[301] Database 3

Tyler Caraza-Harter

Learning Objectives Today

GROUP BY

- how to break data into buckets
- combination of GROUP BY with ORDER BY
- WHERE vs. HAVING

Aggregates

- SUM, COUNT, MAX, MIN, SUM
- Aliases with AS

Outline

Aggregation Queries

Grouping with Python

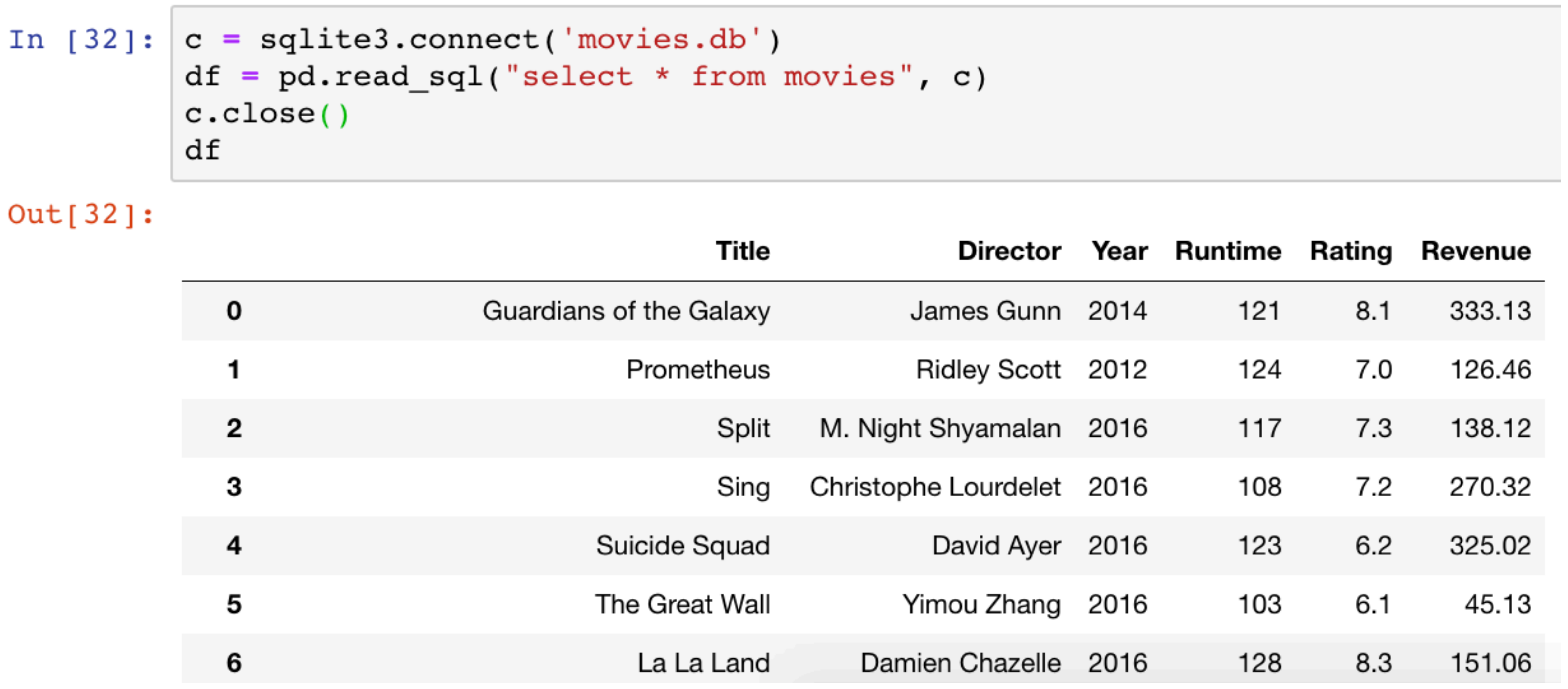
Grouping with SQL

Combining with LIMIT and ORDER BY

WHERE vs. HAVING

Practice

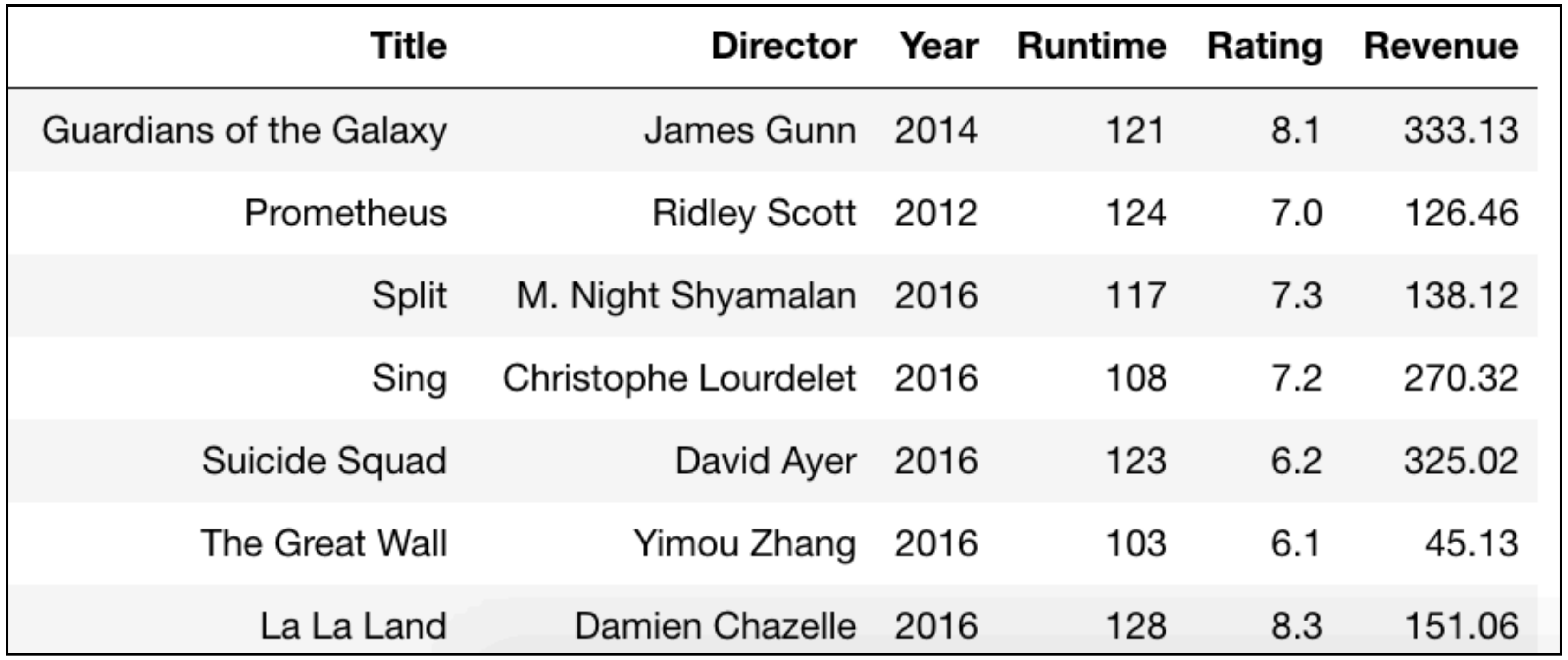
Example: Movies Database



```
In [32]: c = sqlite3.connect('movies.db')
         df = pd.read_sql("select * from movies", c)
         c.close()
         df
```

Out[32]:

	Title	Director	Year	Runtime	Rating	Revenue
0	Guardians of the Galaxy	James Gunn	2014	121	8.1	333.13
1	Prometheus	Ridley Scott	2012	124	7.0	126.46
2	Split	M. Night Shyamalan	2016	117	7.3	138.12
3	Sing	Christophe Lourdelet	2016	108	7.2	270.32
4	Suicide Squad	David Ayer	2016	123	6.2	325.02
5	The Great Wall	Yimou Zhang	2016	103	6.1	45.13
6	La La Land	Damien Chazelle	2016	128	8.3	151.06



Title	Director	Year	Runtime	Rating	Revenue
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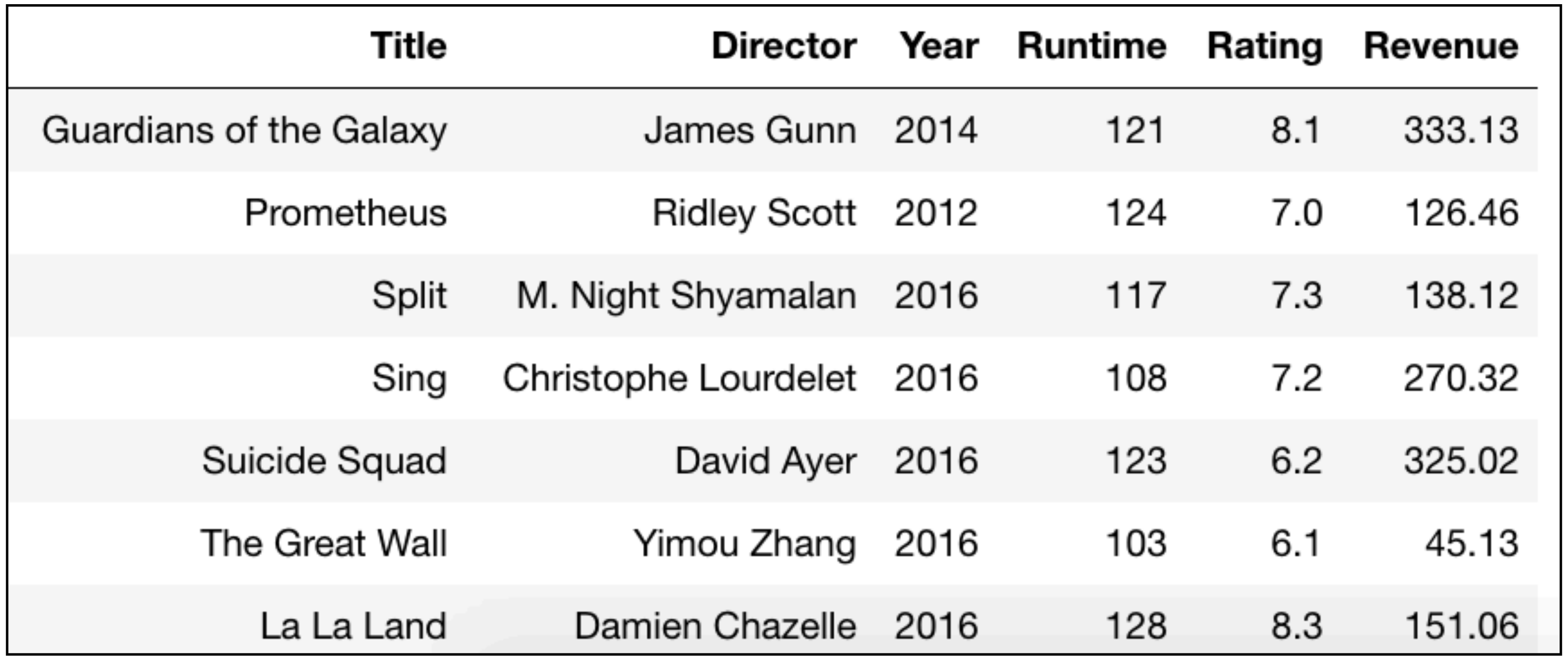
The Great Wall	Yimou Zhang	2016	103	6.1	45.13
La La Land	Damien Chazelle	2016	128	8.3	151.06

Question: which movie has the highest rating?

SQL Query:

```
SELECT Title FROM Movies
ORDER BY Rating DESC
LIMIT 1
```



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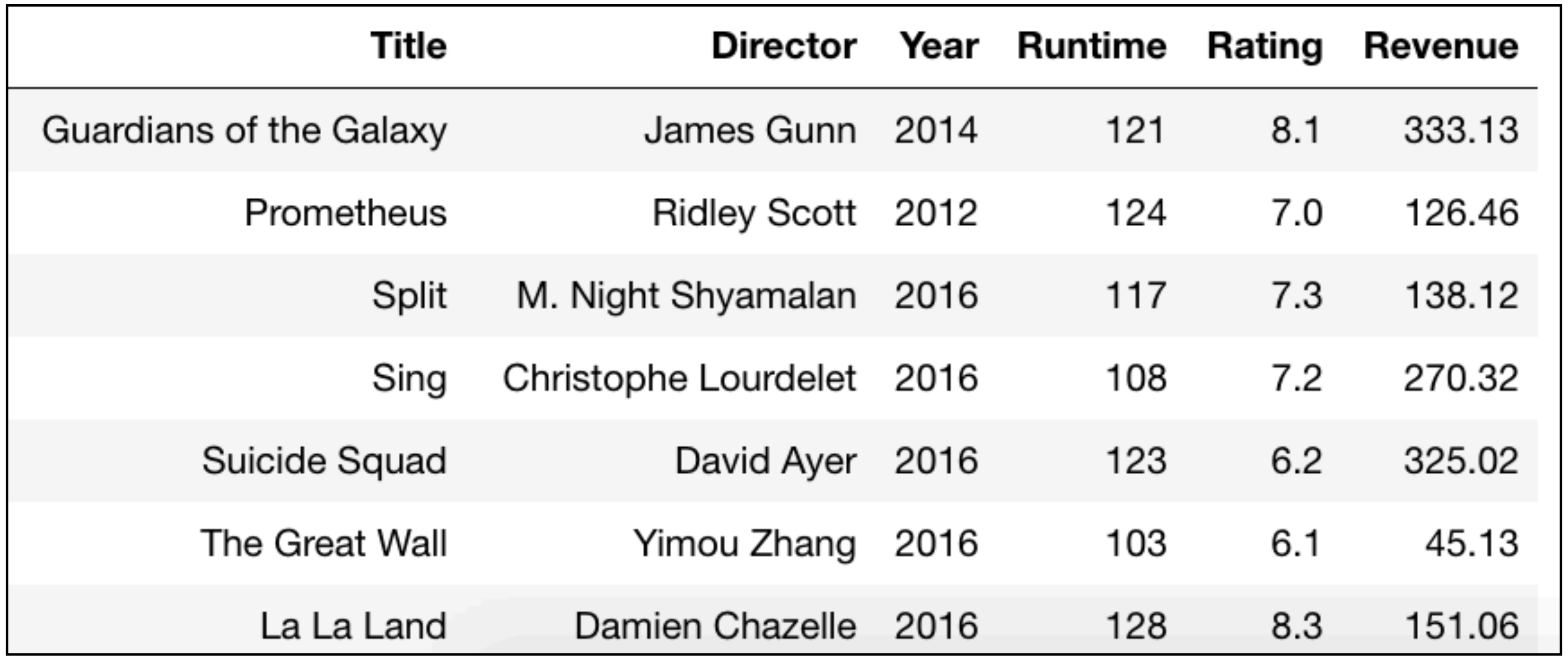
The Great Wall	Yimou Zhang	2016	103	6.1	45.13
La La Land	Damien Chazelle	2016	128	8.3	151.06

Question: which director made the shortest movie?

SQL Query:

```
SELECT Director FROM Movies
ORDER BY Runtime ASC
LIMIT 1
```



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La La Land	Damien Chazelle	2016	128	8.3	151.06

Question: which director made the highest-revenue movie?

SQL Query:

```
SELECT Director FROM Movies
ORDER BY Revenue DESC
LIMIT 1
```

Title	Director	Year	Runtime	Rating	Revenue
Guardians of the Galaxy	James Gunn	2014	121	8.1	333.13
Prometheus	Ridley Scott	2012	124	7.0	126.46
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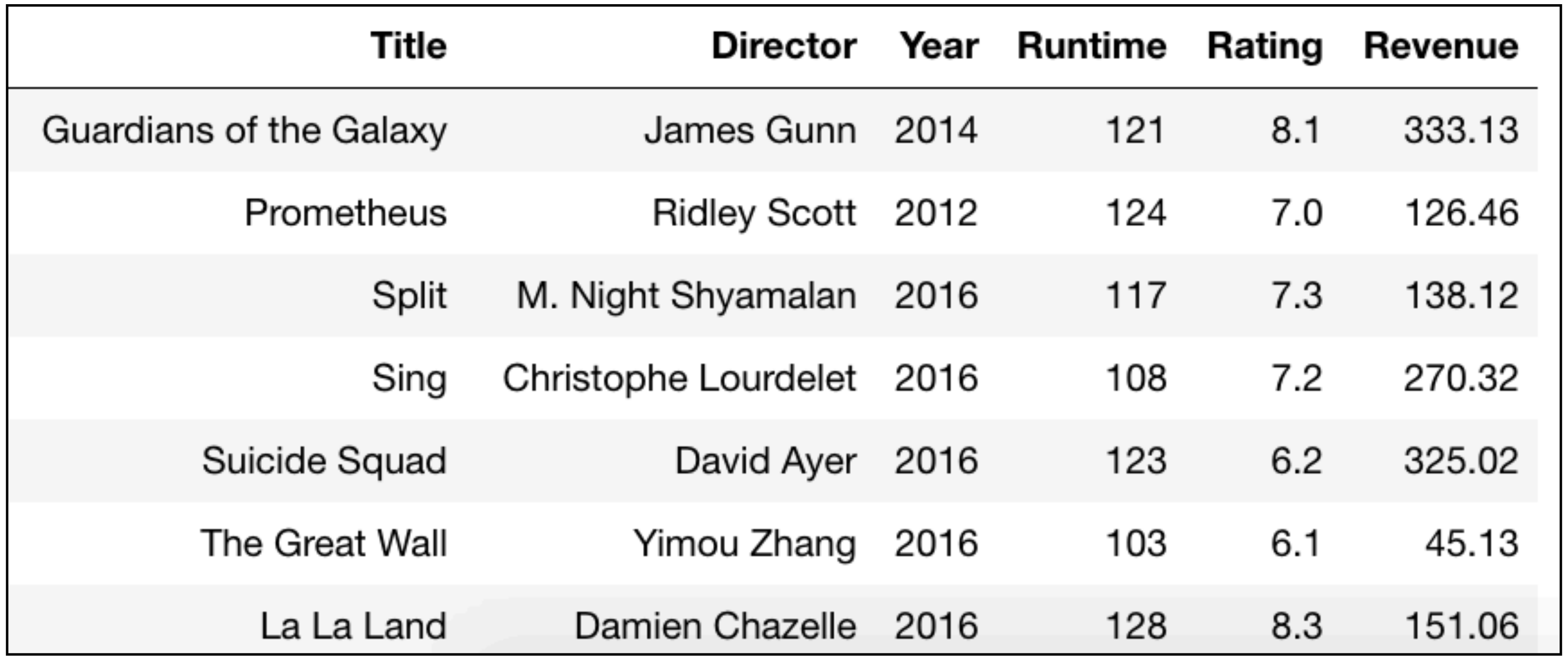
The Great Wall	Yimou Zhang	2016	103	6.1	45.13
La La Land	Damien Chazelle	2016	128	8.3	151.06

Question: which movie had the highest revenue in 2016?

SQL Query:

```
SELECT Director FROM Movies
WHERE Year = 2016
ORDER BY Revenue DESC
LIMIT 1
```



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La La Land	Damien Chazelle	2016	128	8.3	151.06

Question: which 3 movies had the highest revenues in 2016?

SQL Query:

```
SELECT Director FROM Movies
WHERE Year = 2016
ORDER BY Revenue DESC
LIMIT 3
```

Data Questions

which movie has the highest rating?

which director made the shortest movie?

which director made the highest-revenue movie?

which movie had the highest revenue in 2016?

which 3 movies had the highest revenues in 2016?

These questions all have something in common:

identify certain rows, then **just extract**
specific columns from those rows to answer

Data Questions

which movie has the highest rating?

which director made the shortest movie?

which director made the highest-revenue movie?

which movie had the highest revenue in 2016?

which 3 movies had the highest revenues in 2016?

These questions all have something in common:

identify certain rows, then **just extract**
specific columns from those rows to answer

Sometimes we want a summary over multiple rows

called an **“aggregate”**

Extract data:

which movie has the highest rating?

which director made the shortest movie?

which director made the highest-revenue movie?

which movie had the highest revenue in 2016?

which 3 movies had the highest revenues in 2016?

Summarize data:

what is the **average** rating across all movies?

what is the **average** runtime for a James Gunn movie?

what is the **average** revenue for a Ridley Scott movie?

how many movies were there in 2016?

what was the **total** revenue of all movies in 2016?

Extract data:

which movie has the highest rating?

which director made the shortest movie?

which director made the highest-revenue movie?

which movie had the highest revenue in 2016?

which 3 movies had the highest revenues in 2016?

Summarize data:

today

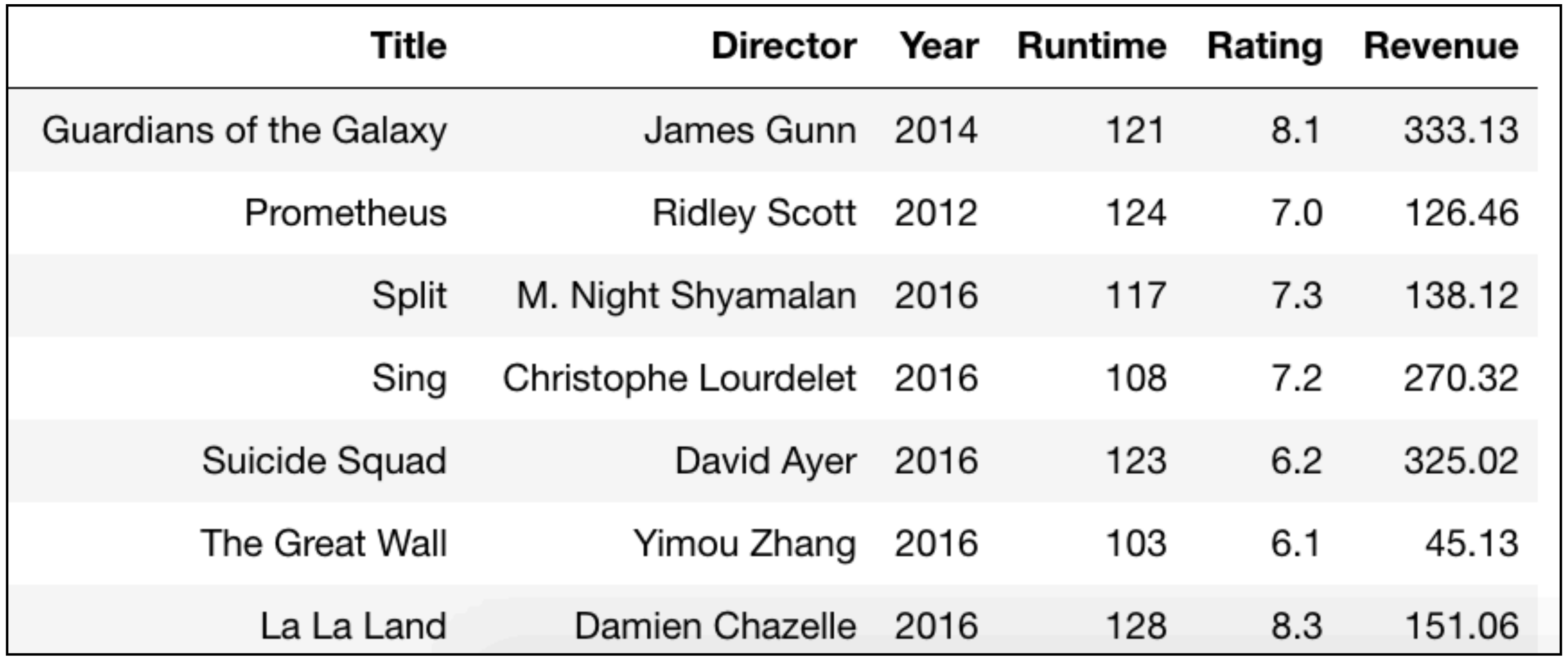
what is the **average** rating across all movies?

what is the **average** runtime for a James Gunn movie?

what is the **average** revenue for a Ridley Scott movie?

how many movies were there in 2016?

what was the **total** revenue of all movies in 2016?



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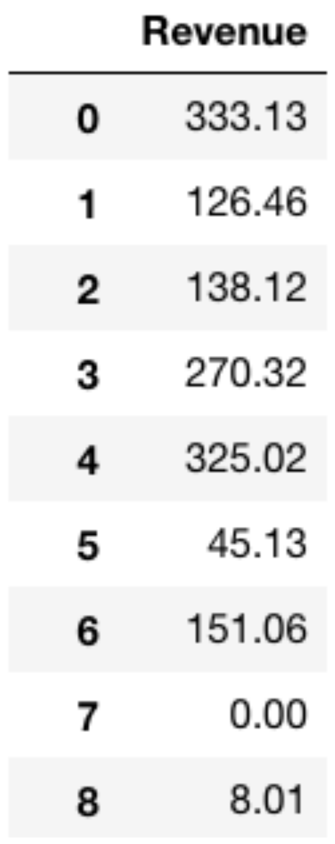
La La Land	Damien Chazelle	2016	128	8.3	151.06

Question: what is the total revenue of all the movies?

SQL Query:

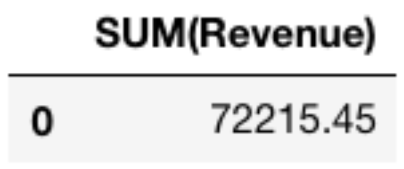
```
SELECT * FROM Movies
```



	Revenue
0	333.13
1	126.46
2	138.12
3	270.32
4	325.02
5	45.13
6	151.06
7	0.00
8	8.01

Question: what is the total revenue of all the movies?

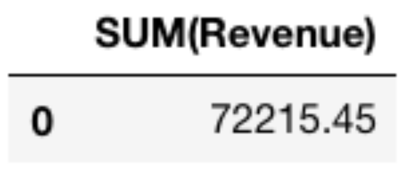
SQL Query: `SELECT Revenue FROM Movies`



	SUM(Revenue)
0	72215.45

Question: what is the total revenue of all the movies?

SQL Query: `SELECT SUM(Revenue) FROM Movies`



	SUM(Revenue)
0	72215.45

Question: what is the total revenue of all the movies?

SQL Query: `SELECT SUM(Revenue) FROM Movies`

SUM is an aggregate function

	SUM(Revenue)
0	72215.45

Question: what is the total revenue of all the movies?

SQL Query: `SELECT SUM(Revenue) FROM Movies`

SUM is an aggregate function

aggregates functions: SUM, AVG, COUNT, MIN, MAX

	SUM(Revenue)	COUNT()
0	72215.45	998

Question: what is the total revenue of all the movies? and how many movies are there?

SQL Query:

```
SELECT SUM(Revenue), COUNT() FROM Movies
```

COUNT doesn’t need an argument

aggregates functions: SUM, AVG, COUNT, MIN, MAX

	SUM(Revenue) / COUNT()
0	72.36017

Question: what is the average revenue of all the movies?

SQL Query:

```
SELECT SUM(Revenue) / COUNT() FROM Movies
```

you can combine aggregates

aggregates functions: SUM, AVG, COUNT, MIN, MAX

	AVG(Revenue)
0	72.36017

Question: what is the average revenue of all the movies?

SQL Query:

```
SELECT AVG(Revenue) FROM Movies
```

SUM divided by COUNT

aggregates functions: SUM, AVG, COUNT, MIN, MAX

	AVG(Revenue)	AVG(Runtime)
0	72.36017	113.170341

Question: what is the average revenue of all the movies?
what is the average runtime of all the movies?

SQL Query:

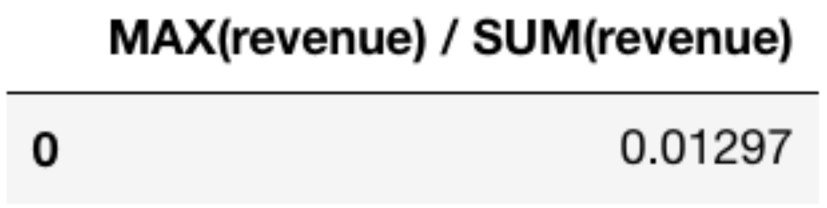
```
SELECT AVG(Revenue), AVG(Runtime) FROM Movies
```

aggregates functions: SUM, AVG, COUNT, MIN, MAX

Question: what percentage of the total revenue came from the highest-revenue movie?

SQL Query: `???`

aggregates functions: SUM, AVG, COUNT, MIN, MAX



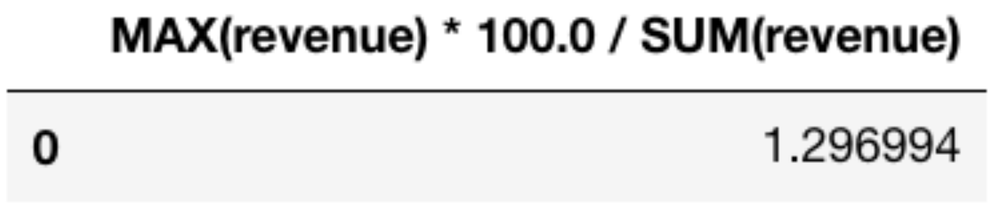
	MAX(revenue) / SUM(revenue)
0	0.01297

Question: what percentage of the total revenue came from the highest-revenue movie?

SQL Query:

```
SELECT MAX(Revenue)/SUM(Revenue) FROM Movies
```

aggregates functions: SUM, AVG, COUNT, MIN, MAX



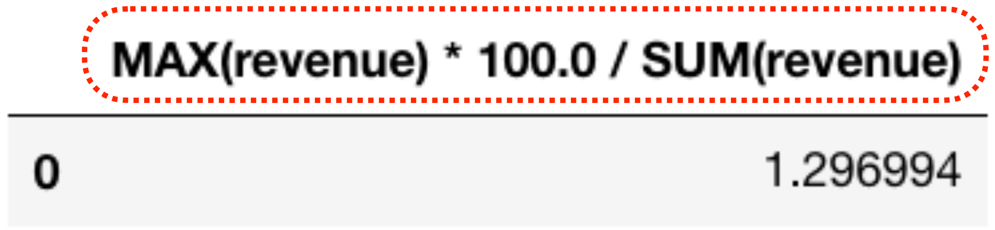
	MAX(revenue) * 100.0 / SUM(revenue)
0	1.296994

Question: what percentage of the total revenue came from the highest-revenue movie?

SQL Query: `SELECT 100 * MAX(Revenue)/SUM(Revenue) FROM Movies`

aggregates functions: SUM, AVG, COUNT, MIN, MAX

clunky column name for Pandas DataFrame



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Question: what percentage of the total revenue came from the highest-revenue movie?

SQL Query:

```
SELECT 100 * MAX(Revenue)/SUM(Revenue) FROM Movies
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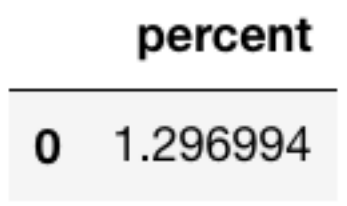
aggregates functions: SUM, AVG, COUNT, MIN, MAX



	percent
0	1.296994

Question: what percentage of the total revenue came from the highest-revenue movie?

SQL Query:

```
SELECT 100 * MAX(Revenue)/SUM(Revenue) AS percent
FROM Movies
```

aggregates functions: SUM, AVG, COUNT, MIN, MAX

	percent
0	1.296994

Question: what percentage of the total revenue came from the highest-revenue movie?

SQL Query:

```
SELECT 100 * MAX(Revenue)/SUM(Revenue) AS percent
FROM Movies
```

you can use "AS" to call columns whatever you like…

aggregates functions: SUM, AVG, COUNT, MIN, MAX

	percent
0	1.296994

Question: what percentage of the total revenue came from the highest-revenue movie?

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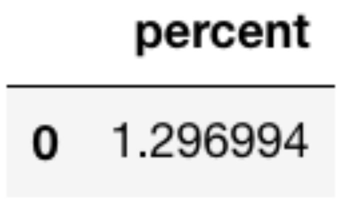

	percent
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what if we want to answer this question just for movies in 2016?

Question: what percentage of the total revenue came from the highest-revenue movie?

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what if we want to
answer this question just
for movies in 2016?

Question: what percentage of the total revenue **in 2016** came from the highest-revenue movie?

SQL Query:

```
SELECT 100 * MAX(Revenue)/SUM(Revenue) AS percent
FROM Movies
```

aggregates functions: SUM, AVG, COUNT, MIN, MAX

Question: what percentage of the total revenue **in 2016** came from the highest-revenue movie?

SQL Query:

```
SELECT 100 * MAX(Revenue)/SUM(Revenue) AS percent
FROM Movies
WHERE year = 2016
```

you can combine WHERE with aggregates
(filtering is done before aggregation)

aggregates functions: SUM, AVG, COUNT, MIN, MAX

Year	percent
2014	333.13
2012	126.46
2016	138.12
2016	270.32
2016	325.02
2016	45.13
2016	151.06

in progress…

Question: what percentage of the total revenue **in 2016** came from the highest-revenue movie?

SQL Query:

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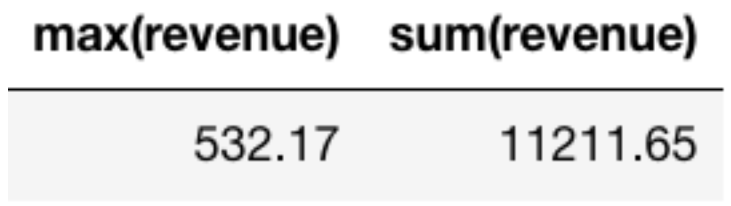

max(revenue)	sum(revenue)
532.17	11211.65

in progress...

Question: what percentage of the total revenue **in 2016** came from the highest-revenue movie?

SQL Query:

```
SELECT 100 * MAX(Revenue)/SUM(Revenue) AS percent
FROM Movies
WHERE year = 2016
```

you can combine WHERE with aggregates
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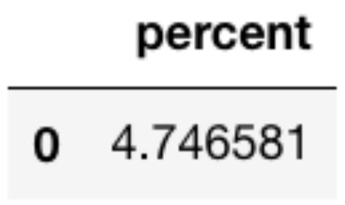


	percent
0	4.746581

Question: what percentage of the total revenue **in 2016** came from the highest-revenue movie?

SQL Query:

```
SELECT 100 * MAX(Revenue)/SUM(Revenue) AS percent
FROM Movies
WHERE year = 2016
```

you can combine WHERE with aggregates
(filtering is done before aggregation)

aggregates functions: SUM, AVG, COUNT, MIN, MAX

Outline

Aggregation Queries

Grouping with Python

Grouping with SQL

Combining with LIMIT and ORDER BY

WHERE vs. HAVING

Practice

Extract data:

previously

which movie has the highest rating?

which director made the shortest movie?

which director made the highest-revenue movie?

which movie had the highest revenue in 2016?

which 3 movies had the highest revenues in 2016?

Summarize data:

just now

what is the average rating across all movies?

what is the average runtime for a James Gunn movie?

what is the average revenue for a Ridley Scott movie?

how many movies were there in 2016?

what was the total revenue of all movies in 2016?

Summarize data across groups:

now…

what is the average rating for **each** director?

what is the average runtime for **each** director?

what is the average revenue for **each** year?

how many movies were there in **each** year?

what was the total revenue for **each** year?

Extract data:

previously

which movie has the highest rating?
which director made the shortest movie?
which director made the highest-revenue movie?
which movie had the highest revenue in 2016?
which 3 movies had the highest revenues in 2016?

Summarize data:

just now

what is the average rating across all movies?
what is the average runtime for a James Gunn movie?
what is the average revenue for a Ridley Scott movie?
how many movies were there in 2016?
what was the total revenue of all movies in 2016?

Summarize data across groups:

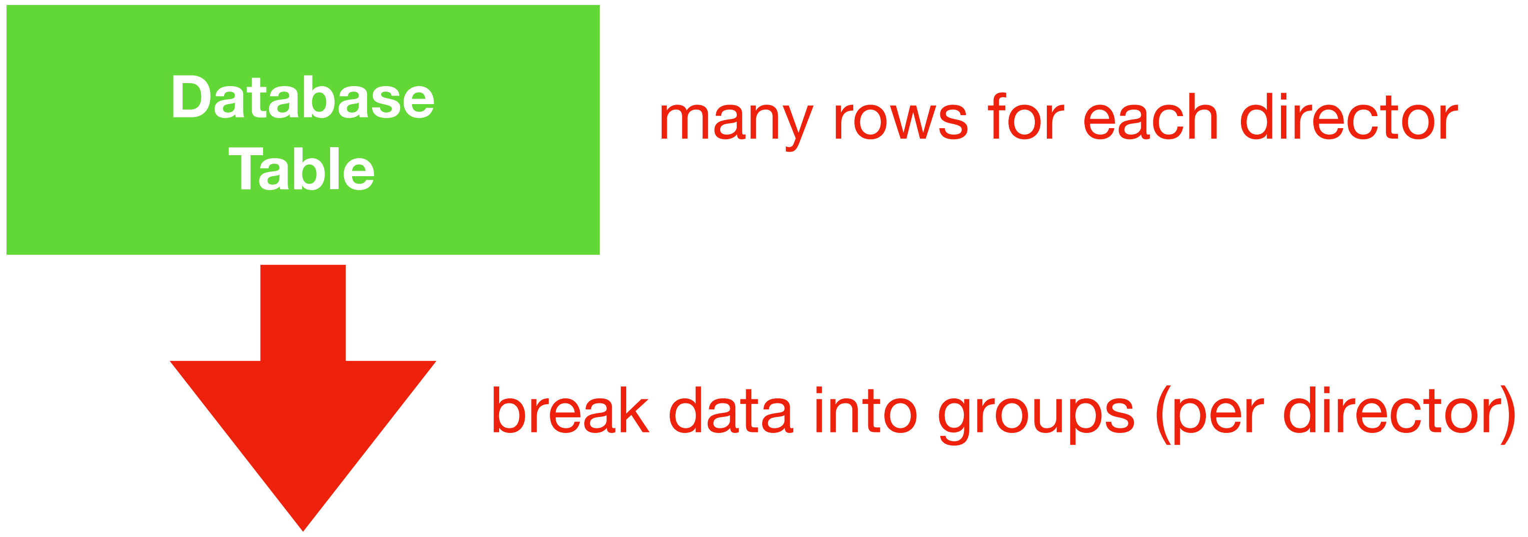
now…

what is the average rating for **each** director?
what is the average runtime for **each** director?
what is the average revenue for **each** year?
how many movies were there in **each** year?
what was the total revenue for **each** year?

Demo 1: Average Rating per Director

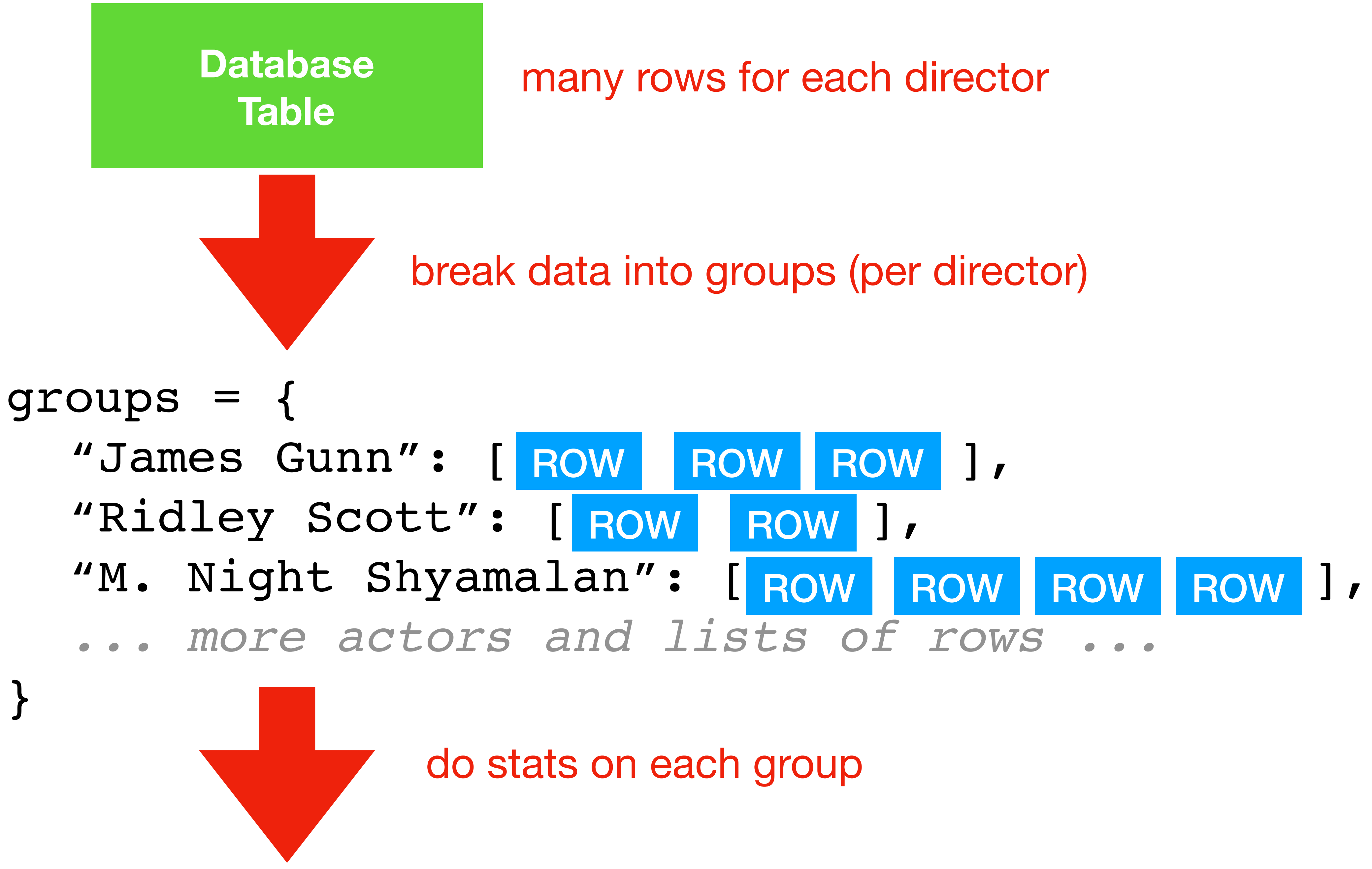
Database Table
many rows for each director

Demo 1: Average Rating per Director


Database Table
many rows for each director
break data into groups (per director)

```
groups = {
   "James Gunn": [ ROW  ROW  ROW ],
   "Ridley Scott": [ ROW  ROW ],
   "M. Night Shyamalan": [ ROW  ROW  ROW  ROW ],
   ... more actors and lists of rows ...
}
```

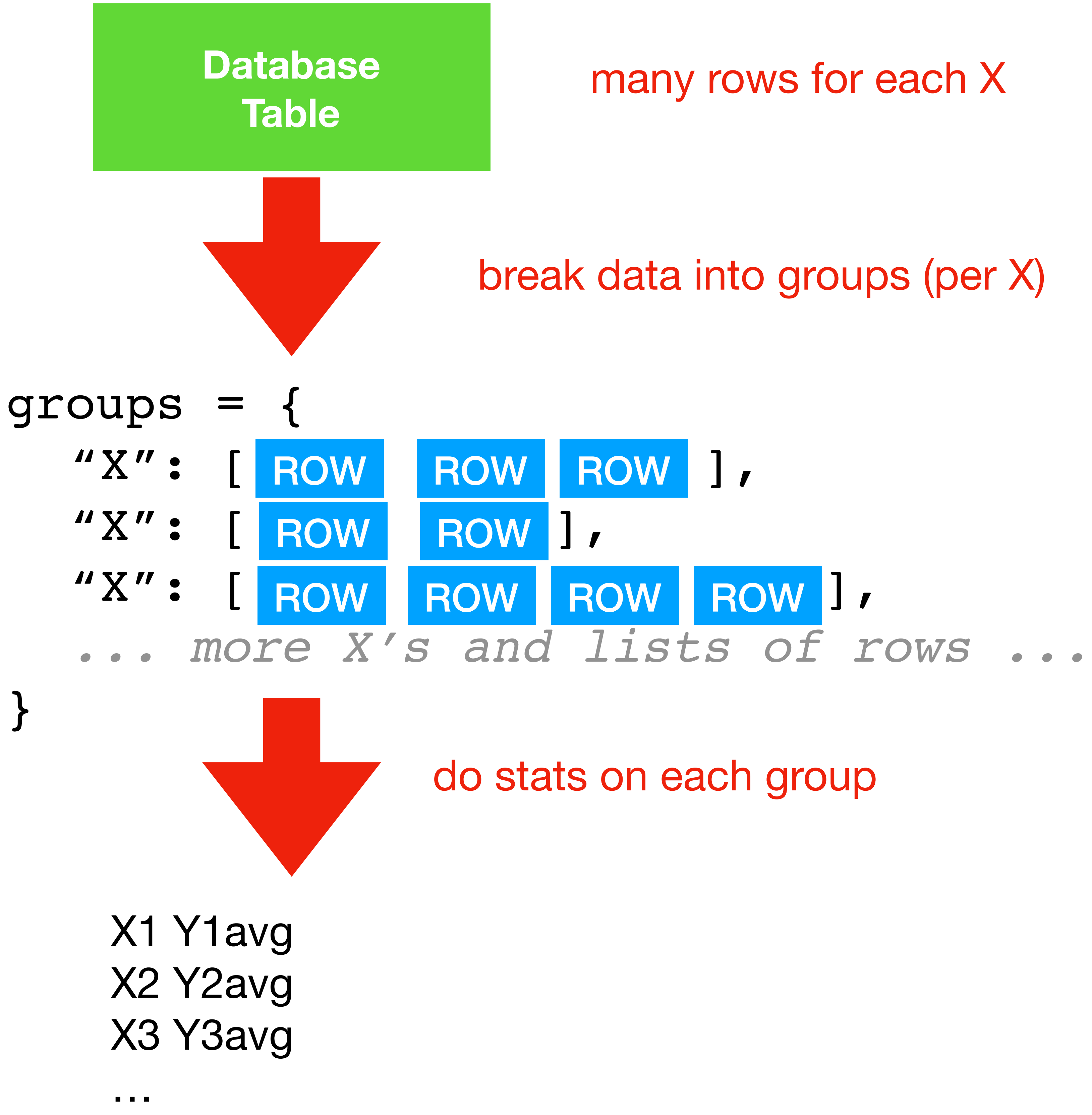
Demo 1: Average Rating per Director


Database Table
many rows for each director
break data into groups (per director)
do stats on each group

```
groups = {
   "James Gunn": [ ROW  ROW  ROW ],
   "Ridley Scott": [ ROW  ROW ],
   "M. Night Shyamalan": [ ROW  ROW  ROW  ROW ],
   ... more actors and lists of rows ...
}
```

James Gunn 7.13
Ridley Scott 6.85
M. Night Shyamalan 5.53
...

Demo 2: Average Y per X



```
groups = {
   "X": [ ROW  ROW ROW ],
   "X": [ ROW  ROW ],
   "X": [ ROW ROW ROW ROW ],
   ... more X's and lists of rows ...
}
```

X1 Y1avg
X2 Y2avg
X3 Y3avg
...

Outline

Aggregation Queries

Grouping with Python

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WHERE vs. HAVING

Practice

Group By, by example…

	SUM(Revenue)
0	72215.45

Question: what is the total revenue of **all the movies**?

SQL Query: `SELECT SUM(Revenue) FROM Movies`

Group By, by example…

Question: what is the total revenue of **per year**?

SQL Query:

```
SELECT SUM(Revenue) FROM Movies
```

Group By, by example…

Question: what is the total revenue of **per year**?

SQL Query:

```
SELECT SUM(Revenue) FROM Movies
GROUP BY year
```

Group By, by example…

	SUM(Revenue)
0	3624.46
1	4306.23
2	5053.22
3	5292.26
4	5989.65
5	5431.96

Question: what is the total revenue of **per year**?

SQL Query:

```
SELECT SUM(Revenue) FROM Movies
GROUP BY year
```

Group By, by example…

	SUM(Revenue)
0	3624.46
1	4306.23
2	5053.22
3	5292.26
4	5989.65
5	5431.96

each row was the total revenue for one year.

Question: what is the total revenue of **per year**?

SQL Query:

```
SELECT SUM(Revenue) FROM Movies
GROUP BY year
```

Group By, by example…

	SUM(Revenue)
0	3624.46
1	4306.23
2	5053.22
3	5292.26
4	5989.65
5	5431.96

each row was the total revenue for one year.
But which year?

Question: what is the total revenue of **per year**?

SQL Query:

```
SELECT SUM(Revenue) FROM Movies
GROUP BY year
```

Group By, by example…

	Year	SUM(Revenue)
0	2006	3624.46
1	2007	4306.23
2	2008	5053.22
3	2009	5292.26
4	2010	5989.65
5	2011	5431.96

Question: what is the total revenue of **per year**?

SQL Query:

```
SELECT year, SUM(Revenue) FROM Movies
GROUP BY year
```

Group By, by example…

	Year	SUM(Revenue)
0	2006	3624.46
1	2007	4306.23
2	2008	5053.22
3	2009	5292.26
4	2010	5989.65
5	2011	5431.96

Question: what is the total revenue of **per year**?

it's very common that in the SELECT, the group-by variable is plain, and the others are aggregated

SQL Query:

```
SELECT year, SUM(Revenue) FROM Movies
GROUP BY year
```

Group By, by example…

Question: how many movies were by each director?

SQL Query:

```
SELECT ???, ??? FROM Movies
GROUP BY ???
```

Group By, by example…

Question: how many movies were by each director?

SQL Query:

```
SELECT ???, ??? FROM Movies
GROUP BY ???
```

Group By, by example…

Question: how many movies were by each director?

SQL Query:

```
SELECT director, ??? FROM Movies
GROUP BY director
```

Group By, by example…

Question: how many movies were by each director?

SQL Query:

```
SELECT director, ??? FROM Movies
GROUP BY director
```

Group By, by example…

Question: how many movies were by each director?

SQL Query:

```
SELECT director, COUNT() FROM Movies
GROUP BY director
```

Group By, by example…

	Director	COUNT()
0	Aamir Khan	1
1	Abdellatif Kechiche	1
2	Adam Leon	1
3	Adam McKay	4
4	Adam Shankman	2
5	Adam Wingard	2
6	Afonso Poyart	1

Question: how many movies were by each director?

SQL Query:

```
SELECT director, COUNT() FROM Movies
GROUP BY director
```

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Aggregation Queries

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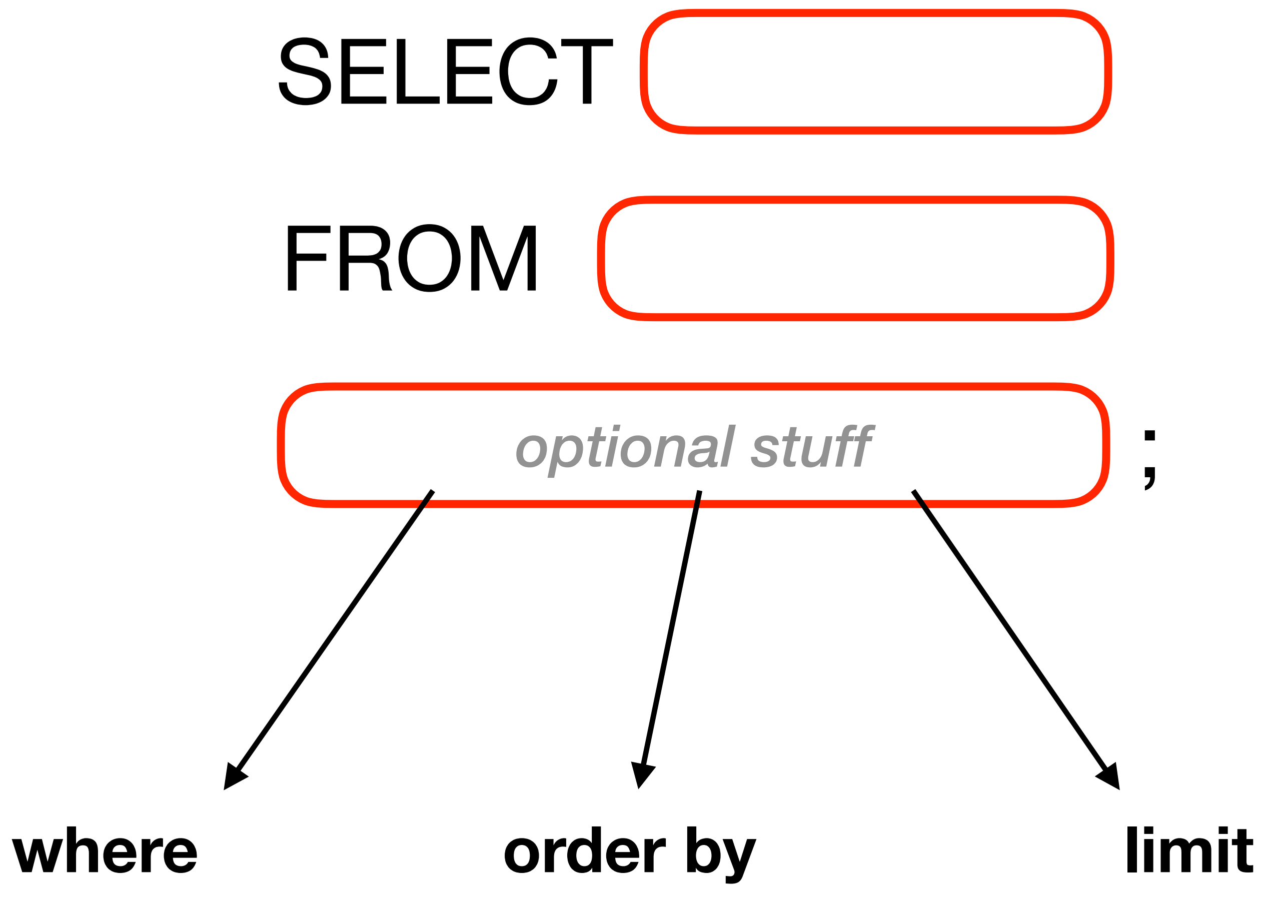
Practice

Review from previous lecture



Review from previous lecture

SELECT

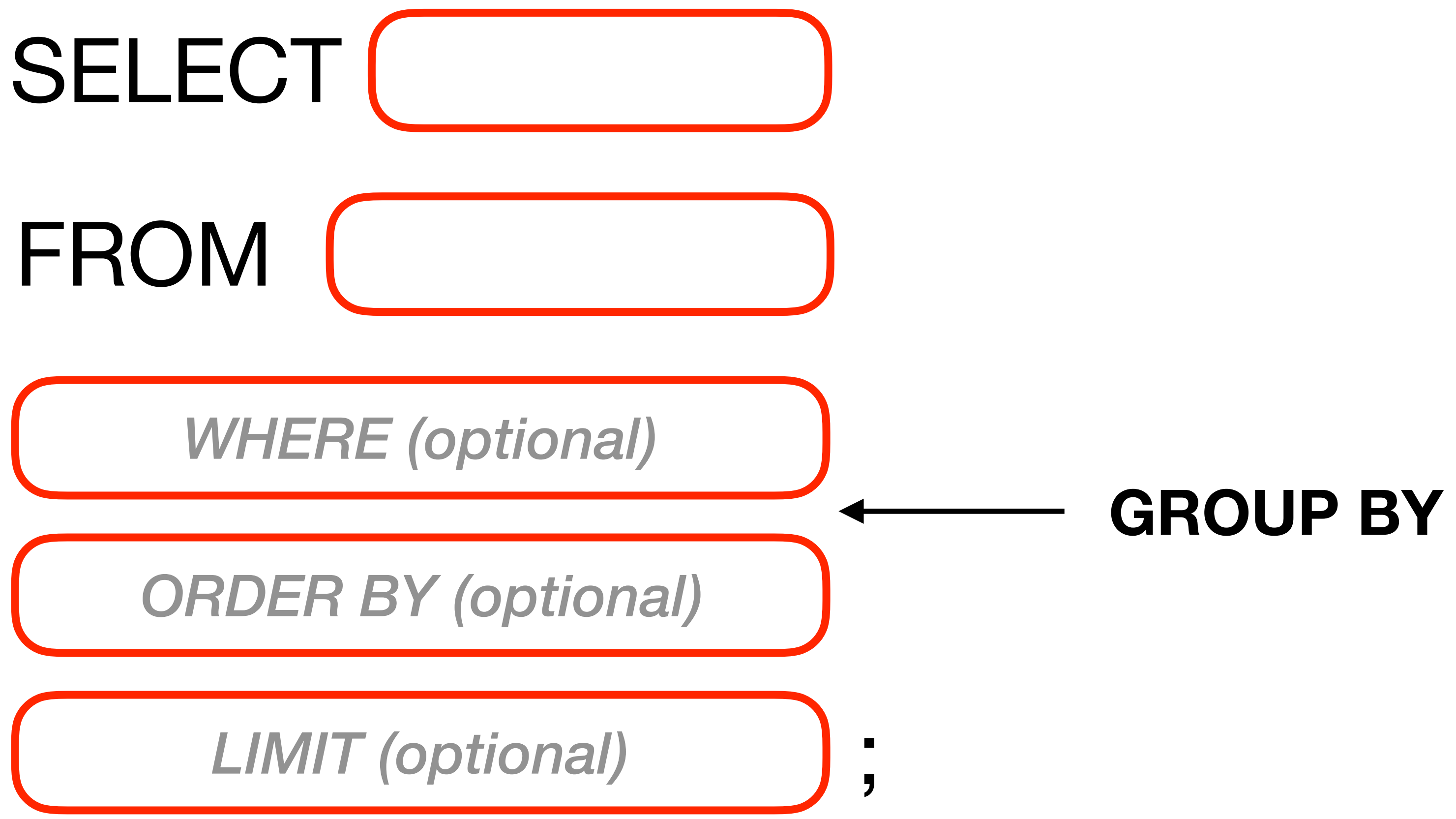
FROM

WHERE (optional)

ORDER BY (optional)

LIMIT (optional) ;

Mixing in GROUP BY



Mixing in GROUP BY

SELECT $\boxed{}$

FROM $\boxed{}$

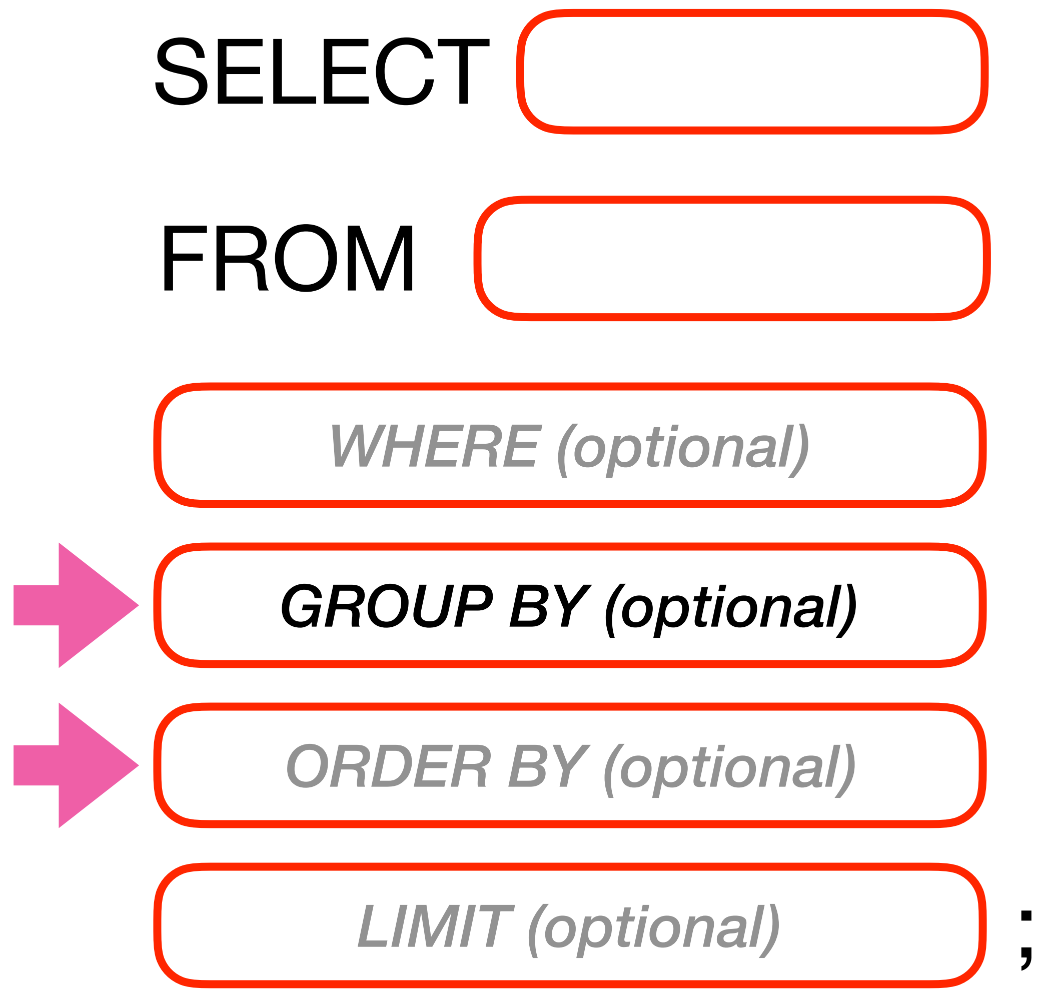
WHERE (optional)

GROUP BY (optional)

ORDER BY (optional)

LIMIT (optional) ;

Mixing in GROUP BY



	Year	SUM(Revenue)
0	2006	3624.46
1	2007	4306.23
2	2008	5053.22
3	2009	5292.26
4	2010	5989.65
5	2011	5431.96
6	2012	6910.29

Question: what is the total revenue of **per year**?

SQL Query:

```
SELECT year, SUM(Revenue) FROM Movies
GROUP BY year
```

Question: what is the total revenue of **per year**?
show most-recent years first…

SQL Query:

```
SELECT year, SUM(Revenue) FROM Movies
GROUP BY year
```

Question: what is the total revenue of **per year**?
show most-recent years first…

SQL Query:

```
SELECT year, SUM(Revenue) FROM Movies
GROUP BY year
ORDER BY year DESC
```

	Year	SUM(Revenue)
0	2016	11211.65
1	2015	8854.12
2	2014	7997.40
3	2013	7544.21
4	2012	6910.29
5	2011	5431.96
6	2010	5989.65

Question: what is the total revenue of **per year**?
show most-recent years first…

SQL Query:

```
SELECT year, SUM(Revenue) FROM Movies
GROUP BY year
ORDER BY year DESC
```

Question: what is the total revenue of **per year**?
show highest-revenue years first…

order by this

SQL Query:

```
SELECT year, SUM(Revenue) FROM Movies
GROUP BY year
ORDER BY year DESC
```

Question: what is the total revenue of **per year**?
show highest-revenue years first…

name it

SQL Query:

```
SELECT year, SUM(Revenue) AS rev FROM Movies
GROUP BY year
ORDER BY year DESC
```

Question: what is the total revenue of **per year**?
show highest-revenue years first…

name it

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```
SELECT year, SUM(Revenue) AS rev FROM Movies
GROUP BY year
ORDER BY rev DESC
```

order by it

	Year	rev
0	2016	11211.65
1	2015	8854.12
2	2014	7997.40
3	2013	7544.21
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show highest-revenue years first…

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GROUP BY year
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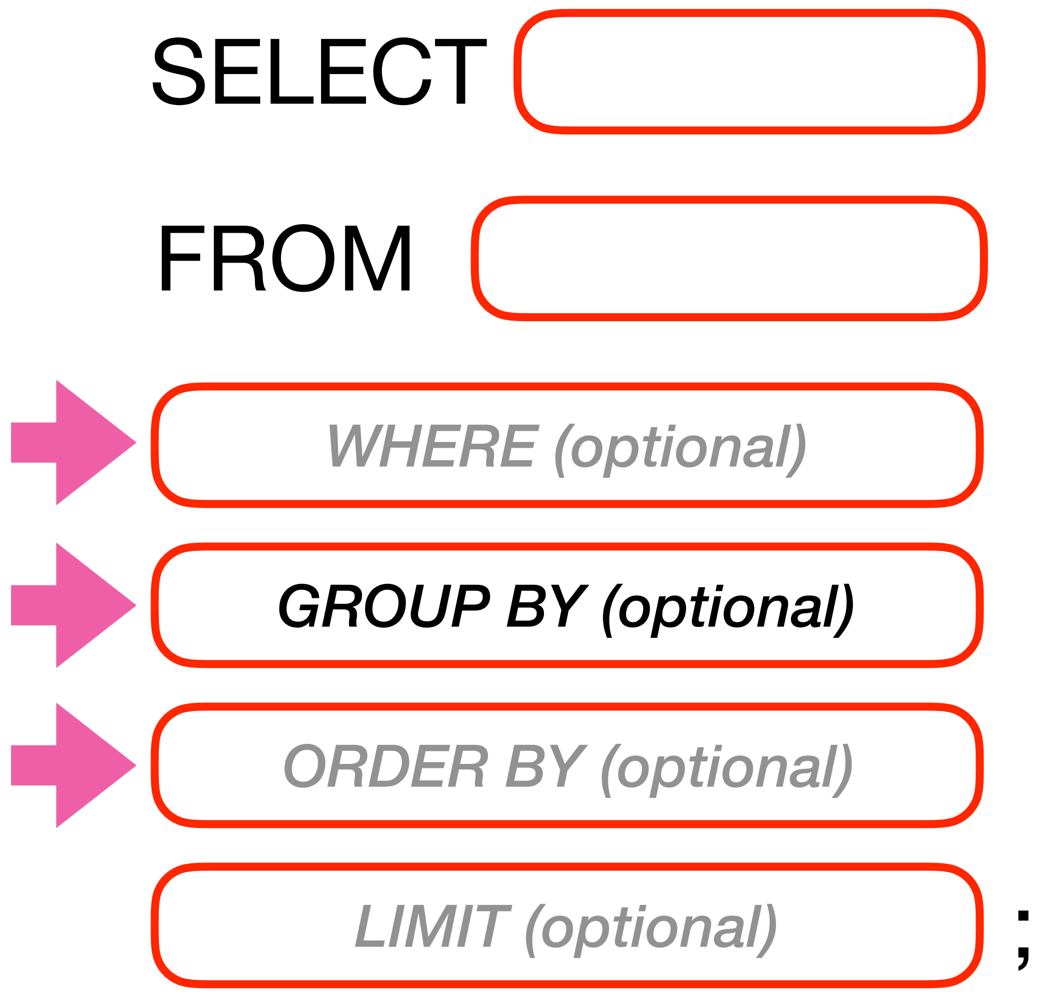
order by it

Mixing in GROUP BY



Question: which directors have had the largest number of movies earning over $100M?

SQL Query:

```
SELECT ??? FROM Movies
WHERE ???
GROUP BY ???
ORDER BY ???
```

Question: which directors have had the largest number of movies earning over $100M?

SQL Query:

```
SELECT ??? FROM Movies
WHERE revenue > 100
GROUP BY ???
ORDER BY ???
```

Question: which directors have had the largest number of movies earning over $100M?

SQL Query:

```
SELECT director FROM Movies
WHERE revenue > 100
GROUP BY director
ORDER BY ???
```

Question: which directors have had the largest number of movies earning over $100M?

SQL Query:

```
SELECT director, COUNT() FROM Movies
WHERE revenue > 100
GROUP BY director
ORDER BY ???
```

Question: which directors have had the largest number of movies earning over $100M?

SQL Query:

```
SELECT director, COUNT() AS tot FROM Movies
WHERE revenue > 100
GROUP BY director
ORDER BY tot DESC
```

	Director	tot
0	David Yates	6
1	J.J. Abrams	5
2	Christopher Nolan	4
3	Dennis Dugan	4
4	Francis Lawrence	4
5	Justin Lin	4
6	Michael Bay	4

Question: which directors have had the largest number of movies earning over $100M?

SQL Query:

```
SELECT director, COUNT() AS tot FROM Movies
WHERE revenue > 100
GROUP BY director
ORDER BY tot DESC
```

Mixing in GROUP BY

SELECT

FROM

WHERE (optional)

GROUP BY (optional)

ORDER BY (optional)

LIMIT (optional) ;

Question: which 3 of the directors have the greatest average rating?

SQL Query:

```
SELECT ??? FROM Movies
GROUP BY ???
ORDER BY ???
LIMIT ???
```

Question: which 3 of the directors have the greatest average rating?

SQL Query:

```
SELECT director FROM Movies
GROUP BY director
ORDER BY ???
LIMIT ???
```

Question: which 3 of the directors have the greatest average rating?

SQL Query:

```
SELECT director, AVG(Rating) FROM Movies
GROUP BY director
ORDER BY ???
LIMIT ???
```

Question: which 3 of the directors have the greatest average rating?

SQL Query:

```
SELECT director, AVG(Rating) AS r FROM Movies
GROUP BY director
ORDER BY r DESC
LIMIT ???
```

Question: which 3 of the directors have the greatest average rating?

SQL Query:

```
SELECT director, AVG(Rating) AS r FROM Movies
GROUP BY director
ORDER BY r DESC
LIMIT 3
```

	Director	r
0	Nitesh Tiwari	8.80
1	Christopher Nolan	8.68
2	Makoto Shinkai	8.60

Question: which 3 of the directors have the greatest average rating?

SQL Query:

```
SELECT director, AVG(Rating) AS r FROM Movies
GROUP BY director
ORDER BY r DESC
LIMIT 3
```

avg over how many?

	Director	r
0	Nitesh Tiwari	8.80
1	Christopher Nolan	8.68
2	Makoto Shinkai	8.60

Question: which 3 of the directors have the greatest average rating?

SQL Query:

```
SELECT director, AVG(Rating) AS r FROM Movies
GROUP BY director
ORDER BY r DESC
LIMIT 3
```

	Director	r	COUNT()
0	Nitesh Tiwari	8.80	1
1	Christopher Nolan	8.68	5
2	Makoto Shinkai	8.60	1

Question: which 3 of the directors have the greatest average rating?

SQL Query:

```
SELECT director, AVG(Rating) AS r, COUNT()
FROM Movies
GROUP BY director
ORDER BY r DESC
LIMIT 3
```

	Director	r	COUNT()
0	Nitesh Tiwari	8.80	1
1	Christopher Nolan	8.68	5
2	Makoto Shinkai	8.60	1

what if we only want to consider actors in 5+ movies?

can’t use WHERE. WHERE filters rows **before** groups are made

Question: which 3 of the directors have the greatest average rating?

SQL Query:

```
SELECT director, AVG(Rating) AS r, COUNT()
FROM Movies
GROUP BY director
ORDER BY r DESC
LIMIT 3
```

Outline

Aggregation Queries

Grouping with Python

Grouping with SQL

Combining with LIMIT and ORDER BY

WHERE vs. HAVING

Practice

Filtering, before and after GROUP BY

Sometimes we want to filter data before we form groups.

Sometimes we want to filter groups themselves.

Filtering, before and after GROUP BY

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Which directors have had more than 5 movies since 2014?

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filter groups **filter input rows**

Filtering, before and after GROUP BY

Sometimes we want to filter data before we form groups.

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Which directors have had more than 5 movies since 2014?

filter groups **filter input rows**

`HAVING` **`WHERE`**

“HAVING” is basically a “WHERE” for groups…

Filtering

SELECT

FROM

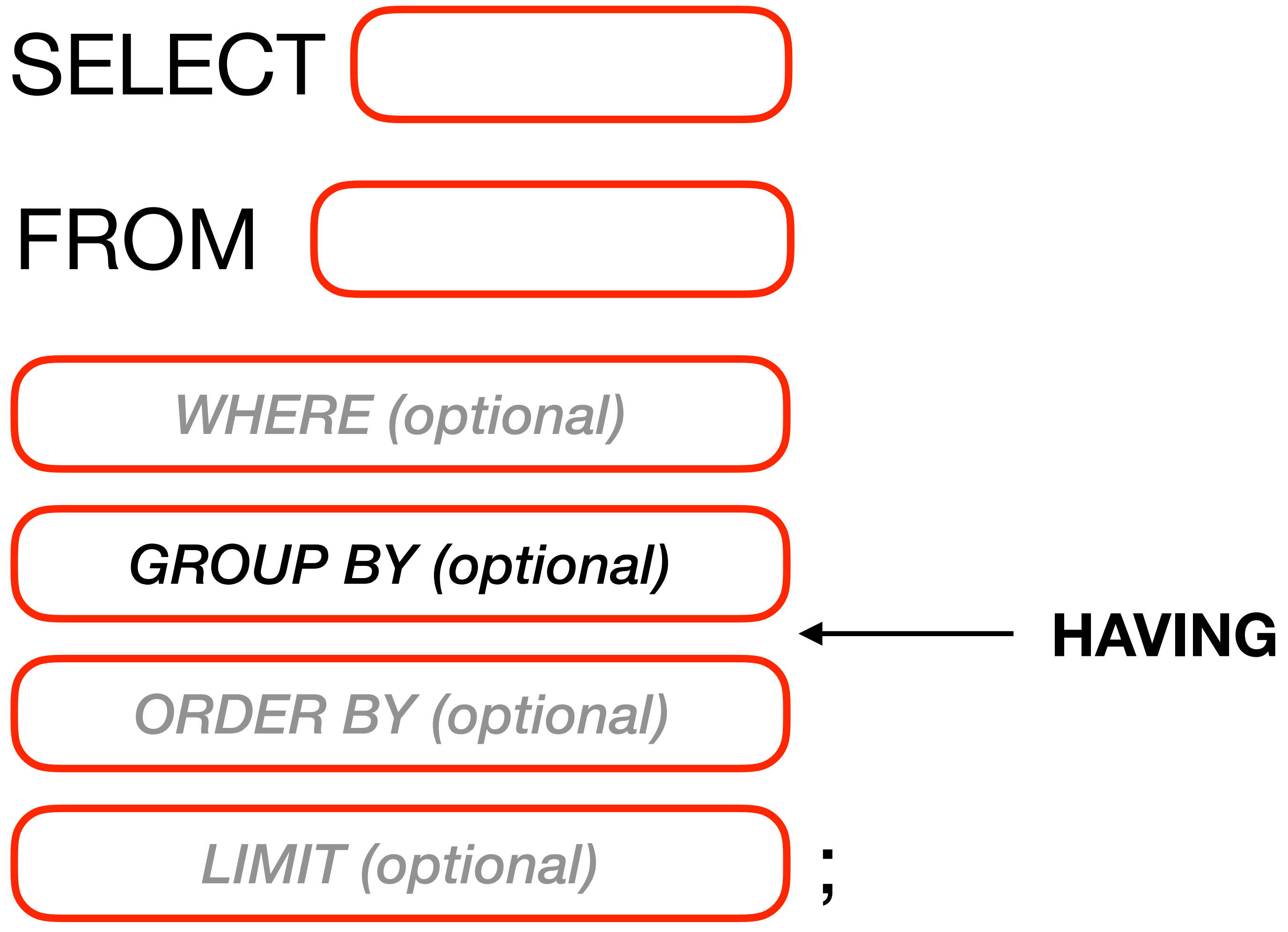
WHERE (optional)

GROUP BY (optional)

ORDER BY (optional)

LIMIT (optional) ;

Filtering


SELECT
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WHERE (optional)
GROUP BY (optional)
HAVING
ORDER BY (optional)
LIMIT (optional)
;

Filtering

SELECT

FROM

WHERE (optional) — *filter rows **before** bucketing into groups*

GROUP BY (optional)

HAVING (optional) — *filter groups **after** computing aggregates*

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LIMIT (optional) ;

Filtering

SELECT

FROM

WHERE (optional) — *filter rows **before** bucketing into groups*

GROUP BY (optional)

HAVING (optional) — *filter groups **after** computing aggregates*

ORDER BY (optional)

LIMIT (optional) ;

Note: this is very similar to "top directors" in P7

Question: which 3 of the directors with at least 5 movies have the greatest average rating?

SQL Query:

```
SELECT ???
FROM Movies
GROUP BY ???
HAVING ???
ORDER BY ???
LIMIT ???
```

Note: this is very similar to "top directors" in P7

Question: which 3 of the $\boxed{\text{directors}}$ with at least 5 movies have the greatest average rating?

SQL Query:

```
SELECT director
FROM Movies
GROUP BY director
HAVING ???
ORDER BY ???
LIMIT ???
```

Note: this is very similar to “top directors” in P7

Question: which 3 of the directors with at least 5 movies have the greatest average rating?

SQL Query:

```
SELECT director, COUNT() as c
FROM Movies
GROUP BY director
HAVING c >= 5
ORDER BY ???
LIMIT ???
```

Note: this is very similar to "top directors" in P7

Question: which 3 of the directors with at least 5 movies have the greatest $\boxed{\text{average rating}}$?

SQL Query:

```
SELECT director, COUNT() as c, AVG(rating) as r
FROM Movies
GROUP BY director
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LIMIT ???
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Question: which 3 of the directors with at least 5 movies have the greatest average rating?

SQL Query:

```
SELECT director, COUNT() as c, AVG(rating) as r
FROM Movies
GROUP BY director
HAVING c >= 5
ORDER BY r DESC
LIMIT 3
```

	Director	c	r
0	Christopher Nolan	5	8.68
1	Martin Scorsese	5	7.92
2	David Fincher	5	7.82

Question: which 3 of the directors with at least 5 movies have the greatest average rating?

SQL Query:

```
SELECT director, COUNT() as c, AVG(rating) as r
FROM Movies
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HAVING c >= 5
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LIMIT 3
```

Outline

Aggregation Queries

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Fill in this notebook:

https://github.com/tylerharter/caraza-harter-com/blob/master/tyler/cs301/fall18/materials/code/lec-33/bus.ipynb