...  435 EAST 35T...  60616     51953     54589     5%      31ST ST HARB...  60
4 5     Leslie A. Ha...  2325 EAST 71...  60649     55302     51455     -7%     JACKSON PARK...  60
(50, 9)
```

Let's practice!

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One to many relationships

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One-to-one

A	B	C
A1	B1	C1
A2	B2	C2
A3	B3	C3

C	D
C1	D1
C2	D2
C3	D3

One-To-One = Every row in the left table is related to only one row in the right table

One-to-one example

```
  ward  alderman          address          zip
0 1     Proco "Joe" ...   2058 NORTH W...  60647
1 2     Brian Hopkins     1400 NORTH  ...  60622
2 3     Pat Dowell        5046 SOUTH S...  60609
3 4     William D. B...   435 EAST 35T...  60616
4 5     Leslie A. Ha...   2325 EAST 71...  60649
```

```
  ward  pop_2000  pop_2010  change  address          zip
0 1     52951     56149     6%      2765 WEST SA...  60647
1 2     54361     55805     3%      WM WASTE MAN...  60622
2 3     40385     53039     31%     17 EAST 38TH...  60653
3 4     51953     54589     5%      31ST ST HARB...  60653
4 5     55302     51455     -7%     JACKSON PARK...  60637
```

One-to-many

A	B	C
A1	B1	C1
A2	B2	C2
A3	B3	C3

C	D
C1	D1
C1	D2
C1	D3
C2	D4

One-To-Many = Every row in left table is related to one or more rows in the right table

One-to-many example

One-to-many example

```
licenses = pd.read_csv('Business_Licenses.csv')
print(licenses.head())
print(licenses.shape)
```

```
  account  ward  aid  business          address          zip
0 307071   3     743  REGGIE'S BAR...   2105 S STATE ST  60616
1 10       10    829  HONEYBEERS        13200 S HOUS...  60633
2 10002    14    775  CELINA DELI       5089 S ARCHE...  60632
3 10005    12    nan  KRAFT FOODS ...   2005 W 43RD ST   60609
4 10044    44    638  NEYBOUR'S TA...   3651 N SOUTH...  60613
(10000, 6)
```

One-to-many example

```
  ward  alderman          address          zip
0 1     Proco "Joe" ...   2058 NORTH W...  60647
1 2     Brian Hopkins     1400 NORTH  ...  60622
2 3     Pat Dowell        5046 SOUTH S...  60609
3 4     William D. B...   435 EAST 35T...  60616
4 5     Leslie A. Ha...   2325 EAST 71...  60649
```

```
  account  ward  aid  business         address          zip
0 307071   3     743  REGGIE'S BAR...  2105 S STATE ST  60616
1 10       10    829  HONEYBEERS       13200 S HOUS...  60633
2 10002    14    775  CELINA DELI      5089 S ARCHE...  60632
3 10005    12    nan  KRAFT FOODS ...  2005 W 43RD ST   60609
4 10044    44    638  NEYBOUR'S TA...  3651 N SOUTH...  60613
```

One-to-many example

```
ward_licenses = wards.merge(licenses, on='ward', suffixes=('_ward','_lic'))
print(ward_licenses.head())
```

```
  ward  alderman          address_ward     zip_ward  account  aid  business          address_lic
0 1     Proco "Joe" ...   2058 NORTH W...  60647     12024    nan  DIGILOG ELEC...   1038 N ASHLA...
1 1     Proco "Joe" ...   2058 NORTH W...  60647     14446    743  EMPTY BOTTLE...   1035 N WESTE...
2 1     Proco "Joe" ...   2058 NORTH W...  60647     14624    775  LITTLE MEL'S...   2205 N CALIF...
3 1     Proco "Joe" ...   2058 NORTH W...  60647     14987    nan  MR. BROWN'S ...   2301 W CHICA...
4 1     Proco "Joe" ...   2058 NORTH W...  60647     15642    814  Beat Kitchen      2000-2100 W ...
```

One-to-many example

```
print(wards.shape)
```

```
(50, 4)
```

```
print(ward_licenses.shape)
```

```
(10000, 9)
```

Let's practice!

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Merging multiple DataFrames

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Merging multiple tables

A	B	C
A1	B1	C1
A2	B2	C2
A3	B3	C3

C	D
C1	D1
C2	D2
C3	D3

A	B	C
A1	B1	C1
A2	B2	C2
A3	B3	C3

C	E
C1	E1
C2	E2
C3	E3

E	F	G
E1	F1	G1
E2	F2	G2
E3	F3	G3

Remembering the licenses table

```
print(licenses.head())
```

```
  account  ward  aid  business         address          zip
0 307071   3     743  REGGIE'S BAR...  2105 S STATE ST  60616
1 10       10    829  HONEYBEERS       13200 S HOUS...  60633
2 10002    14    775  CELINA DELI      5089 S ARCHE...  60632
3 10005    12    nan  KRAFT FOODS ...  2005 W 43RD ST   60609
4 10044    44    638  NEYBOUR'S TA...  3651 N SOUTH...  60613
```

Remembering the wards table

```
print(wards.head())
```

```
  ward  alderman          address          zip
0 1     Proco "Joe" ...  2058 NORTH W...  60647
1 2     Brian Hopkins    1400 NORTH  ...  60622
2 3     Pat Dowell       5046 SOUTH S...  60609
3 4     William D. B...  435 EAST 35T...  60616
4 5     Leslie A. Ha...  2325 EAST 71...  60649
```

Review new data

```
grants = pd.read_csv('Small_Business_Grant_Agreements.csv')
print(grants.head())
```

```
  address          zip    grant       company
0 1000 S KOSTN...  60624  148914.50   NATIONWIDE F...
1 1000 W 35TH ST   60609  100000.00   SMALL BATCH,...
2 1000 W FULTO...  60612  34412.50    FULTON MARKE...
3 10008 S WEST...  60643  12285.32    LAW OFFICES ...
4 1002 W ARGYL...  60640  28998.75    MASALA'S IND...
```

Tables to merge

```
  address          zip    grant      company
0 1031 N CICER...  60651  150000.00  1031 HANS LLC
1 1375 W LAKE ST   60612  150000.00  1375 W LAKE ...
2 1800 W LAKE ST   60612  47700.00   1800 W LAKE LLC
3 4311 S HALST...  60609  87350.63   4311 S. HALS...
4 1747 W CARRO...  60612  50000.00   ACE STYLINE ...
```

```
  account  ward  aid  business         address          zip
0 307071   3     743  REGGIE'S BAR...  2105 S STATE ST  60616
1 10       10    829  HONEYBEERS       13200 S HOUS...  60633
2 10002    14    775  CELINA DELI      5089 S ARCHE...  60632
3 10005    12    nan  KRAFT FOODS ...  2005 W 43RD ST   60609
4 10044    44    638  NEYBOUR'S TA...  3651 N SOUTH...  60613
```

Theoretical merge

```
grants_licenses = grants.merge(licenses, on='zip')
print(grants_licenses.loc[grants_licenses['business']=="REGGIE'S BAR & GRILL",
                          ['grant','company','account','ward','business']])
```

```
  grant      company          account  ward  business
0 136443.07  CEDARS MEDIT...  307071   3     REGGIE'S BAR...
1 39943.15   DARRYL & FYL...  307071   3     REGGIE'S BAR...
2 31250.0    JGF MANAGEMENT   307071   3     REGGIE'S BAR...
3 143427.79  HYDE PARK AN...  307071   3     REGGIE'S BAR...
4 69500.0    ZBERRY INC       307071   3     REGGIE'S BAR...
```

Single merge

```
grants.merge(licenses, on=['address','zip'])
```

```
  address          zip    grant     company          account  ward  aid  business
0 1020 N KOLMA...  60651  68309.8   TRITON INDUS...  7689     37    929  TRITON INDUS...
1 10241 S COMM...  60617  33275.5   SOUTH CHICAG...  246598   10    nan  SOUTH CHICAG...
2 11612 S WEST...  60643  30487.5   BEVERLY RECO...  3705     19    nan  BEVERLY RECO...
3 1600 S KOSTN...  60623  128513.7  CHARTER STEE...  293825   24    nan  LEELO STEEL,...
4 1647 W FULTO...  60612  5634.0    SN PECK BUIL...  85595    27    673  S.N. PECK BU...
```

Merging multiple tables

```
grants_licenses_ward = grants.merge(licenses, on=['address','zip']) \
                        .merge(wards, on='ward', suffixes=('_bus','_ward'))
grants_licenses_ward.head()
```

```
  address_bus      zip_bus  grant     company          account  ward  aid  business         alderma
0 1020 N KOLMA...  60651    68309.8   TRITON INDUS...  7689     37    929  TRITON INDUS...  Emma M.
1 10241 S COMM...  60617    33275.5   SOUTH CHICAG...  246598   10    nan  SOUTH CHICAG...  Susan S
2 11612 S WEST...  60643    30487.5   BEVERLY RECO...  3705     19    nan  BEVERLY RECO...  Matthew
3 3502 W 111TH ST  60655    50000.0   FACE TO FACE...  263274   19    704  FACE TO FACE     Matthew
4 1600 S KOSTN...  60623    128513.7  CHARTER STEE...  293825   24    nan  LEELO STEEL,...  Michael
```

Results

```
import matplotlib.pyplot as plt
grant_licenses_ward.groupby('ward').agg('sum').plot(kind='bar', y='grant')
plt.show()
```

Merging even more...

Three tables:

```
df1.merge(df2, on='col') \
    .merge(df3, on='col')
```

Four tables:

```
df1.merge(df2, on='col') \
    .merge(df3, on='col') \
    .merge(df4, on='col')
```

Let's practice!

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