# Inner join

JOINING DATA WITH PANDAS

**Aaren Stubberfield**
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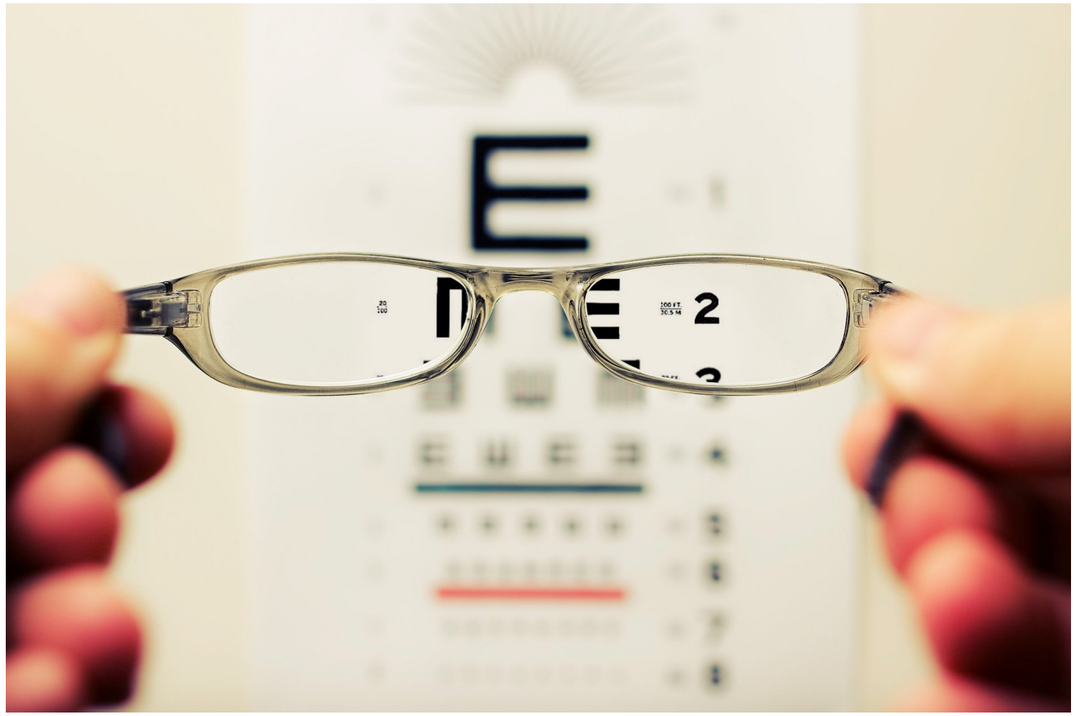
# For clarity



Tables = DataFrames

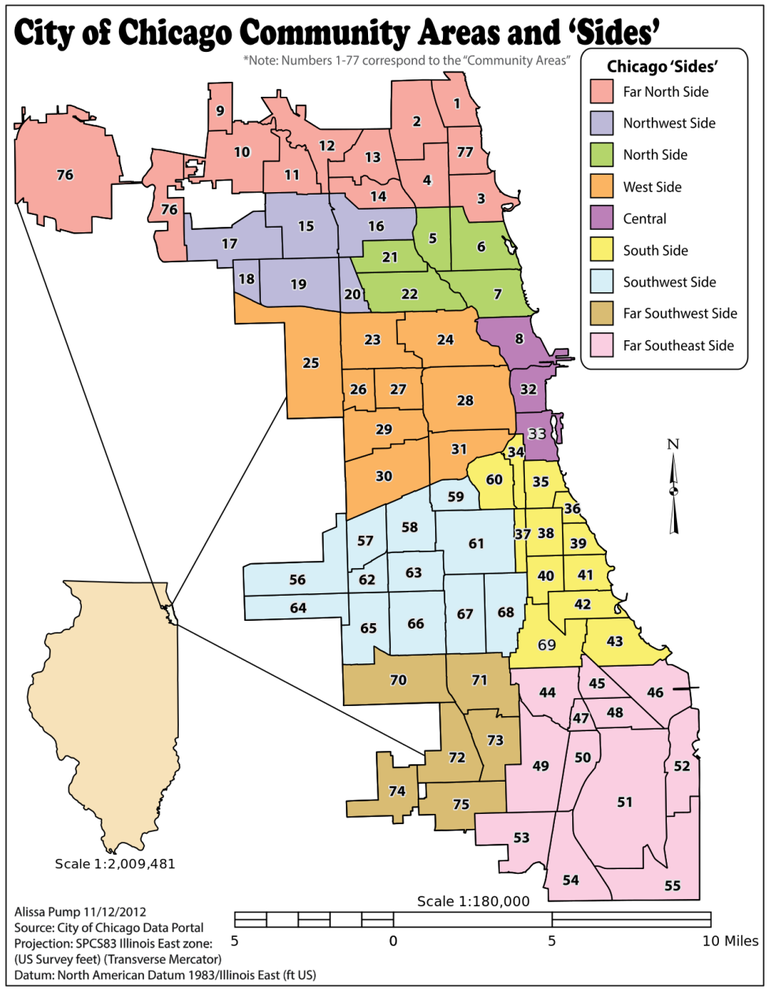
Merging = Joining

[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

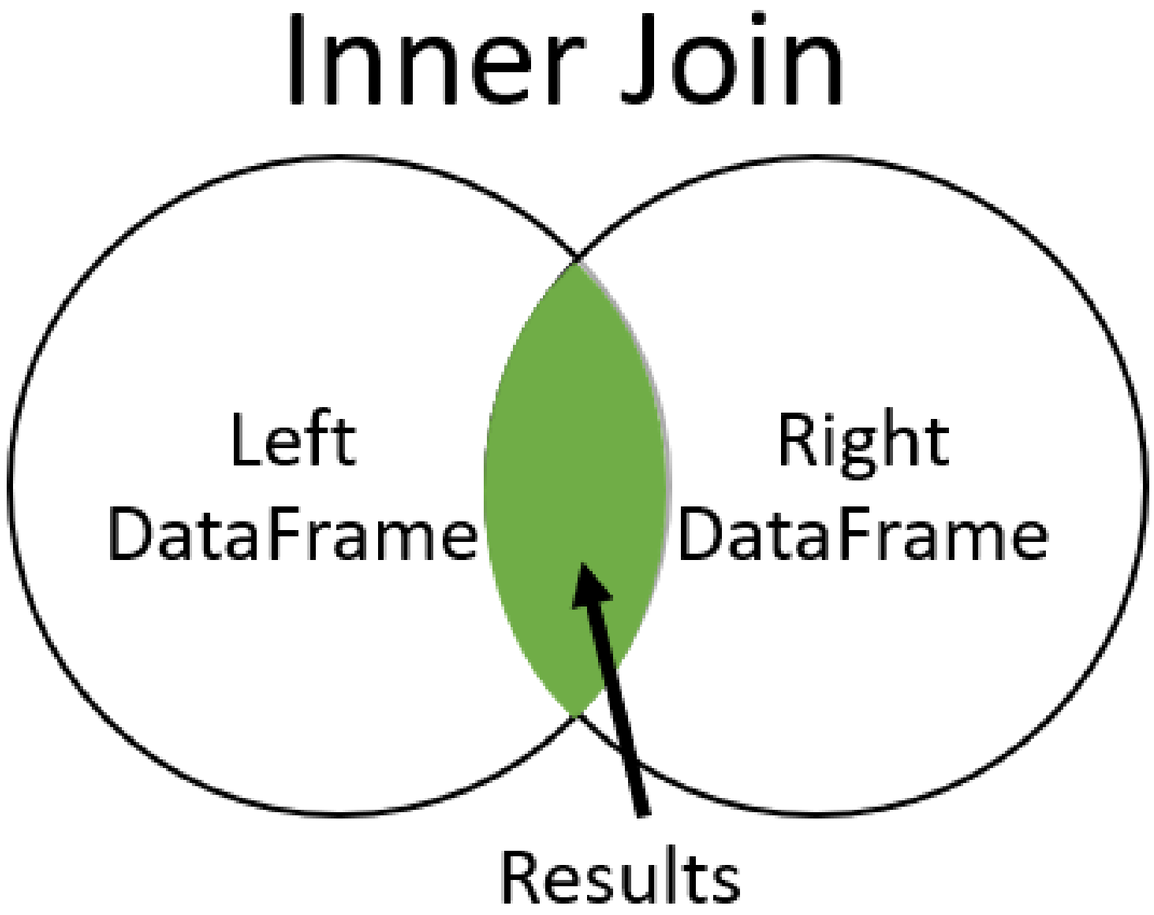
```
wards_census = wards.merge(census, on='ward')
print(wards_census.head(4))
```

```
  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!

JOINING DATA WITH PANDAS

# One to many relationships

JOINING DATA WITH PANDAS

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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
```

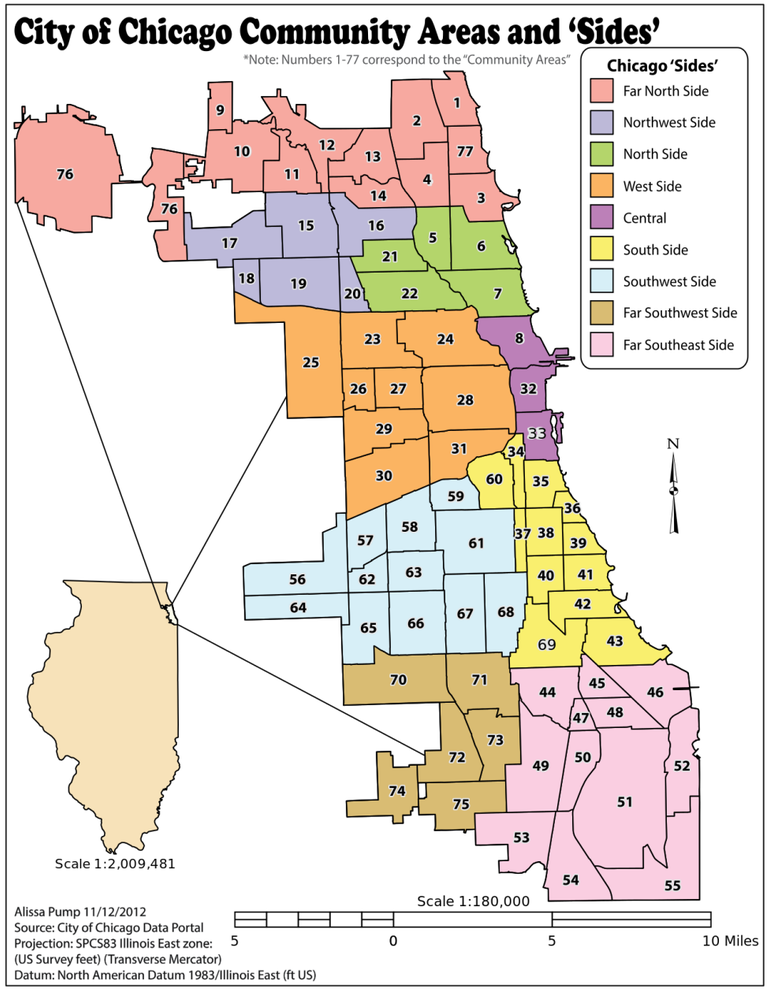
# One-to-many

| 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!

JOINING DATA WITH PANDAS

# Merging multiple DataFrames

JOINING DATA WITH PANDAS

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Instructor

datacamp

# 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... |

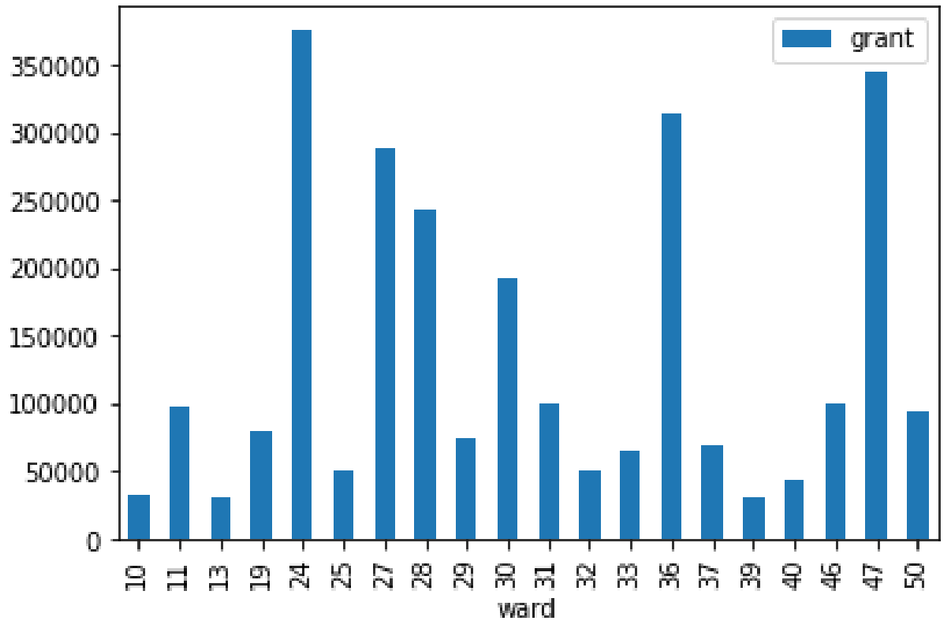
# Merging multiple tables

```
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!

JOINING DATA WITH PANDAS