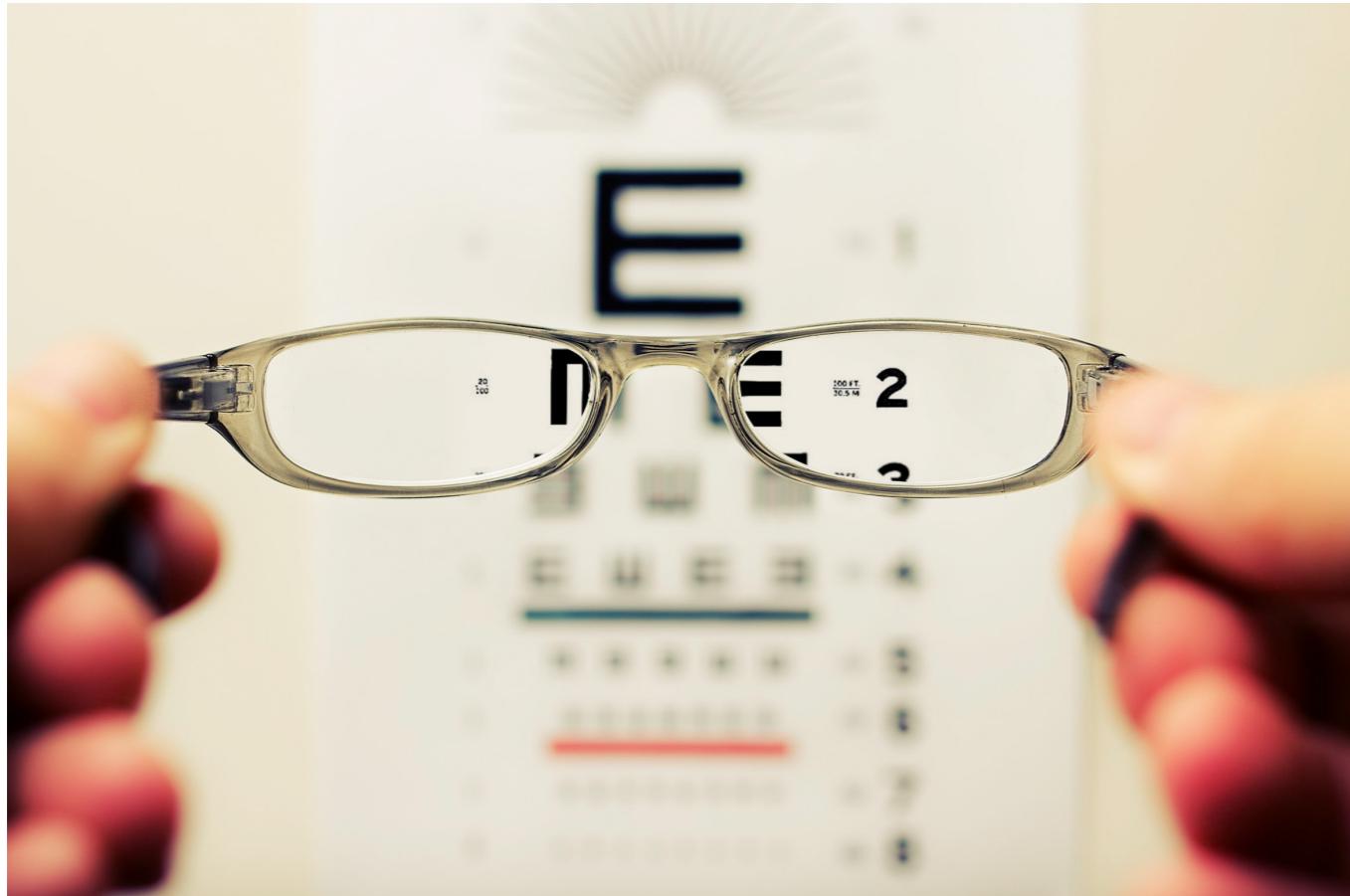


# For clarity



**Tables = DataFrames**

**Merging = Joining**

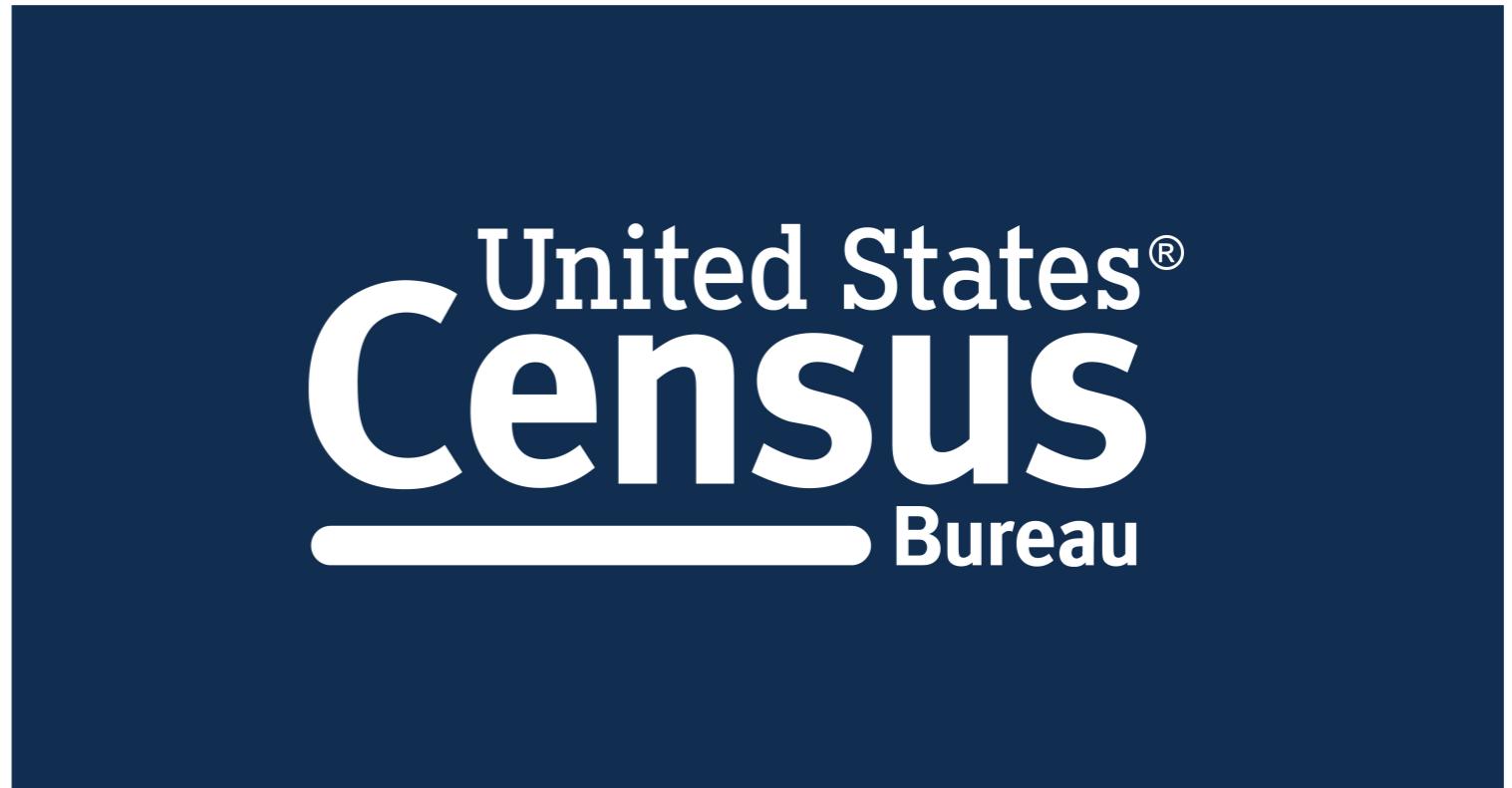
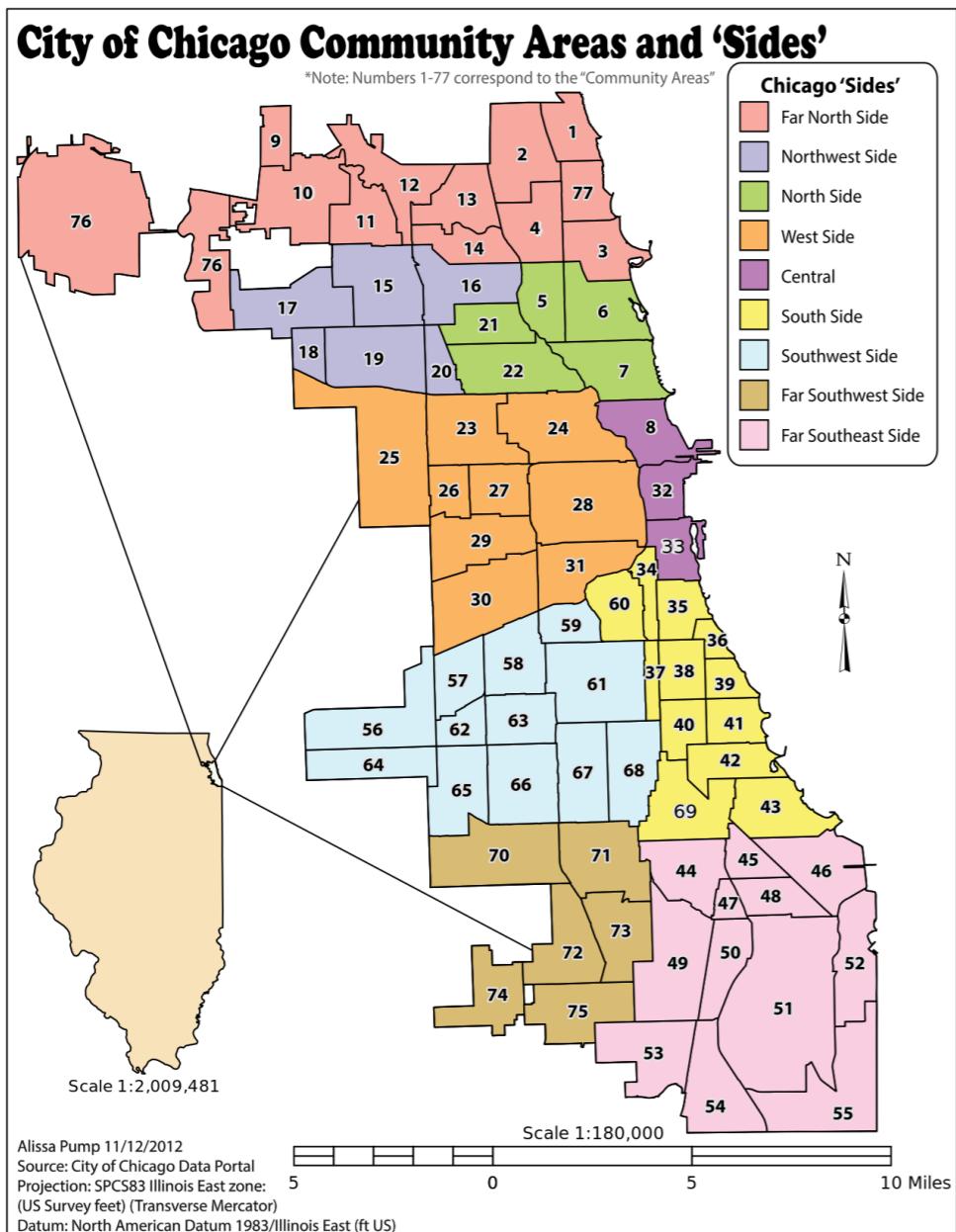
<sup>1</sup> Photo by David Travis on Unsplash

# Chicago data portal dataset



<sup>1</sup> Photo by Pedro Lastra on Unsplash

# Datasets for example



<sup>1</sup> 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))
```

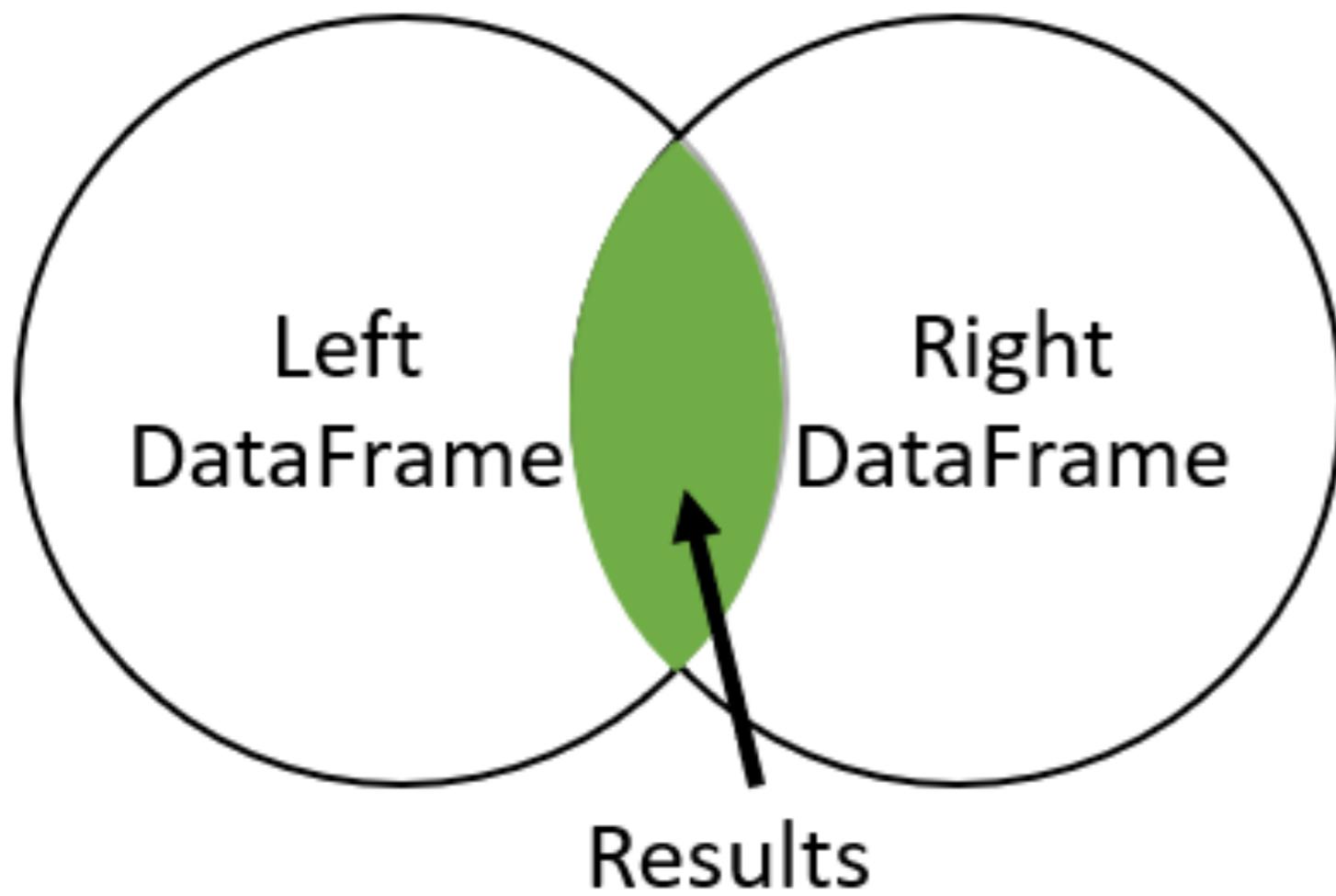
```
   ward alderman      address_x      zip_x  pop_2000  pop_2010    change address_y      zip_y
0  1  Proco "Joe" ...  2058 NORTH W...  60647    52951    56149     6%  2765 WEST SA...  60647
1  2  Brian Hopkins  1400 NORTH ...  60622    54361    55805     3%  WM WASTE MAN...  60622
2  3  Pat Dowell    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

## 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	zip_
0	1	Proco "Joe" ...	2058 NORTH W...	60647	52951	56149	6%	2765 WEST SA...	6064
1	2	Brian Hopkins	1400 NORTH ...	60622	54361	55805	3%	WM WASTE MAN...	6062
2	3	Pat Dowell	5046 SOUTH S...	60609	40385	53039	31%	17 EAST 38TH...	6065
3	4	William D. B...	435 EAST 35T...	60616	51953	54589	5%	31ST ST HARB...	6065
4	5	Leslie A. Ha...	2325 EAST 71...	60649	55302	51455	-7%	JACKSON PARK...	6063
(50, 9)									

# **Let's practice!**

**JOINING DATA WITH PANDAS**

# One-to-one

A	B	C	C	D
A1	B1	C1	C1	D1
A2	B2	C2	C2	D2
A3	B3	C3	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

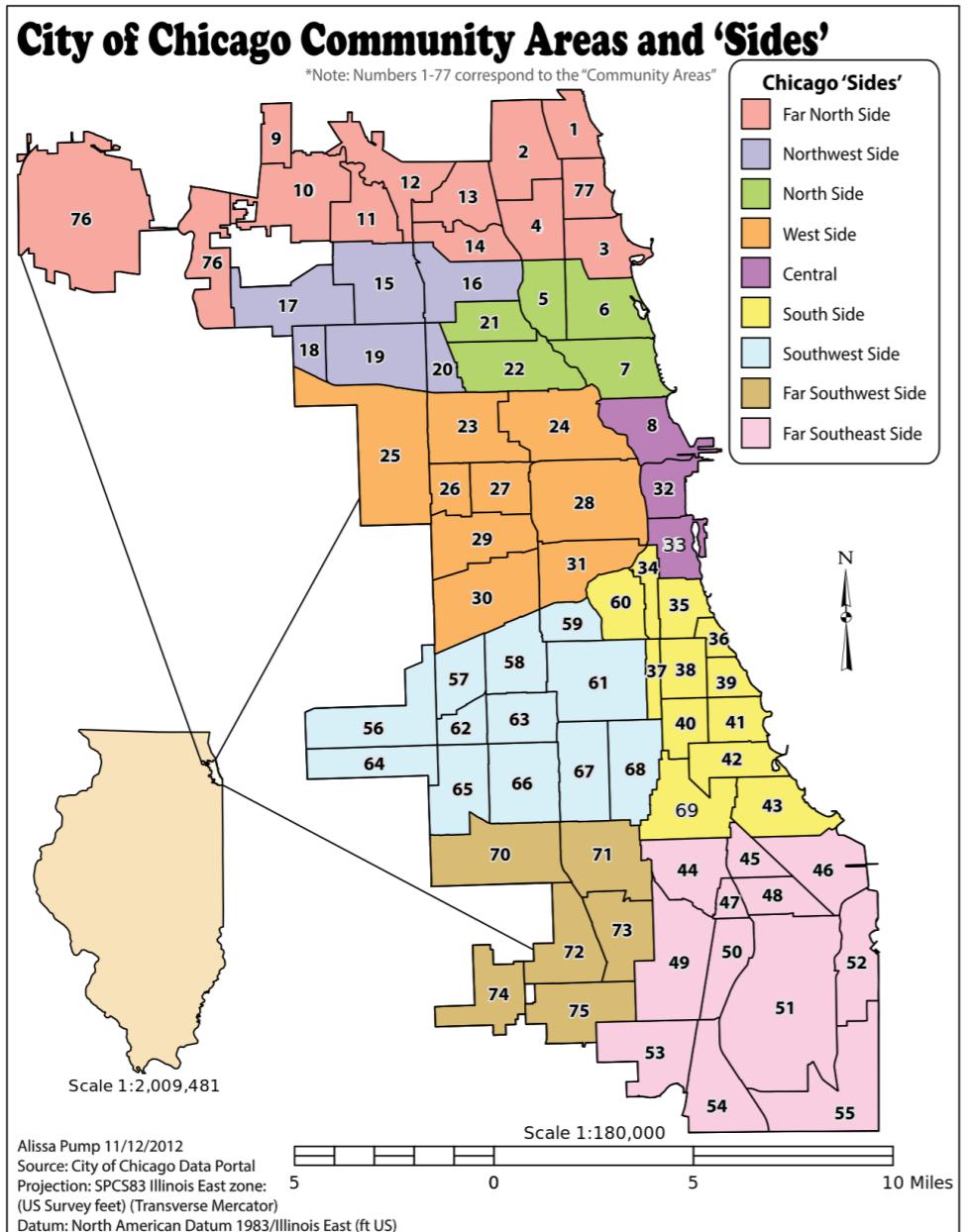
	ward	pop_2000	pop_2010	change	address	zip
0	1	52951	56149	6%	2765 WEST SA...	60647
1	2	54361	55805	3%	WM WASTE MAN...	60622
2	3	40385	53039	31%	17 EAST 38TH...	60653
3	4	51953	54589	5%	31ST ST HARB...	60653
4	5	55302	51455	-7%	JACKSON PARK...	60637

# One-to-many

A	B	C	C	D
A1	B1	C1	C1	D1
A2	B2	C2	C1	D2
A3	B3	C3	C1	D3

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	z
0	1	Proco "Joe" ...	2058 NORTH W...	60647	12024	nan	DIGILOG ELEC...	1038 N ASHLA...	6
1	1	Proco "Joe" ...	2058 NORTH W...	60647	14446	743	EMPTY BOTTLE...	1035 N WESTE...	6
2	1	Proco "Joe" ...	2058 NORTH W...	60647	14624	775	LITTLE MEL'S...	2205 N CALIF...	6
3	1	Proco "Joe" ...	2058 NORTH W...	60647	14987	nan	MR. BROWN'S ...	2301 W CHICA...	6
4	1	Proco "Joe" ...	2058 NORTH W...	60647	15642	814	Beat Kitchen	2000-2100 W ...	6

# One-to-many example

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

```
(50, 4)
```

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

```
(10000, 9)
```

# **Let's practice!**

**JOINING DATA WITH PANDAS**

# Merging multiple tables

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

A	B	C	C	E	E	F	G
A1	B1	C1	C1	E1	E1	F1	G1
A2	B2	C2	C2	E2	E2	F2	G2
A3	B3	C3	C3	E3	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...

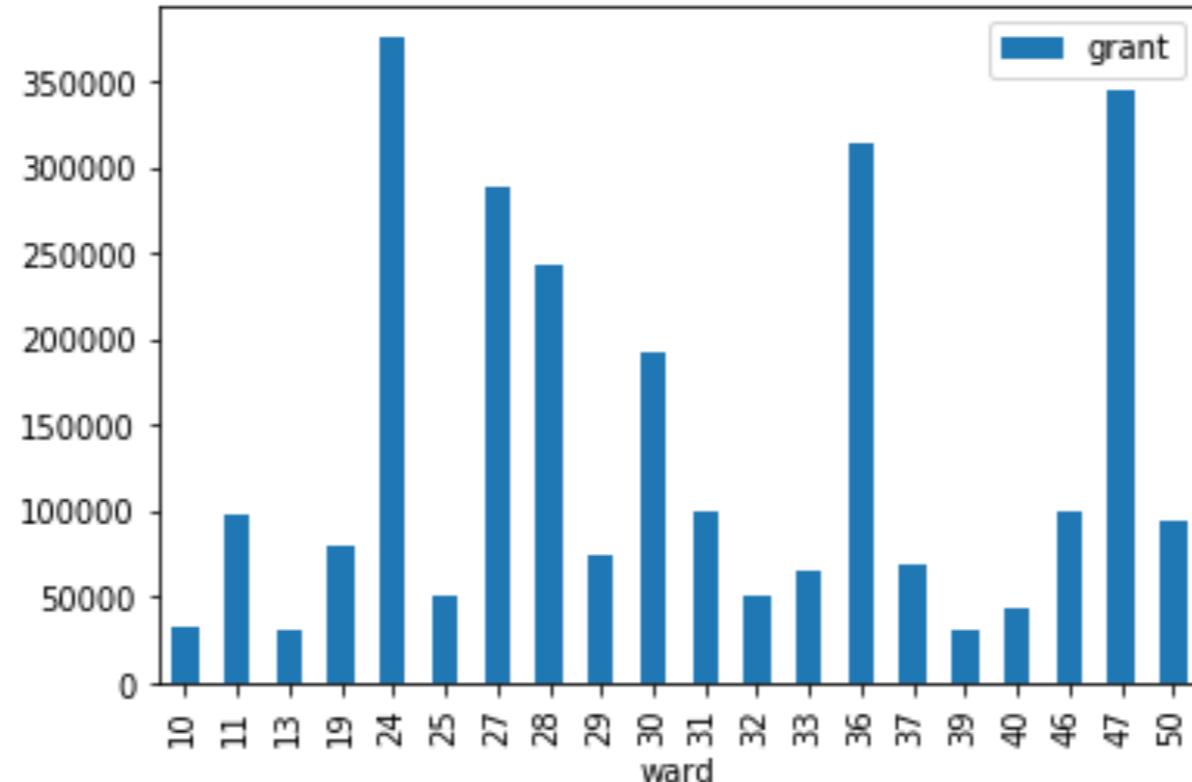
# Merging multiple tables

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

# 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**