

# CODE 301

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*Intermediate Software Development*



# AGENDA

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- Assignment review
- SQL Joins and Relationships

# SQL JOINS AND RELATIONSHIPS

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*SQL Strikes Back*



**SOMETIMES RELATIONSHIPS NEED A LITTLE SPACE**





“

The relational model of data permits the database designer to create a consistent, logical representation of information. Consistency is achieved by including declared constraints in the database design, which is usually referred to as the logical schema.

*from the Relational Model ([https://en.wikipedia.org/wiki/Relational\\_model](https://en.wikipedia.org/wiki/Relational_model))*

# SINGLE TABLE: THE STORY SO FAR

---

id	title	author	authorUrl	markdown	publishedOn
1	Bacon Ipsum	Kevin Bacon	https://bacon.com	# Hickory...	2013-04-22
2	Six Degrees	Keven Bacon	https://bacon.com	# I know...	2013-12-13
3	Cat Ipsum	Meow Meow	http://meow.com	# chasing...	2013-07-18
4	Cajun Ipsum	Zatarans	https://cajun.com	# boudin...	2012-06-05
5	If It Fits	Meow Meow	http://meow.com	# I sits...	2014-08-01
6	Why Grumpy?	Meow Meow	https://meows.com	# nyan...	2015-12-02

# RELATIONAL DATA

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- Complex data is better organized using more than one table.
- In our example, there is a lot of redundant data.
- This redundancy is also very error prone.
- The problem will grow if we store more data about each author (bio, favorite sandwich, etc.).

# SINGLE TABLE: NOTICE ANY PROBLEMS?

.....

id	title	author	authorUrl	markdown	publishedOn
1	Bacon Ipsum	Kevin Bacon	https://bacon.com	# Hickory...	2013-04-22
2	Six Degrees	Keven Bacon	https://bacon.com	# I know...	2013-12-13
3	Cat Ipsum	Meow Meow	http://meow.com	# chasing...	2013-07-18
4	Cajun Ipsum	Zatarans	https://cajun.com	# boudin...	2012-06-05
5	If It Fits	Meow Meow	http://meow.com	# I sits...	2014-08-01
6	Why Grumpy?	Meow Meow	https://meows.com	# nyan...	2015-12-02



# SINGLE TABLE: AUTHOR NAMES MAY CONTAIN ERRORS

---

id	title	author	authorUrl	markdown	publishedOn
1	Bacon Ipsum	Kevin Bacon	https://bacon.com	# Hickory...	2013-04-22
2	Six Degrees	Keven Bacon	https://bacon.com	# I know...	2013-12-13
3	Cat Ipsum	Meow Meow	http://meow.com	# chasing...	2013-07-18
4	Cajun Ipsum	Zatarans	https://cajun.com	# boudin...	2012-06-05
5	If It Fits	Meow Meow	http://meow.com	# I sits...	2014-08-01
6	Why Grumpy?	Meow Meow	https://meows.com	# nyan...	2015-12-02

# SINGLE TABLE: AUTHOR URLS MAY NEED UPDATES

---

id	title	author	authorUrl	markdown	publishedOn
1	Bacon Ipsum	Kevin Bacon	https://bacon.com	# Hickory...	2013-04-22
2	Six Degrees	Keven Bacon	https://bacon.com	# I know...	2013-12-13
3	Cat Ipsum	Meow Meow	http://meow.com	# chasing...	2013-07-18
4	Cajun Ipsum	Zatarans	https://cajun.com	# boudin...	2012-06-05
5	If It Fits	Meow Meow	https://meow.com	# I sits...	2014-08-01
6	Why Grumpy?	Meow Meow	https://meows.com	# nyan...	2015-12-02

# SINGLE TABLE: PREVENTING ERRORS

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- How can we prevent these errors and keep all author data in sync?
- Update `authorUrl` fields for each record for a given author every time something changes?
- What if both the `authorUrl` and `author` fields have errors?



# INTERLUDE: MVC MODELS

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- We are now thinking about *article* and *author* as separate **resources**.
- We'd therefore like to have different model objects in JavaScript, in different files.
- Yet we have just one table.
- Isn't that strange?

**THERE MUST BE A BETTER WAY**



# NORMALIZATION





# NORMALIZATION: WHAT

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- Decomposing a table into smaller, less redundant tables without losing information.

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---

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id	A1	A2	B1	B2

# NORMALIZATION: WHAT

---

- Decomposing a table into smaller, less redundant tables without losing information.

id		A1	A2	B1	B2

id	A1	A2	B_id

id	B1	B2



# NORMALIZATION: WHAT

---

- Decomposing a table into smaller, less redundant tables without losing information.

id	A1	A2	B_id

id	B1	B2

# NORMALIZATION: WHAT

---

- Decomposing a table into smaller, less redundant tables without losing information.
- Using foreign keys in the old table to reference the primary keys of new tables.

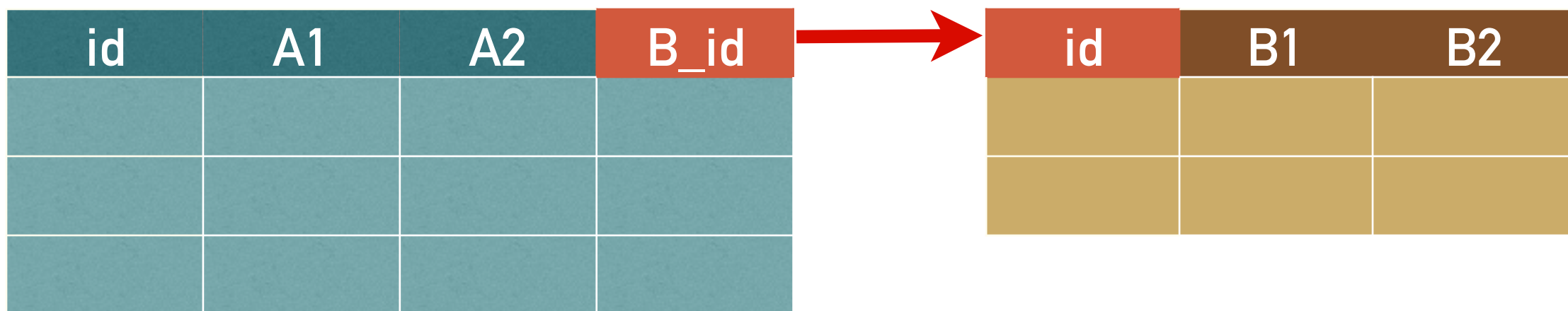
id	A1	A2	B_id

id	B1	B2

# NORMALIZATION: WHAT

---

- Decomposing a table into smaller, less redundant tables without losing information.
- Using foreign keys in the old table to reference the primary keys of new tables.





# NORMALIZATION: WHY

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- Why does this help us?
  - Reduce modification anomalies
  - Minimize redesign when extending database structure
  - Facilitate different types of queries

# NORMALIZATION: HOW

---

- How is it used?
  - Let's run through it step-by-step.

**HERE'S WHERE WE ARE AT NOW**



# SINGLE TABLE: ARTICLES WITH AUTHORS

---

id	title	author	authorUrl	markdown	publishedOn
1	Bacon Ipsum	Kevin Bacon	https://bacon.com	# Hickory...	2013-04-22
2	Six Degrees	Kevin Bacon	https://bacon.com	# I know...	2013-12-13
3	Cat Ipsum	Meow Meow	https://meow.com	# chasing...	2013-07-18
4	Cajun Ipsum	Zatarans	https://cajun.com	# boudin...	2012-06-05
5	If It Fits	Meow Meow	https://meow.com	# I sits...	2014-08-01
6	Why Grumpy?	Meow Meow	https://meow.com	# nyan...	2015-12-02

# SINGLE TABLE: ARTICLES WITH AUTHORS

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id	title	author	authorUrl	markdown	publishedOn
1	Bacon Ipsum	Kevin Bacon	https://bacon.com	# Hickory...	2013-04-22
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4	Cajun Ipsum	Zatarans	https://cajun.com	# boudin...	2012-06-05
5	If It Fits	Meow Meow	https://meow.com	# I sits...	2014-08-01
6	Why Grumpy?	Meow Meow	https://meow.com	# nyan...	2015-12-02



**LET'S START FRESH**



# DROP OLD TABLE

---

DROP TABLE articles;

# CREATE NEW AUTHORS TABLE

---

```
CREATE TABLE authors(  
  id INTEGER PRIMARY KEY,  
  name VARCHAR(50) UNIQUE NOT NULL,  
  url VARCHAR(255),  
);
```

The unique constraint is applied here because of the way the raw article data is imported into the blog system.

# RESULT: NEW AUTHORS TABLE

.....

id	name	url

# NEW AUTHORS TABLE WITH RECORDS

.....

id	name	url
1	Kevin Bacon	<a href="https://bacon.com">https://bacon.com</a>
2	Meow Meow	<a href="https://meow.com">https://meow.com</a>
3	Zatarans	<a href="https://cajun.com">https://cajun.com</a>



# CREATE NEW ARTICLES TABLE


---

```
CREATE TABLE articles(  
  id INTEGER PRIMARY KEY,  
  title VARCHAR(50) NOT NULL,  
  authorId INTEGER NOT NULL,  
  markdown TEXT NOT NULL,  
  publishedOn DATETIME  
);
```

# CREATE NEW ARTICLES TABLE WITH FOREIGN KEY

---

```
CREATE TABLE articles(  
  id INTEGER PRIMARY KEY,  
  title VARCHAR(50) NOT NULL,  
  authorId INTEGER NOT NULL REFERENCES authors(id),  
  markdown TEXT NOT NULL,  
  publishedOn DATETIME  
);
```



# RESULT: NEW ARTICLES TABLE

id	title	authorId	markdown	publishedOn

id	name	url
1	Kevin Bacon	https://bacon.com
2	Meow Meow	https://meow.com
3	Zatarans	https://cajun.com

# NEW ARTICLES TABLE WITH RECORDS

.....

id	title	authorId	markdown	publishedOn
1	Bacon Ipsum	1	# Hickory...	2013-04-22
2	Six Degrees	1	# I know...	2013-12-13
3	Cat Ipsum	2	# chasing...	2013-07-18
4	Cajun Ipsum	3	# boudin...	2012-06-05
5	If It Fits	2	# I sits...	2014-08-01
6	Why Grumpy?	2	# nyan...	2015-12-02

id	name	url
1	Kevin Bacon	https://bacon.com
2	Meow Meow	https://meow.com
3	Zatarans	https://cajun.com

# NEW AUTHORS TABLE

.....

id	title	authorId	markdown	publishedOn
1	Bacon Ipsum	1	# Hickory...	2013-04-22
2	Six Degrees	1	# I know...	2013-12-13
3	Cat Ipsum	2	# chasing...	2013-07-18
4	Cajun Ipsum	3	# boudin...	2012-06-05
5	If It Fits	2	# I sits...	2014-08-01
6	Why Grumpy?	2	# nyan...	2015-12-02

id	name	url
1	Kevin Bacon	https://bacon.com
2	Meow Meow	https://meow.com
3	Zatarans	https://cajun.com



# MANY-TO-ONE RELATIONSHIP

---

id	title	authorId	markdown	publishedOn
1	Bacon Ipsum	1	# Hickory...	2013-04-22
2	Six Degrees	1	# I know...	2013-12-13
3	Cat Ipsum	2	# chasing...	2013-07-18
4	Cajun Ipsum	3	# boudin...	2012-06-05
5	If It Fits	2	# I sits...	2014-08-01
6	Why Grumpy?	2	# nyan...	2015-12-02



id	name	url
1	Kevin Bacon	<a href="https://bacon.com">https://bacon.com</a>
2	Meow Meow	<a href="https://meow.com">https://meow.com</a>
3	Zatarans	<a href="https://cajun.com">https://cajun.com</a>

# NORMALIZED ARTICLES TABLE

.....

id	title	authorId	markdown	publishedOn
1	Bacon Ipsum	1	# Hickory...	2013-04-22
2	Six Degrees	1	# I know...	2013-12-13
3	Cat Ipsum	2	# chasing...	2013-07-18
4	Cajun Ipsum	3	# boudin...	2012-06-05
5	If It Fits	2	# I sits...	2014-08-01
6	Why Grumpy?	2	# nyan...	2015-12-02

**LOOKING TRIM THERE, MR ARTICLES TABLE!**

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# **HOLD ON!**

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**HOW DO I COMBINE YOUR INFO WITH AUTHORS?**



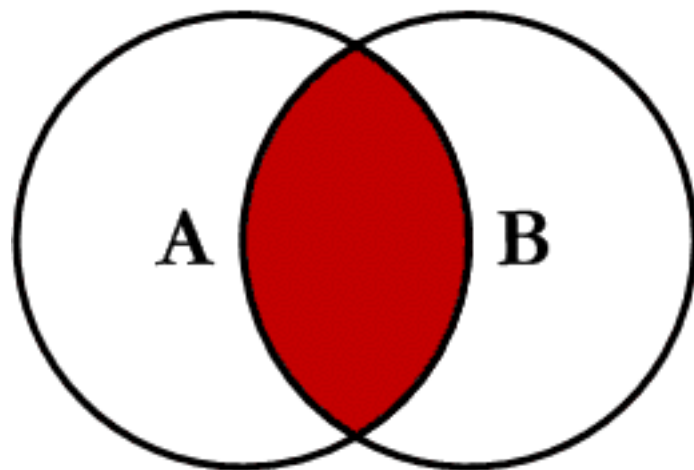
---

**JOIN ME**



# INNER JOIN

---



# SELECT QUERY WITH INNER JOIN


---

```
SELECT articles.id, title, authors.name AS author, authors.url AS  
authorUrl, markdown, publishedOn  
FROM articles  
INNER JOIN authors  
ON articles.authorId = authors.id  
ORDER BY publishedOn DESC;
```

# SELECT QUERY WITH INNER JOIN

---

```
SELECT articles.id, title, authors.name AS author, authors.url AS  
authorUrl, markdown, publishedOn  
FROM articles  
INNER JOIN authors  
ON articles.authorId = authors.id  
ORDER BY publishedOn DESC;
```



# SELECT QUERY WITH INNER JOIN


---

```
SELECT articles.id, title, authors.name AS author, authors.url AS  
authorUrl, markdown, publishedOn  
FROM articles  
INNER JOIN authors  
ON articles.authorId = authors.id  
ORDER BY publishedOn DESC;
```

# SELECT QUERY WITH INNER JOIN

---

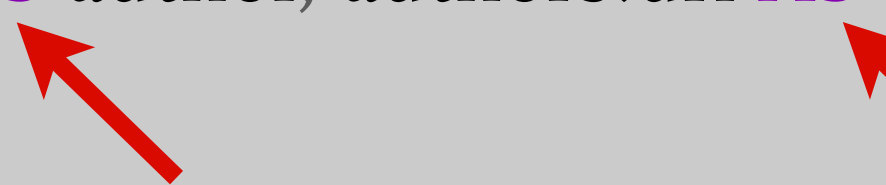
```
SELECT articles.id, title, authors.name AS author, authors.url AS  
authorUrl, markdown, publishedOn  
FROM articles  
INNER JOIN authors  
ON articles.authorId = authors.id  
ORDER BY publishedOn DESC;
```



# SELECT QUERY WITH INNER JOIN

---

```
SELECT articles.id, title, authors.name AS author, authors.url AS  
authorUrl, markdown, publishedOn  
FROM articles  
INNER JOIN authors  
ON articles.authorId = authors.id  
ORDER BY publishedOn DESC;
```

Two red arrows are pointing to the 'AS' keywords in the SQL query. One arrow points to 'AS author' and the other points to 'AS authorUrl'.

- The keys on the result object can remains the same!



# RESULTS: JOINED TABLE

.....

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.....

id	title	author	authorUrl	markdown	publishedOn
1	Bacon Ipsum	Kevin Bacon	https://bacon.com	# Hickory...	2013-04-22
2	Six Degrees	Kevin Bacon	https://bacon.com	# I know...	2013-12-13
3	Cat Ipsum	Meow Meow	https://meow.com	# chasing...	2013-07-18
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5	If It Fits	Meow Meow	https://meow.com	# I sits...	2014-08-01
6	Why Grumpy?	Meow Meow	https://meow.com	# nyan...	2015-12-02

**BUT ISN'T THAT WHERE WE STARTED?**

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**LOOKS LIKE IT! BUT IT'S MUCH BETTER.**

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# NORMALIZED DATABASE: HOW IT'S STORED

---

id	title	authorId	markdown	publishedOn
1	Bacon Ipsum	1	# Hickory...	2013-04-22
2	Six Degrees	1	# I know...	2013-12-13
3	Cat Ipsum	2	# chasing...	2013-07-18
4	Cajun Ipsum	3	# boudin...	2012-06-05
5	If It Fits	2	# I sits...	2014-08-01
6	Why Grumpy?	2	# nyan...	2015-12-02

id	name	url
1	Kevin Bacon	<a href="https://bacon.com">https://bacon.com</a>
2	Meow Meow	<a href="https://meow.com">https://meow.com</a>
3	Zatarans	<a href="https://cajun.com">https://cajun.com</a>



# QUERY WITH JOIN: OPTIONAL WAY TO VIEW DATA

---

id	title	author	authorUrl	markdown	publishedOn
1	Bacon Ipsum	Kevin Bacon	<a href="https://bacon.com">https://bacon.com</a>	# Hickory...	2013-04-22
2	Six Degrees	Kevin Bacon	<a href="https://bacon.com">https://bacon.com</a>	# I know...	2013-12-13
3	Cat Ipsum	Meow Meow	<a href="https://meow.com">https://meow.com</a>	# chasing...	2013-07-18
4	Cajun Ipsum	Zatarans	<a href="https://cajun.com">https://cajun.com</a>	# boudin...	2012-06-05
5	If It Fits	Meow Meow	<a href="https://meow.com">https://meow.com</a>	# I sits...	2014-08-01
6	Why Grumpy?	Meow Meow	<a href="https://meow.com">https://meow.com</a>	# nyan...	2015-12-02

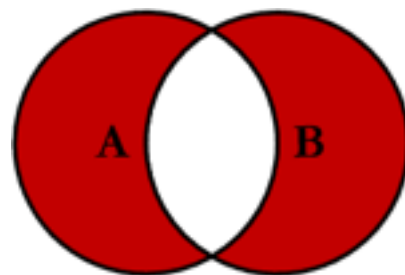
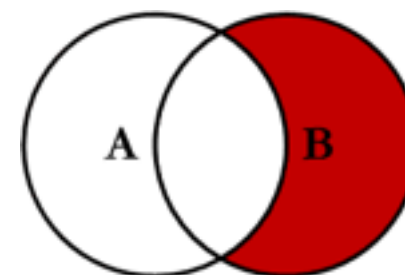
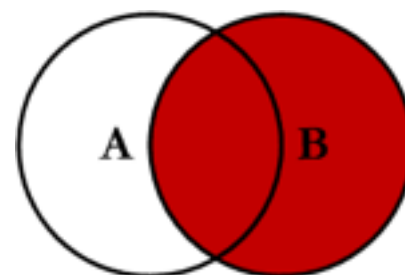
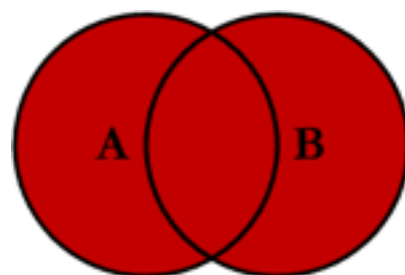
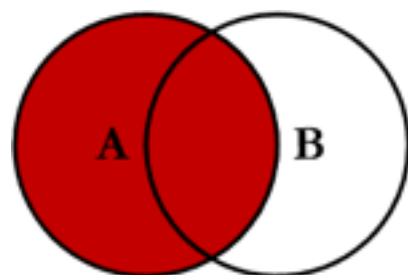
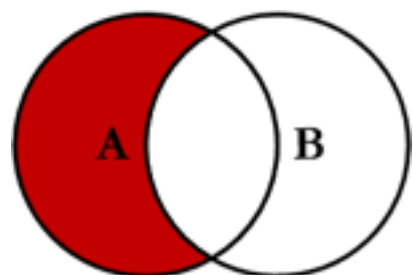


**SO WE CAN HAVE OUR CAKE AND EAT IT TOO!**

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# OTHER JOINS

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# OTHER JOIN TYPES

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- We have used the INNER JOIN.
- Other join types return different sets of joined table data.

Do we want to skip the details here? The students may not have a use for other join types yet.

# SQL JOINS DEMO

**RECAP**

# RECAP

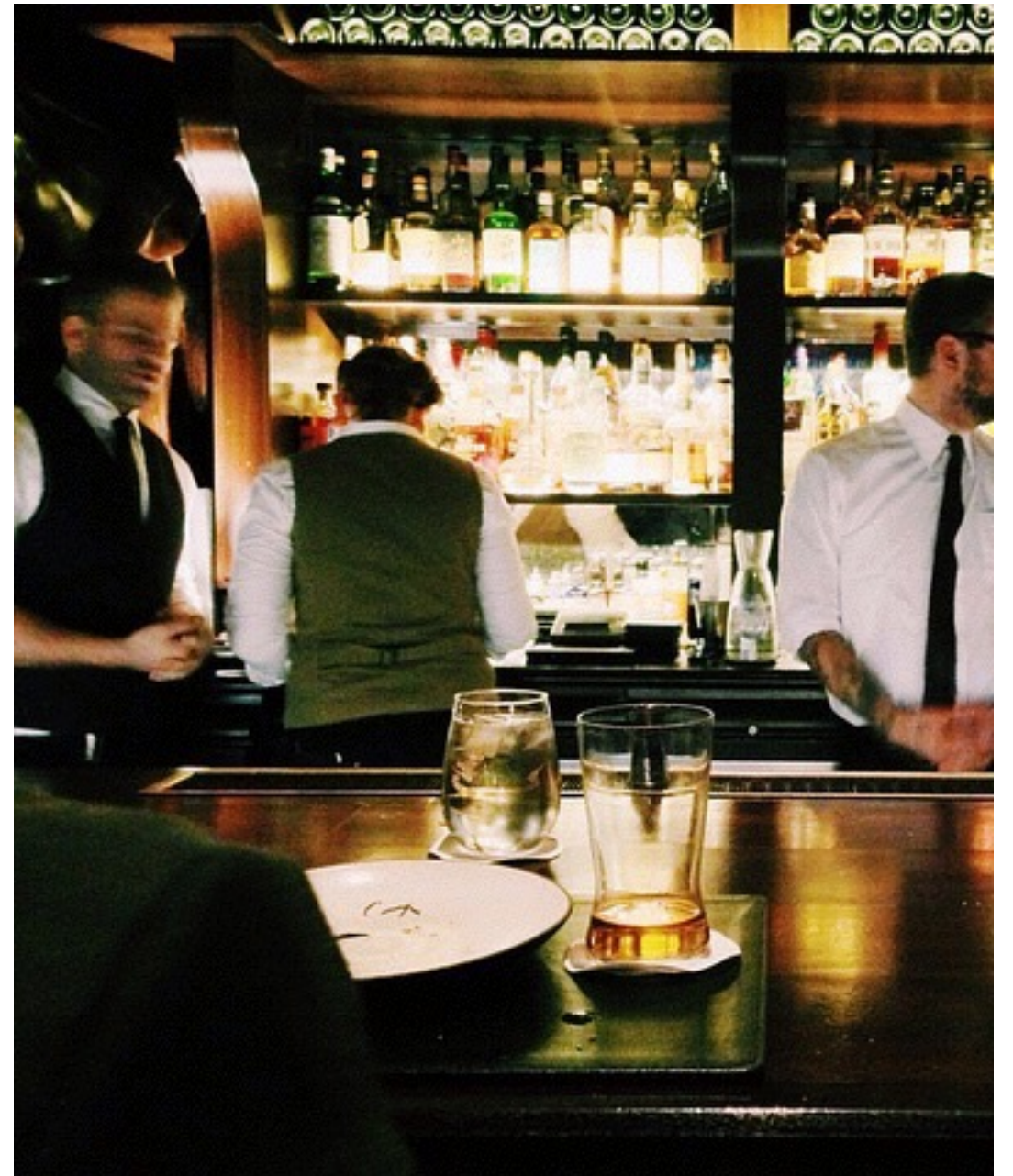
---

- Database normalization is awesome.
- Joins can present data from multiple tables.



SO, SQL  
WALKS INTO  
A BAR...

---



# IT SAUNTERS OVER TO TWO TABLES

---

*and says...*





**MIND IF I  
JOIN YOU?**

.....





# REFERENCES AND SOURCES

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- A Primer on SQL: <https://leanpub.com/aprimeronsql/read>
- Interactive SQL Practice: <http://sqlbolt.com/>
- Join diagram: <http://www.codeproject.com/Articles/33052/Visual-Representation-of-SQL-Joins>
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