Introduction to
Databases with SQL

Relating

The Booker Prizes

```
sqlite3 FILENAME
```

```
.tables
```

Relational Databases

authors

name
Eva Baltasar
Han Kang
Gauz
Olga Tokarczuk

books

title
Boulder
The White Book
Standing Heavy
Flights

name	title
Eva Baltasar	Boulder
Han Kang	The White Book
Gauz	Standing Heavy
Olga Tokarczuk	Flights

name	title
Eva Baltasar	Boulder
Han Kang	The White Book
Gauz	Standing Heavy
Olga Tokarczuk	Flights
Olga Tokarczuk	The Books of Jacob
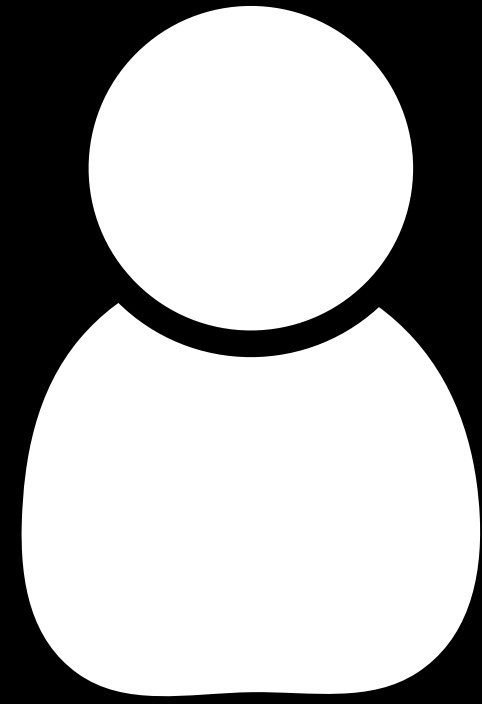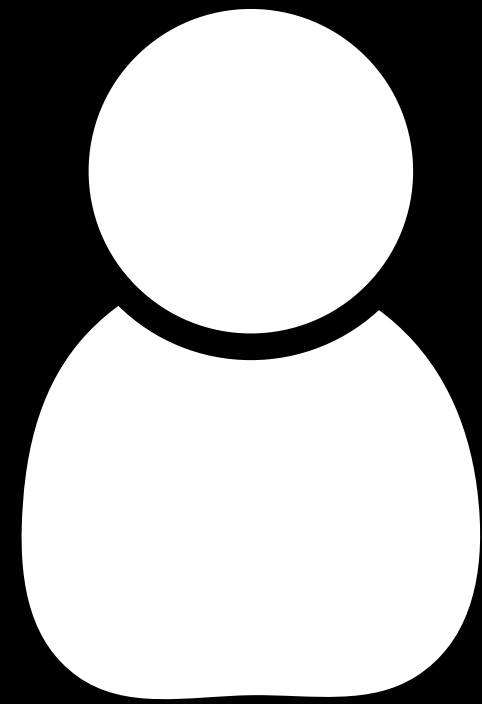
author
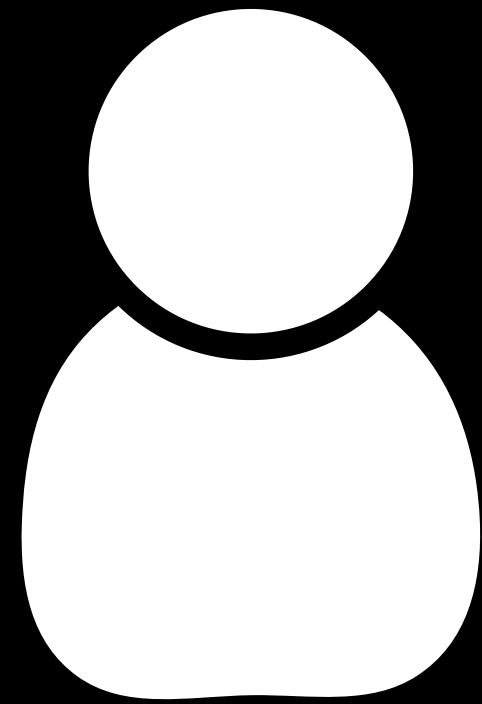
books
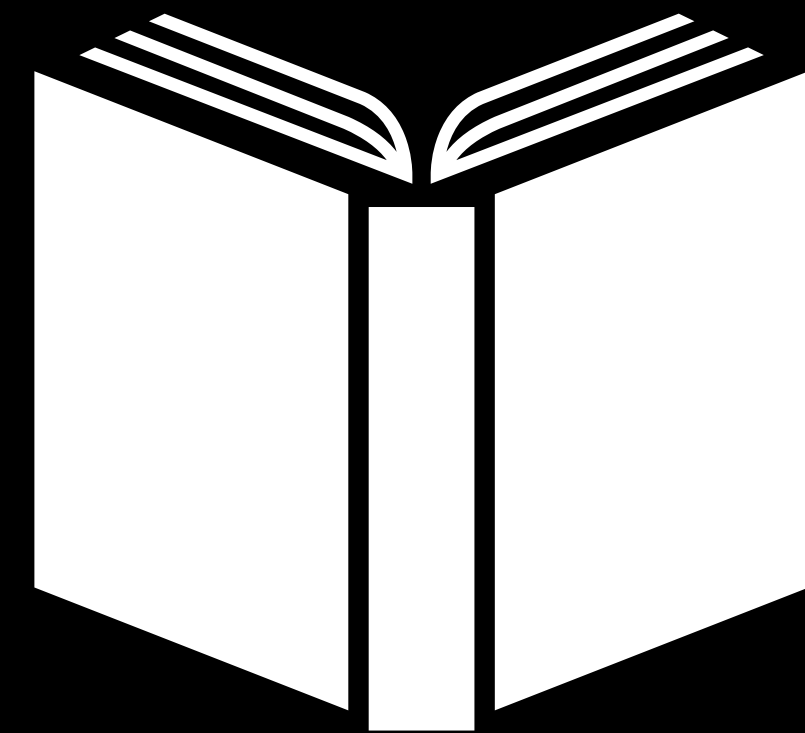
One-to-one

One-to-many

Many-to-many

Entity Relationship Diagrams

ER Diagrams
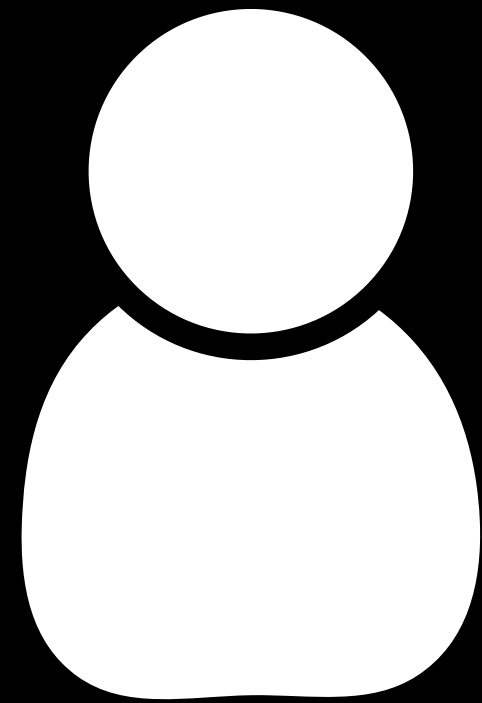
Zero

One

Many

Author —||———||— Book
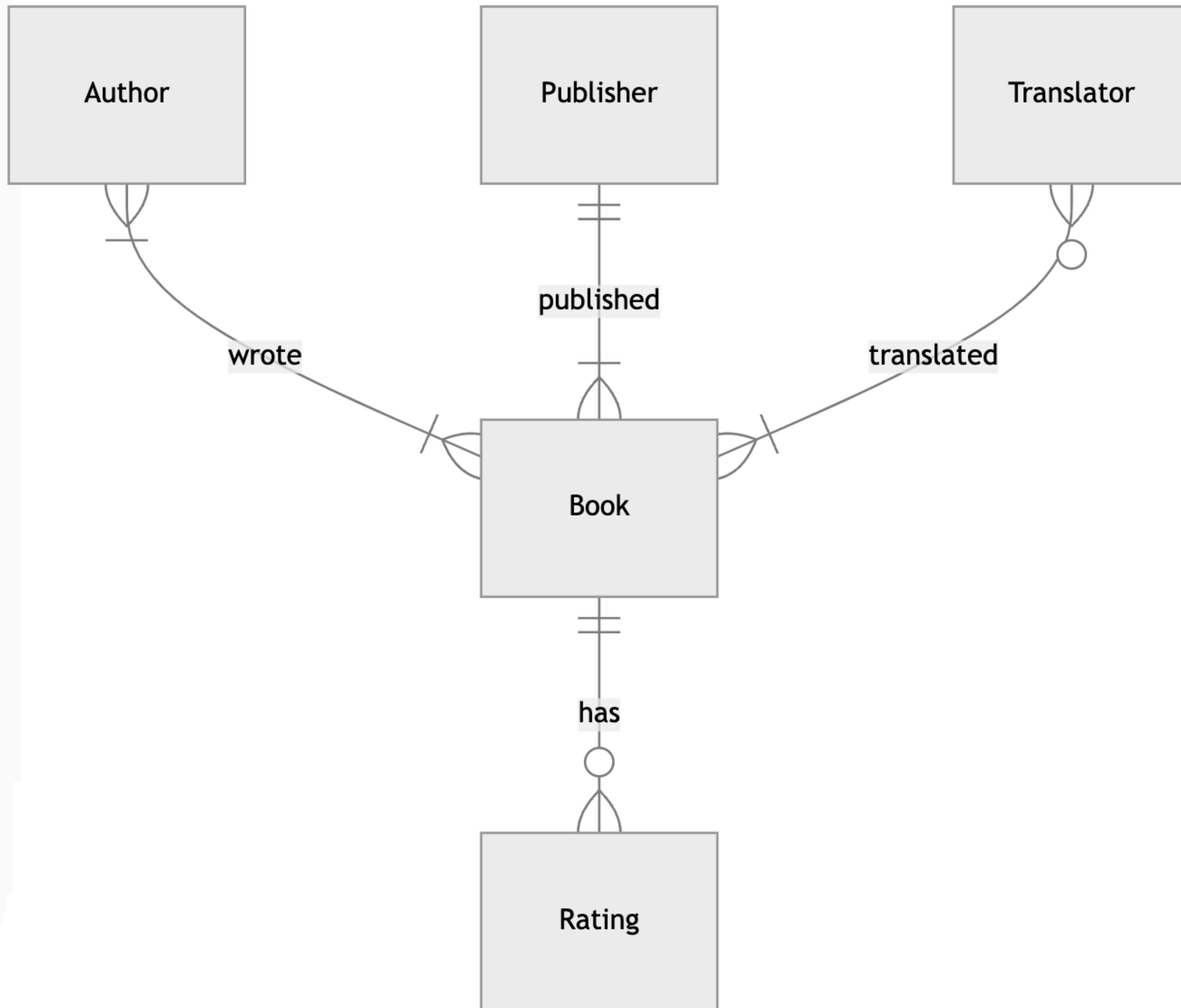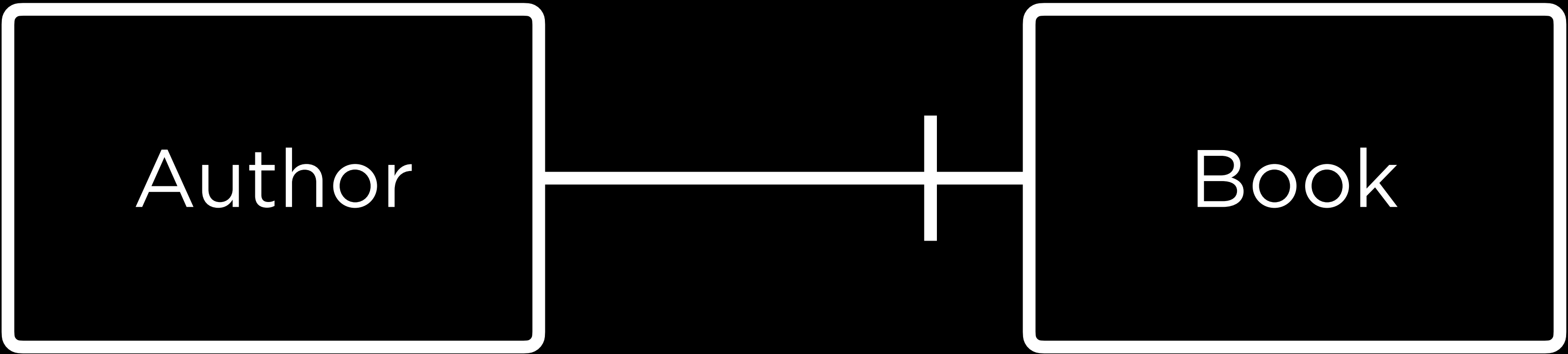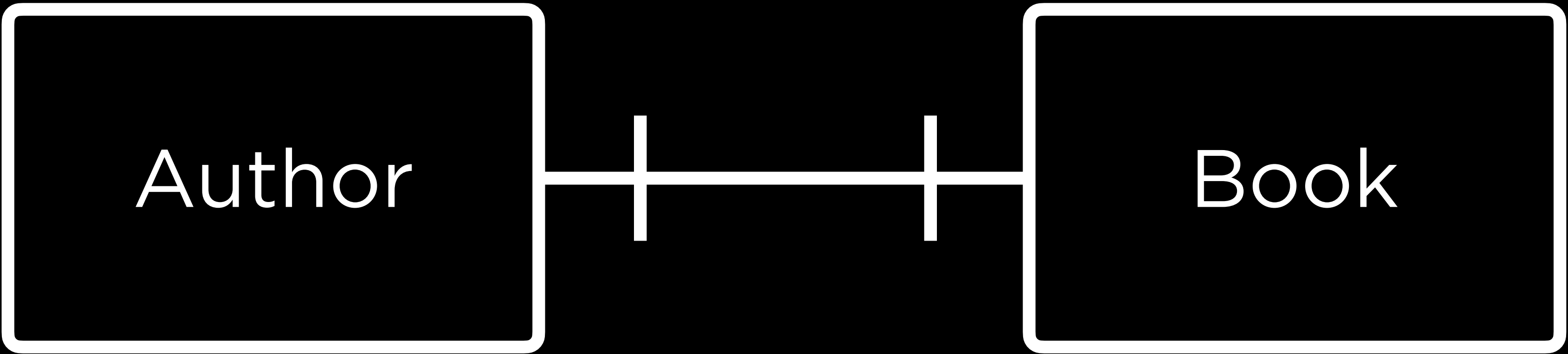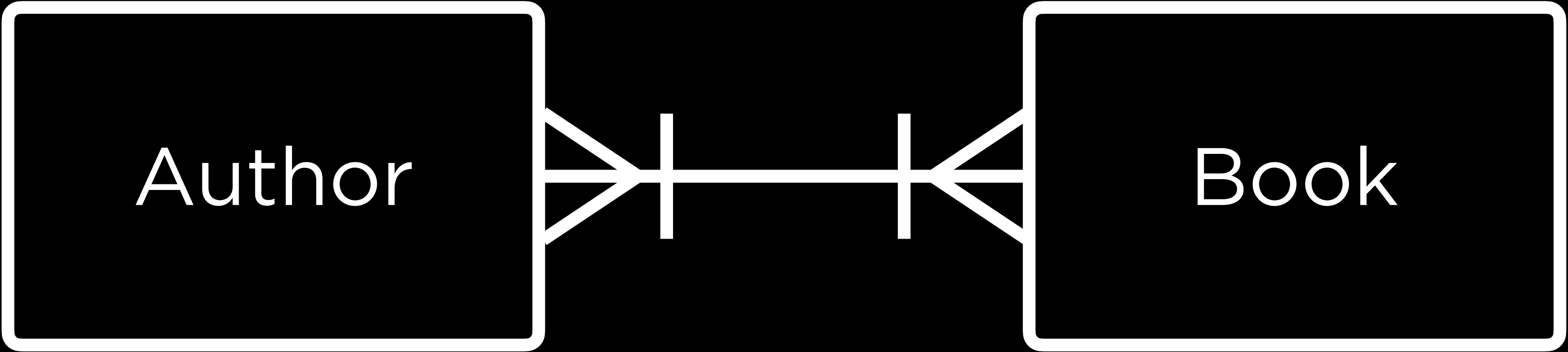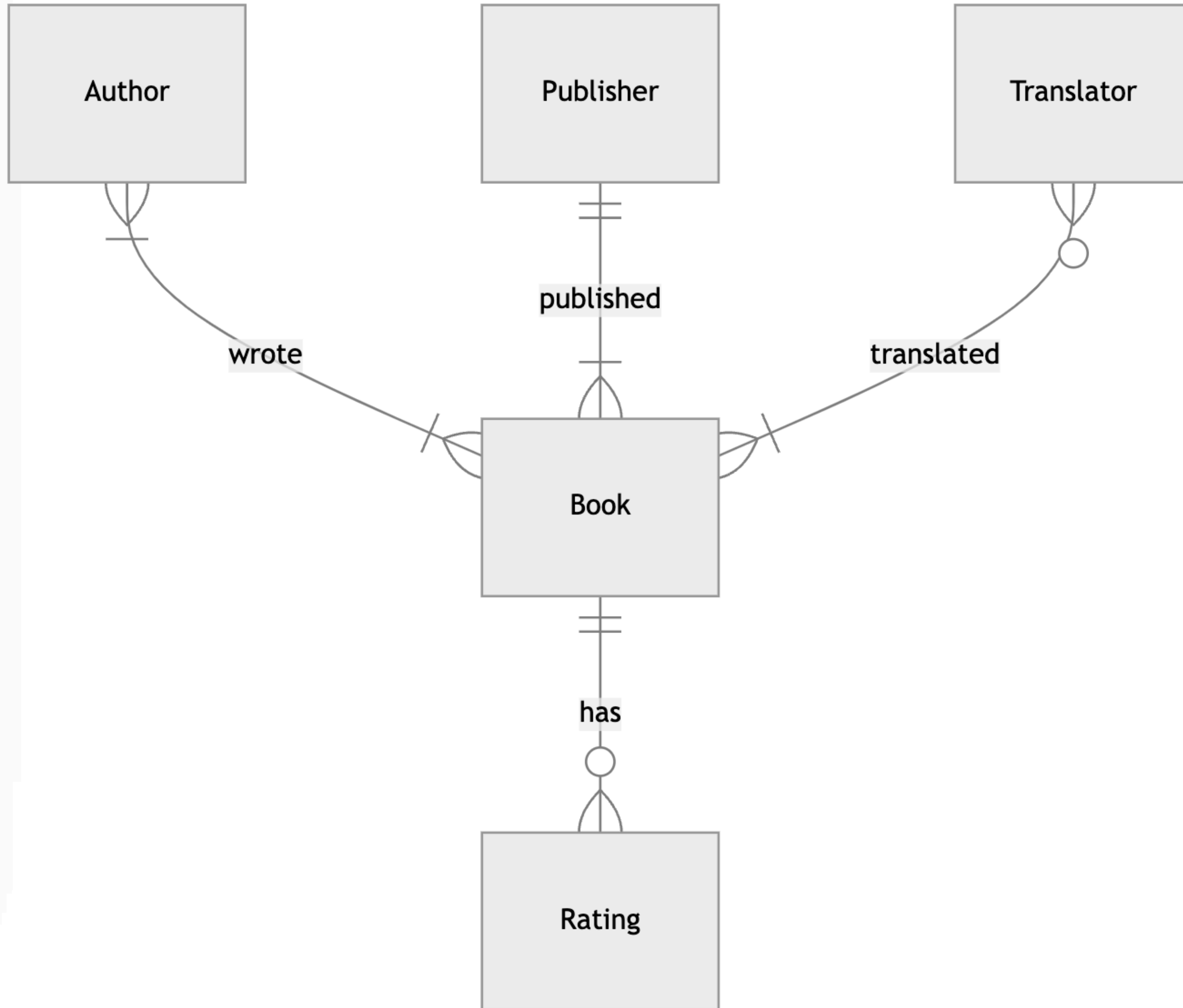
Keys

The Birthday Party

The Birthday Party
Wendy Dranfield | Paperback

The Birthday Party
Laurent Mauvignier | Hardcover

The Birthday Party by Laurent Mauvignier

The Birthday Party
Laurent Mauvignier | Hardcover
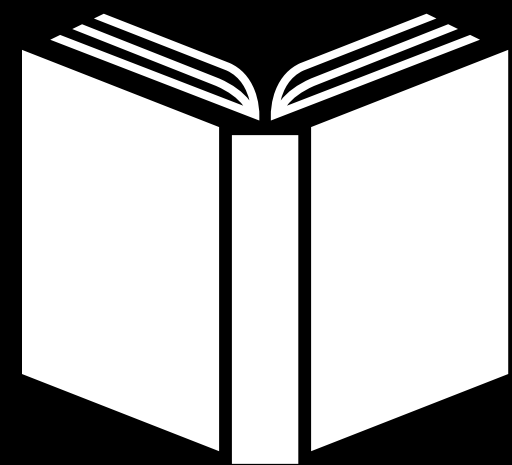
The Birthday Party
Laurent Mauvignier | Paperback

The Birthday Party by Laurent Mauvignier in paperback

The Birthday Party
Laurent Mauvignier | Paperback | 1st edition
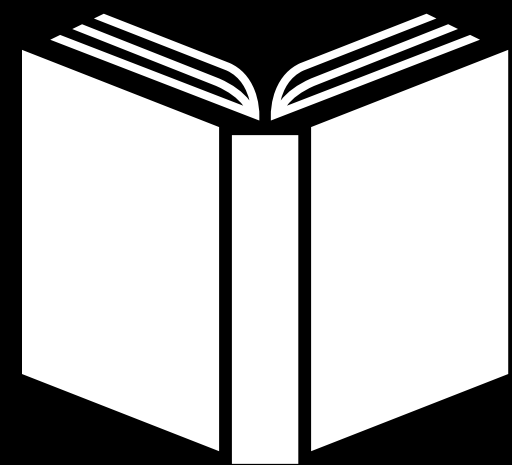
The Birthday Party
Laurent Mauvignier | Paperback | 2nd edition

ISBN
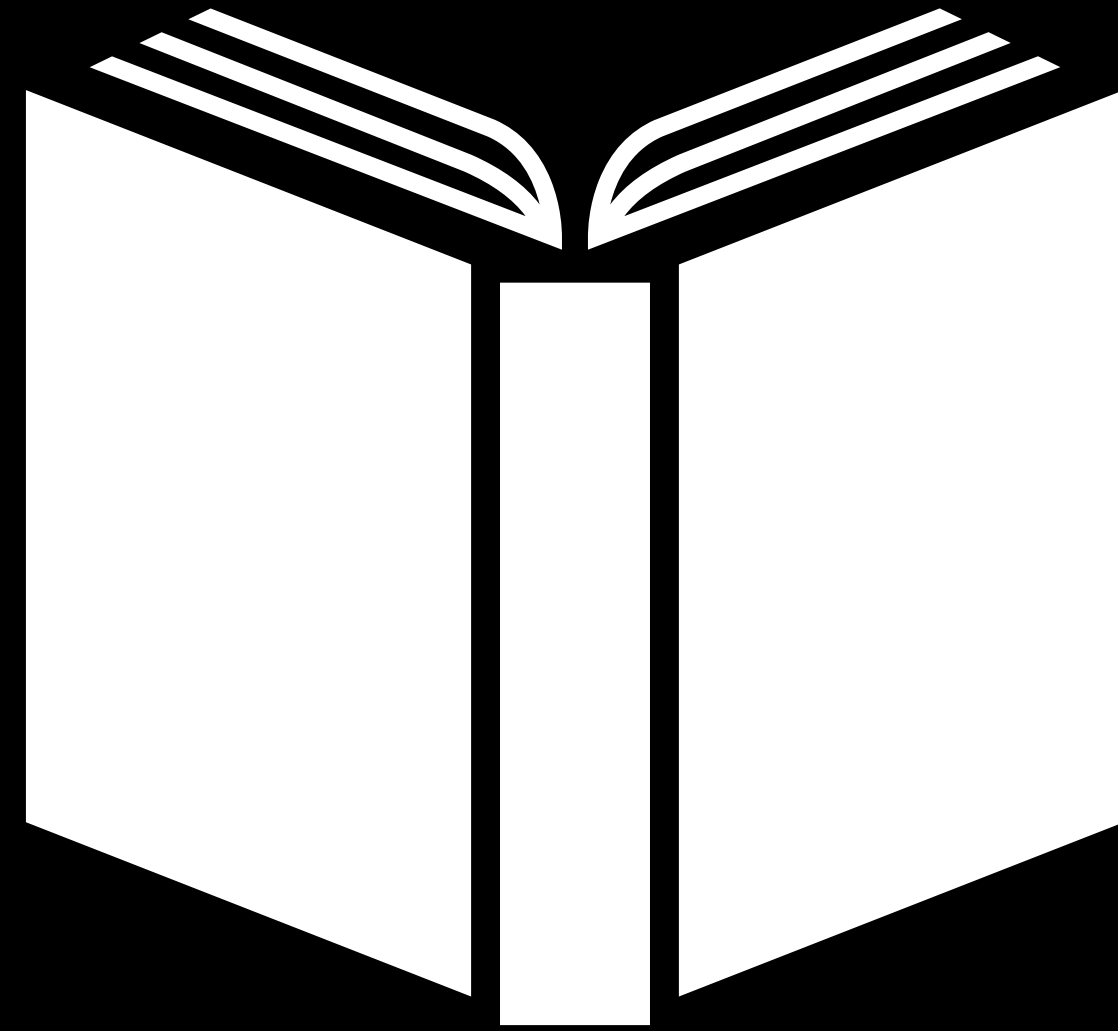
Primary Key

books

isbn	title
9788439736967	Boulder
9780525573067	The White Book
9781529414431	Standing Heavy
9781910695432	Flights

Foreign Key

books

isbn	title
9788439736967	Boulder
9780525573067	The White Book
9781529414431	Standing Heavy
9781910695432	Flights

ratings

isbn	rating
9788439736967	4
9788439736967	3
9788439736967	5
9780525573067	2
9780525573067	3
9781529414431	4
9781910695432	5
9781910695432	4

One-to-many

books

isbn	title
9788439736967	Boulder
9780525573067	The White Book
9781529414431	Standing Heavy
9781910695432	Flights

ratings

isbn	rating
9788439736967	4
9788439736967	3
9788439736967	5
9780525573067	2
9780525573067	3
9781529414431	4
9781910695432	5
9781910695432	4
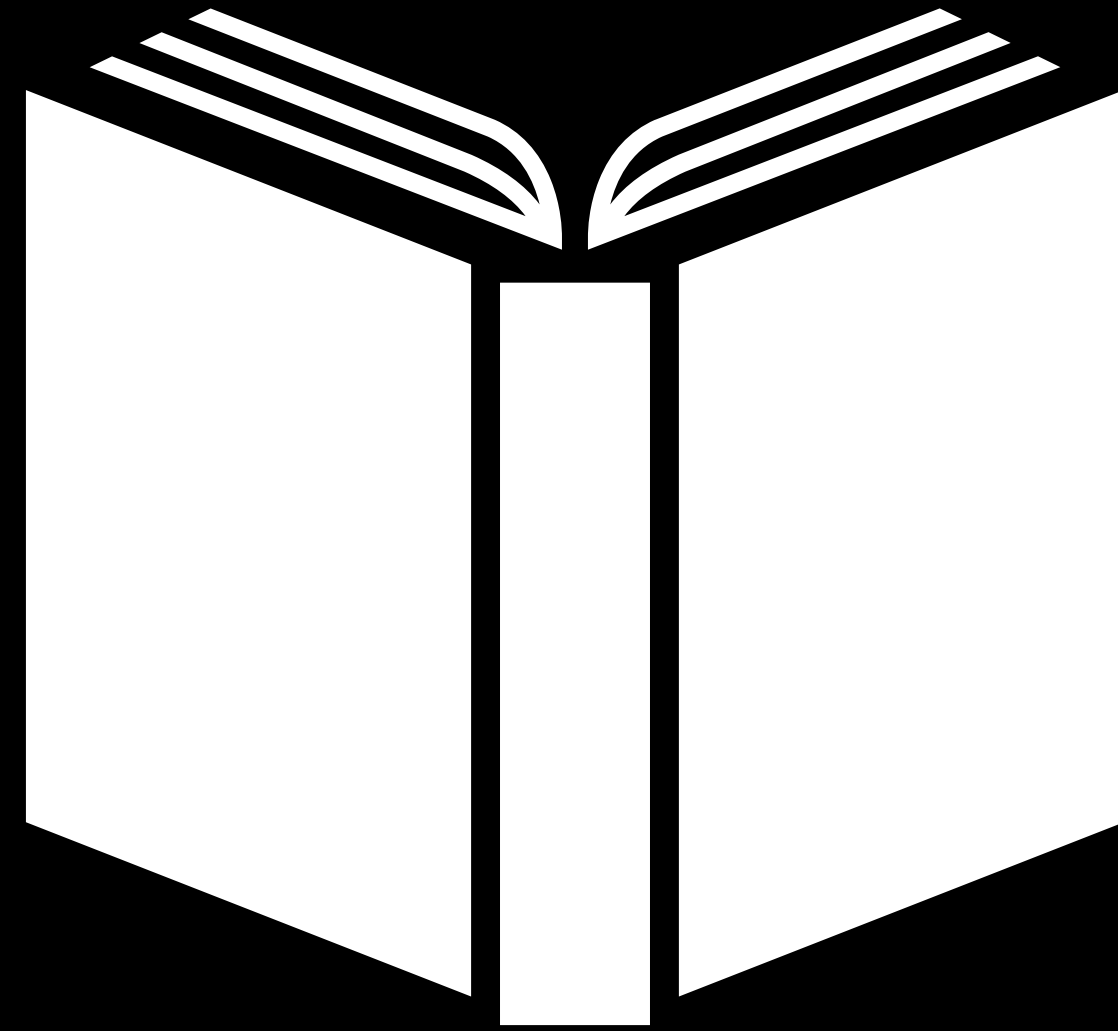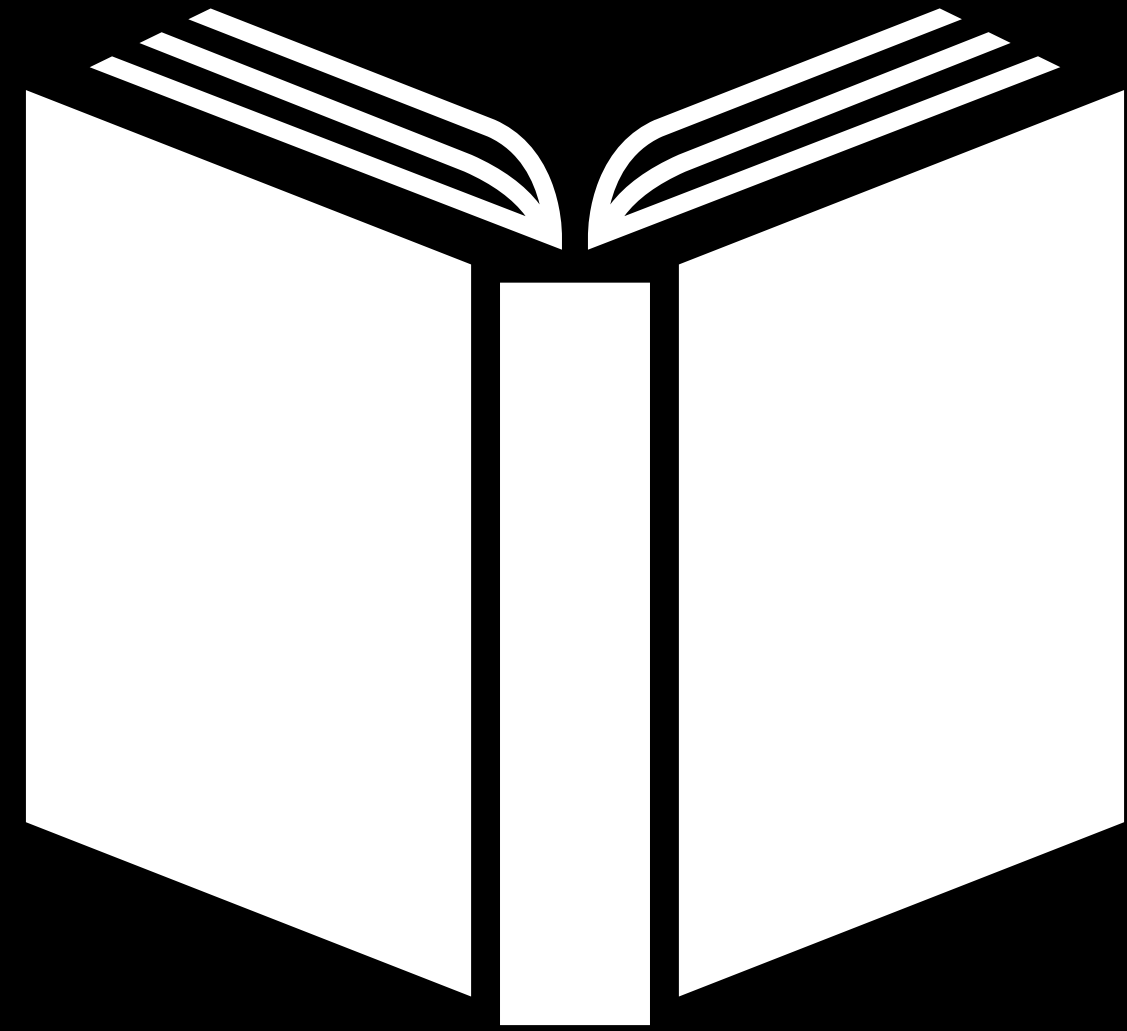
1

books

isbn	title
9788439736967	Boulder
9780525573067	The White Book
9781529414431	Standing Heavy
9781910695432	Flights

ratings

isbn	rating
9788439736967	4
9788439736967	3
9788439736967	5
9780525573067	2
9780525573067	3
9781529414431	4
9781910695432	5
9781910695432	4

books

id	isbn	title
1	9788439736967	Boulder
74	9780525573067	The White Book
4	9781529414431	Standing Heavy
78	9781910695432	Flights

ratings

book_id	rating
1	4
1	3
1	5
74	2
74	3
4	4
78	5
78	4

Many-to-many

authors

id	name
23	Eva Baltasar
31	Han Kang
27	Gauz
58	Olga Tokarczuk

authored

author_id	book_id
23	1
31	74
27	4
58	78

books

id	isbn	title
1	...	Boulder
74	...	The White Book
4	...	Standing Heavy
78	...	Flights

Break

Subqueries

One-to-many

books

publisher_id	title
5	Minor Detail
5	Paradais
33	Love in the New ...
...	...

publishers

id	publisher
5	Fitzcarraldo Editions
22	Seagull Books
33	Yale University Press
...	...

books

publisher_id	title
5	Minor Detail
5	Paradais
33	Love in the New ...
...	...

publishers

id	publisher
5	Fitzcarraldo Editions
22	Seagull Books
33	Yale University Press
...	...

books

publisher_id	title
5	Minor Detail
5	Paradais
33	Love in the New ...
...	...

publishers

id	publisher
5	Fitzcarraldo Editions
22	Seagull Books
33	Yale University Press
...	...

books

publisher_id	title
5	Minor Detail
5	Paradais
33	Love in the New ...
...	...

```sql
SELECT "id" FROM "publishers"
WHERE "publisher" = 'Fitzcarraldo Editions';
```

```sql
SELECT "title" FROM "books"
WHERE "publisher_id" = 5;
```

```sql
SELECT "title" FROM "books"
WHERE "publisher_id" = (
    SELECT "id" FROM "publishers"
    WHERE "publisher" = 'Fitzcarraldo Editions'
);
```

Many-to-many

authors

id	name
23	Eva Baltasar
31	Han Kang
27	Gauz
58	Olga Tokarczuk

authored

author_id	book_id
23	1
31	74
27	4
58	78

books

id	isbn	title
1	...	Boulder
74	...	The White Book
4	...	Standing Heavy
78	...	Flights

authors

id	name
23	Eva Baltasar
31	Han Kang
27	Gauz
58	Olga Tokarczuk

authored

author_id	book_id
23	1
31	74
27	4
58	78

books

id	isbn	title
1	...	Boulder
74	...	The White Book
4	...	Standing Heavy
78	...	Flights

authors

id	name
23	Eva Baltasar
31	Han Kang
27	Gauz
58	Olga Tokarczuk

authored

author_id	book_id
23	1
31	74
27	4
58	78

books

id	isbn	title
1	...	Boulder
74	...	The White Book
4	...	Standing Heavy
78	...	Flights

authors

id	name
23	Eva Baltasar
31	Han Kang
27	Gauz
58	Olga Tokarczuk

authored

author_id	book_id
23	1
31	74
27	4
58	78

books

id	isbn	title
1	...	Boulder
74	...	The White Book
4	...	Standing Heavy
78	...	Flights

authors

id	name
23	Eva Baltasar
31	Han Kang
27	Gauz
58	Olga Tokarczuk

authored

author_id	book_id
23	1
31	74
27	4
58	78

books

id	isbn	title
1	...	Boulder
74	...	The White Book
4	...	Standing Heavy
78	...	Flights

```
SELECT "id" FROM "books"
WHERE "title" = 'Flights';
```

```sql
SELECT "author_id" FROM "authored"
WHERE "book_id" = (
    SELECT "id" FROM "books"
    WHERE "title" = 'Flights'
);
```

```sql
SELECT "name" FROM "authors"
WHERE "id" = (
    SELECT "author_id" FROM "authored"
    WHERE "book_id" = (
        SELECT "id" FROM "books"
        WHERE "title" = 'Flights'
    )
);
```

IN

authors

id	name
23	Eva Baltasar
31	Han Kang
27	Gauz
58	Olga Tokarczuk

authored

author_id	book_id
23	1
31	74
27	4
58	78

books

id	isbn	title
1	...	Boulder
74	...	The White Book
4	...	Standing Heavy
78	...	Flights

authors

id	name
23	Eva Baltasar
31	Han Kang
27	Gauz
58	Olga Tokarczuk

authored

author_id	book_id
23	1
31	74
27	4
58	78

books

id	isbn	title
1	...	Boulder
74	...	The White Book
4	...	Standing Heavy
78	...	Flights

authors

id	name
23	Eva Baltasar
31	Han Kang
27	Gauz
58	Olga Tokarczuk

authored

author_id	book_id
23	1
31	74
27	4
58	78

books

id	isbn	title
1	...	Boulder
74	...	The White Book
4	...	Standing Heavy
78	...	Flights

authors

id	name
23	Eva Baltasar
31	Han Kang
27	Gauz
58	Olga Tokarczuk

authored

author_id	book_id
23	1
31	74
27	4
58	78

books

id	isbn	title
1	...	Boulder
74	...	The White Book
4	...	Standing Heavy
78	...	Flights

authors

id	name
23	Eva Baltasar
31	Han Kang
27	Gauz
58	Olga Tokarczuk

authored

author_id	book_id
23	1
31	74
27	4
58	78

books

id	isbn	title
1	...	Boulder
74	...	The White Book
4	...	Standing Heavy
78	...	Flights

Joins

sea lions

id	name
10484	Ayah
11728	Spot
11729	Tiger
11732	Mabel
11734	Rick
11790	Jolee

migrations

id	distance	days
10484	1000	107
11728	1531	56
11729	1370	37
11732	1622	62
11734	1491	58
11735	2723	82
11736	1571	52
11737	1957	92

sea lions

id	name
10484	Ayah
11728	Spot
11729	Tiger
11732	Mabel
11734	Rick
11790	Jolee

migrations

id	distance	days
10484	1000	107
11728	1531	56
11729	1370	37
11732	1622	62
11734	1491	58
11735	2723	82
11736	1571	52
11737	1957	92

sea lions JOIN migrations

id	name	id	distance	days
10484	Ayah	10484	1000	107
11728	Spot	11728	1531	56
11729	Tiger	11729	1370	37
11732	Mabel	11732	1622	62
11734	Rick	11734	1491	58

JOIN

INNER JOIN

id	name
10484	Ayah
11728	Spot
11790	Jolee

id	distance
10484	1000
11728	1531
11735	2723

id	name	id	distance
10484	Ayah	10484	1000
11728	Spot	11728	1531
11790	Jolee	11735	2723

id	name	id	distance
10484	Ayah	10484	1000
11728	Spot	11728	1531

LEFT JOIN

RIGHT JOIN

FULL JOIN

LEFT OUTER JOIN

RIGHT OUTER JOIN

FULL OUTER JOIN

LEFT OUTER JOIN

id	name
10484	Ayah
11728	Spot
11790	Jolee

id	distance
10484	1000
11728	1531
11735	2723

id	name	id	distance
10484	Ayah	10484	1000
11728	Spot	11728	1531
11790	Jolee		
		11735	2723

id	name	id	distance
10484	Ayah	10484	1000
11728	Spot	11728	1531
11790	Jolee	NULL	NULL
NULL	NULL	11735	2723

id	name	id	distance
10484	Ayah	10484	1000
11728	Spot	11728	1531
11790	Jolee	NULL	NULL

RIGHT OUTER JOIN

id	name
10484	Ayah
11728	Spot
11790	Jolee

id	distance
10484	1000
11728	1531
11735	2723

id	name	id	distance
10484	Ayah	10484	1000
11728	Spot	11728	1531
11790	Jolee		
		11735	2723

id	name	id	distance
10484	Ayah	10484	1000
11728	Spot	11728	1531
11790	Jolee	NULL	NULL
NULL	NULL	11735	2723

id	name	id	distance
10484	Ayah	10484	1000
11728	Spot	11728	1531
NULL	NULL	11735	2723

FULL JOIN

id	name
10484	Ayah
11728	Spot
11790	Jolee

id	distance
10484	1000
11728	1531
11735	2723

id	name	id	distance
10484	Ayah	10484	1000
11728	Spot	11728	1531
11790	Jolee		
		11735	2723

id	name	id	distance
10484	Ayah	10484	1000
11728	Spot	11728	1531
11790	Jolee	NULL	NULL
NULL	NULL	11735	2723

NATURAL JOIN

Break

Sets

Authors

Translators

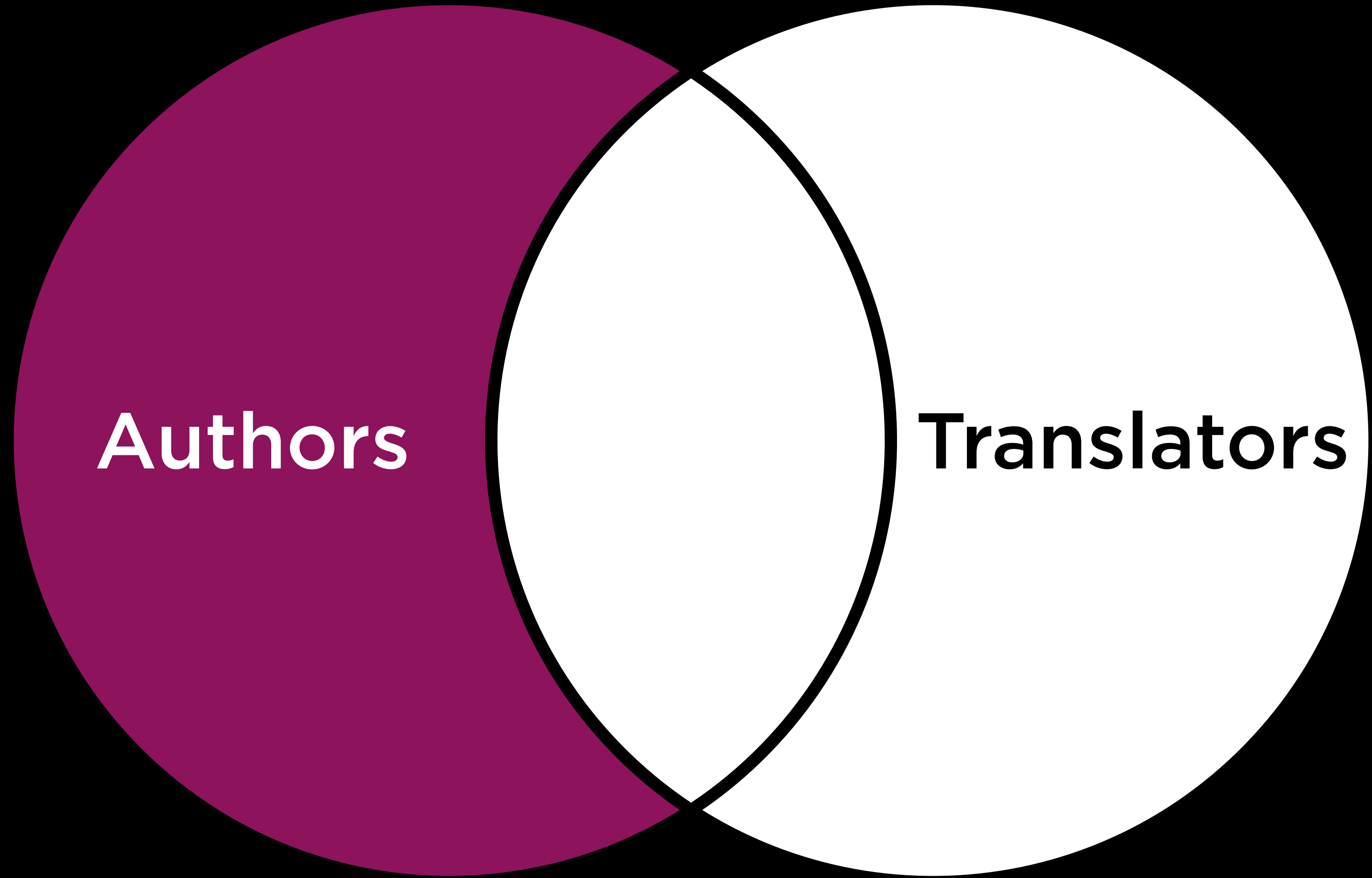Authors INTERSECT Translators

Authors UNION Translators

Authors EXCEPT Translators
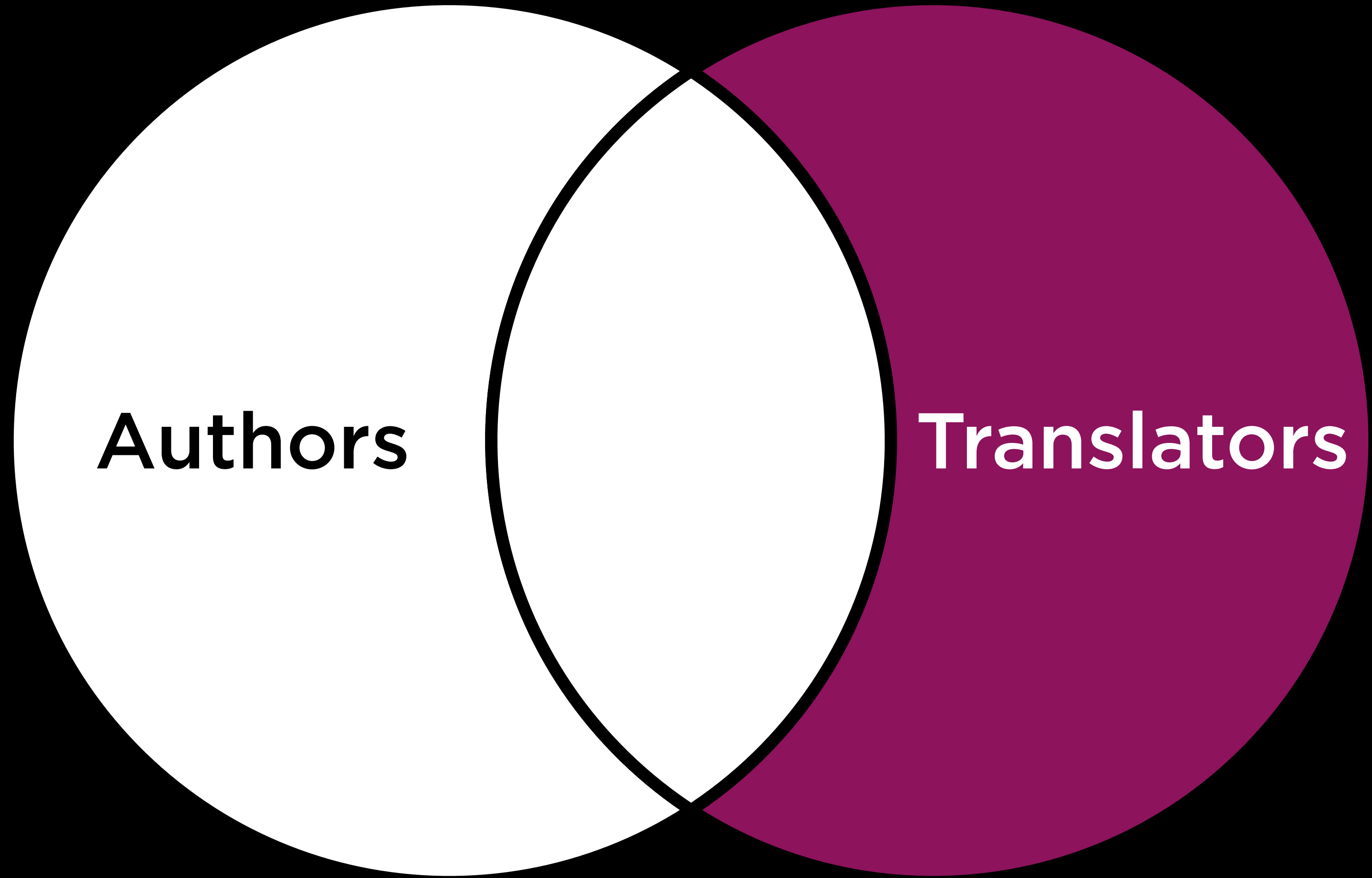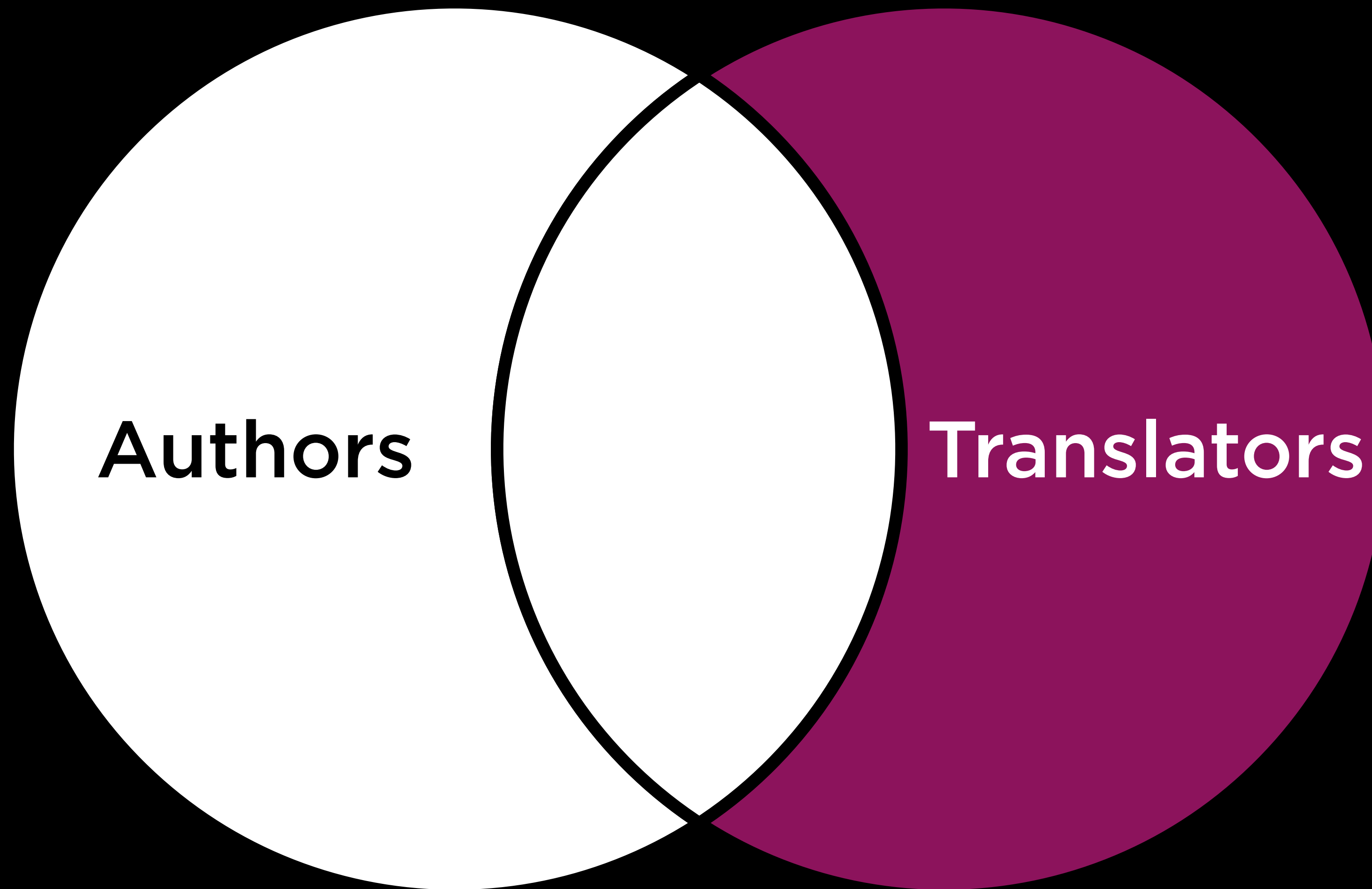
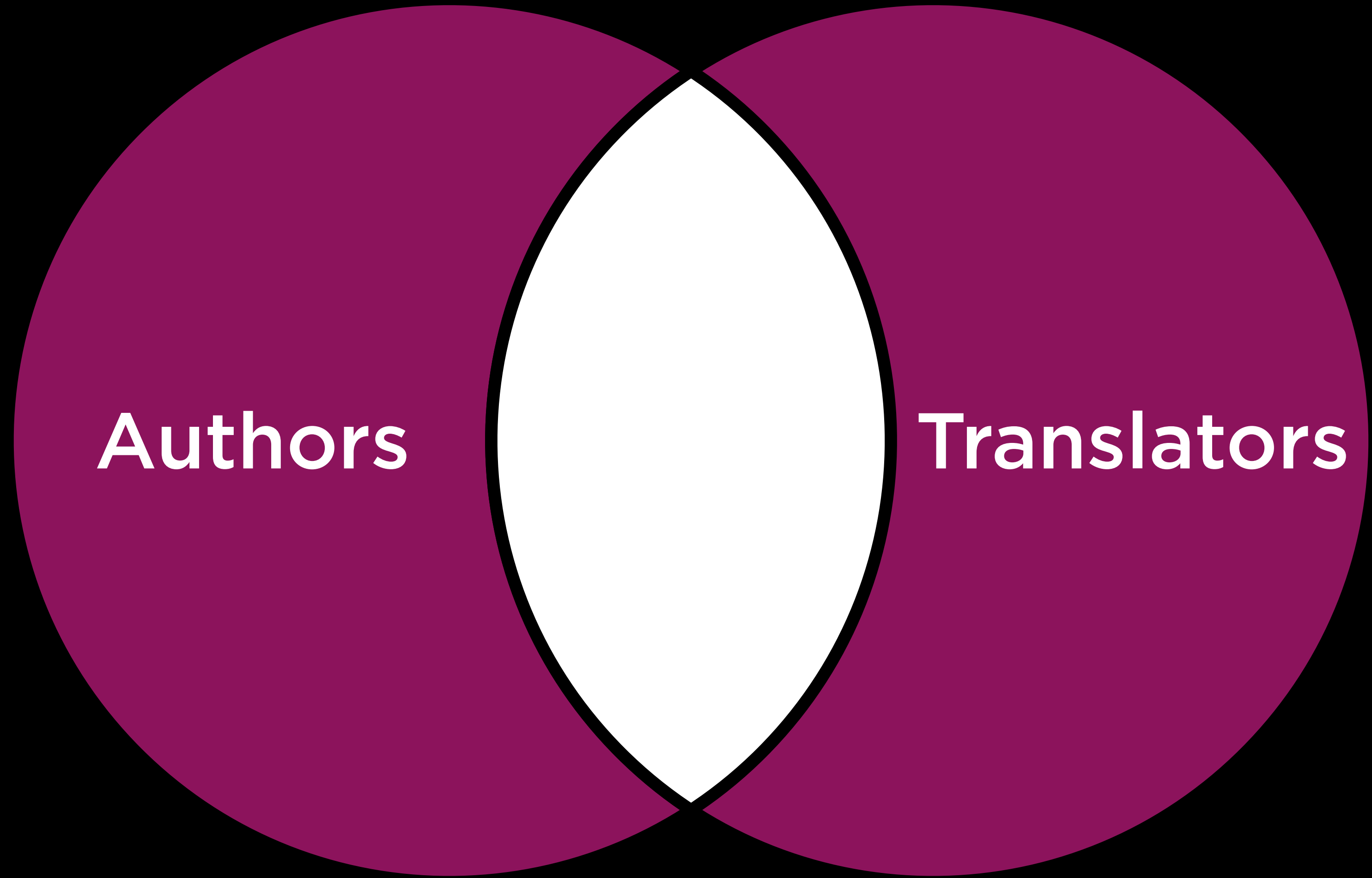Translators EXCEPT Authors

Groups

book_id	rating
1	4
1	3
1	4
2	2
2	3

book_id	rating
1	4
1	3
1	4
2	2
2	3

book_id	rating
1	4
2	3

book_id	average rating
1	3.67
2	2.5

GROUP BY

HAVING

Introduction to
Databases with SQL

Relating