

# Relational Algebra Exercises

## Pubs Database Schema

*author*(author\_id, first\_name, last\_name)

*author\_pub*(author\_id, pub\_id, author\_position)

*book*(book\_id, book\_title, month, year, editor)

*pub*(pub\_id, title, book\_id)

- *author\_id* in *author\_pub* is a foreign key referencing *author*
- *pub\_id* in *author\_pub* is a foreign key referencing *pub*
- *book\_id* in *pub* is a foreign key referencing *book*
- *editor* in *book* is a foreign key referencing *author*(*author\_id*)
- Primary keys are underlined

## Pubs Database State

*r(author)*

author_id	first_name	last_name
1	John	McCarthy
2	Dennis	Ritchie
3	Ken	Thompson
4	Claude	Shannon
5	Alan	Turing
6	Alonzo	Church
7	Perry	White
8	Moshe	Vardi
9	Roy	Batty

*r(author\_pub)*

author_id	pub_id	author_position
1	1	1
2	2	1
3	2	2
4	3	1
5	4	1
5	5	1
6	6	1

*r(book)*

book_id	book_title	month	year	editor
1	CACM	April	1960	8
2	CACM	July	1974	8
3	BST	July	1948	2
4	LMS	November	1936	7
5	Mind	October	1950	NULL
6	AMS	Month	1941	NULL
7	AAAI	July	2012	9
8	NIPS	July	2012	9

*r(pub)*

pub_id	title	book_id
1	LISP	1
2	Unix	2
3	Info Theory	3
4	Turing Machines	4
5	Turing Test	5
6	Lambda Calculus	6

Figure 1: Relational Database Schema

1. How many tuples will be returned by the following relational algebra query?

$$\pi_{book\_title}(book)$$

2. What question does the following expression answer?

$$|\pi_{author\_id}(author) - \pi_{editor}(book)|$$

3. Write a relational algebra expression that returns the names of all authors who are book editors.

4. Write a relational algebra expression that returns the names of all authors who are **not** book editors.

5. Write a relational algebra expression that returns the names of all authors who have at least one publication in the database.

6. How many tuples are returned by the following relational algebra expression?

$$author \bowtie_{author\_id=editor} book$$

7. What question does the following relational algebra expression answer?

$$author * (author\_pub * (\sigma_{month='July'}(book) * pub))$$