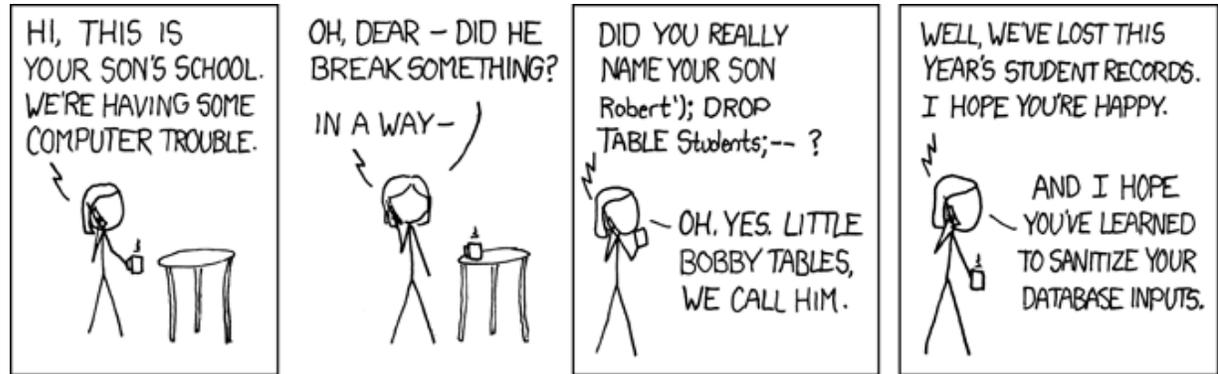


# CSE 154



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## LECTURE 14: MULTI-TABLE SQL QUERIES (JOINS)

# Exceptions for errors

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```
$db = new PDO("mysql:dbname=imdb_small", "jessica", "guinness");  
$db->setAttribute(PDO::ATTR_ERRMODE, PDO::ERRMODE_EXCEPTION);  
$rows = $db->query("SEEELECT * FROM movies WHERE year = 2000");  
# kaboom! PHP
```

- using `setAttribute`, you can tell PDO to throw (generate) a `PDOException` when an error occurs
- the exceptions will appear as error messages on the page output
- you can **catch** the exception to gracefully handle the error

# Related tables and keys

id	name	email
123	Bart	bart@fox.com
456	Milhouse	milhouse@fox.com
888	Lisa	lisa@fox.com
404	Ralph	ralph@fox.com

students

id	name
1234	Krabappel
5678	Hoover
9012	Obourn

teachers

id	name	teacher_id
10001	Computer Science 142	1234
10002	Computer Science 143	5678
10003	Computer Science 154	9012
10004	Informatics 100	1234

courses

student_id	course_id	grade
123	10001	B-
123	10002	C
456	10001	B+
888	10002	A+
888	10003	A+
404	10004	D+

grades

- **primary key**: a column guaranteed to be unique for each record (e.g. Lisa Simpson's ID 888)
- **foreign key**: a column in table A storing a primary key value from table B
  - (e.g. records in grades with `student_id` of 888 are Lisa's grades)
- **normalizing**: splitting tables to improve structure / redundancy (linked by unique IDs)

# Giving names to tables

```
SELECT s.name, g.*
FROM students s
JOIN grades g ON s.id = g.student_id
WHERE g.grade <= 'C';
```

SQL

name	student_id	course_id	grade
Bart	123	10001	B-
Bart	123	10002	C
Milhouse	456	10001	B+
Lisa	888	10002	A+
Lisa	888	10003	A+

- can give names to tables, like a variable name in Java
- to specify all columns from a table, write *table.\**
- (grade column sorts alphabetically, so grades C or better are ones <= it)

# A suboptimal query

---

Exercise: What courses have been taken by both Bart and Lisa?

```
SELECT bart.course_id
FROM grades bart
JOIN grades lisa ON lisa.course_id = bart.course_id
WHERE bart.student_id = 123
AND lisa.student_id = 888;
```

SQL

- problem: requires us to know Bart/Lisa's Student IDs, and only spits back course IDs, not names.
- Write a version of this query that gets us the course *names*, and only requires us to know Bart/Lisa's names, not their IDs.

# Improved query

---

What courses have been taken by both Bart and Lisa?

```
SELECT DISTINCT c.name
FROM courses c
JOIN grades g1 ON g1.course_id = c.id
JOIN students bart ON g1.student_id = bart.id
JOIN grades g2 ON g2.course_id = c.id
JOIN students lisa ON g2.student_id = lisa.id
WHERE bart.name = 'Bart'
AND lisa.name = 'Lisa';
```

SQL

# Practice queries

---

- What are the names of all teachers Bart has had?

```
SELECT DISTINCT t.name
FROM teachers t
JOIN courses c ON c.teacher_id = t.id
JOIN grades g ON g.course_id = c.id
JOIN students s ON s.id = g.student_id
WHERE s.name = 'Bart';
```

SQL

- How many total students has Ms. Krabappel taught, and what are their names?

```
SELECT DISTINCT s.name
FROM students s
JOIN grades g ON s.id = g.student_id
JOIN courses c ON g.course_id = c.id
JOIN teachers t ON t.id = c.teacher_id
WHERE t.name = 'Krabappel';
```

SQL

# Designing a query

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- Figure out the proper SQL queries in the following way:
  - Which table(s) contain the critical data? (**FROM**)
  - Which columns do I need in the result set? (**SELECT**)
  - How are tables connected (**JOIN**) and values filtered (**WHERE**)?
- Test on a small data set (`imdb_small`).
- Confirm on the real data set (`imdb`).
- Try out the queries first in the query tool.
- Write the PHP code to run those same queries.
  - Make sure to check for SQL errors at every step!!

# Example imdb database

id	first_name	last_name	gender
433259	William	Shatner	M
797926	Britney	Spears	F
831289	Sigourney	Weaver	F
...			

**actors**

id	name	year	rank
112290	Fight Club	1999	8.5
209658	Meet the Parents	2000	7
210511	Memento	2000	8.7
...			

**movies**

actor_id	movie_id	role
433259	313398	Capt. James T. Kirk
433259	407323	Sgt. T.J. Hooker
797926	342189	Herself
...		

**roles**

movie_id	genre
209658	Comedy
313398	Action
313398	Sci-Fi
...	

**movies\_genres**

id	first_name	last_name
24758	David	Fincher
66965	Jay	Roach
72723	William	Shatner
...		

**directors**

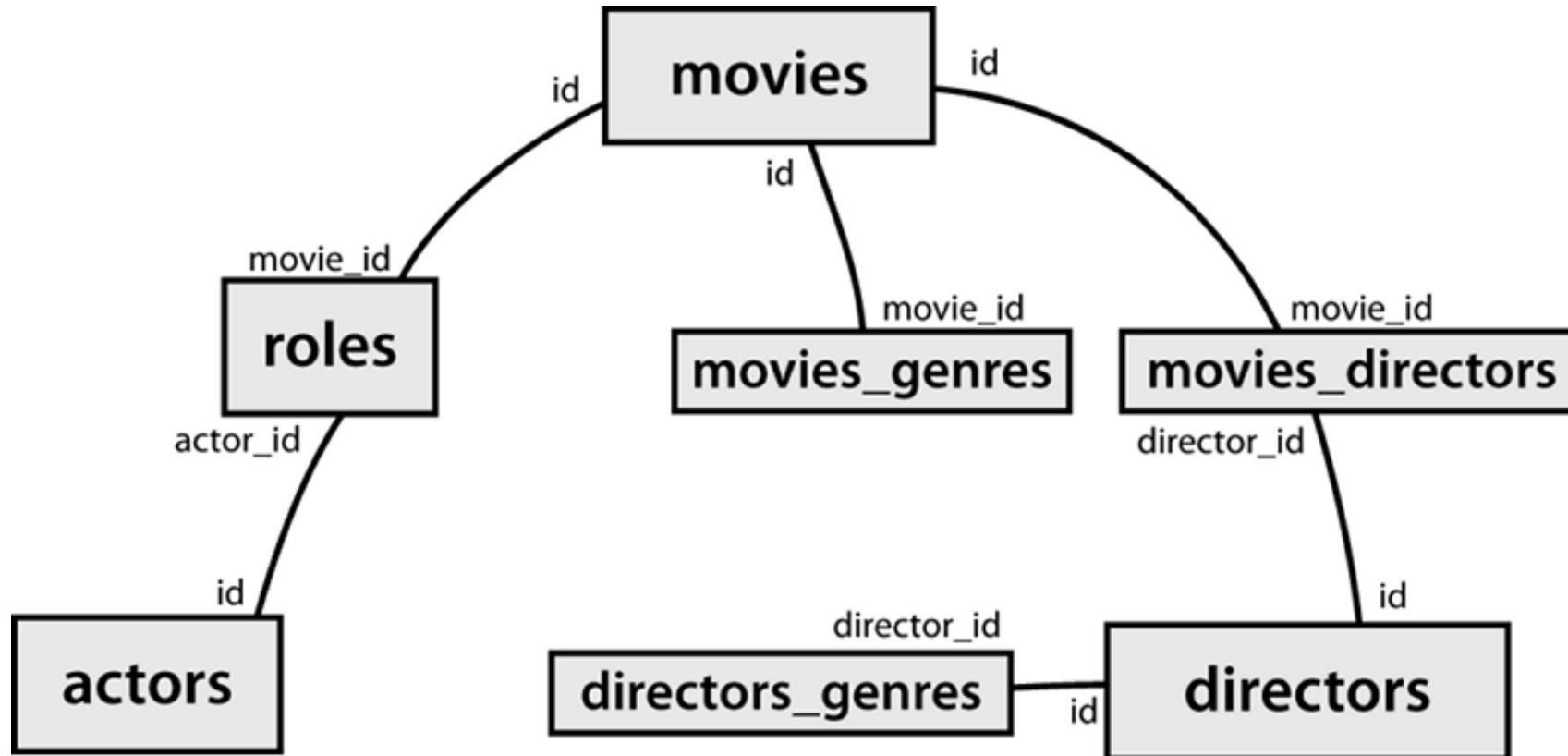
director_id	movie_id
24758	112290
66965	209658
72723	313398
...	

**movies\_directors**

- also available, `imdb_small` with fewer records (for testing queries)

# IMDb table relationships / ids

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# IMDb practice queries

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- What are the names of all movies released in 1995?
- How many people played a part in the movie "Lost in Translation"?
- What are the *names* of all the people who played a part in the movie "Lost in Translation"?
- Who directed the movie "Fight Club"?
- How many movies has Clint Eastwood directed?
- What are the *names* of all movies Clint Eastwood has directed?
- What are the names of all directors who have directed at least one horror film?
- What are the names of every actor who has appeared in a movie directed by Christopher Nolan?