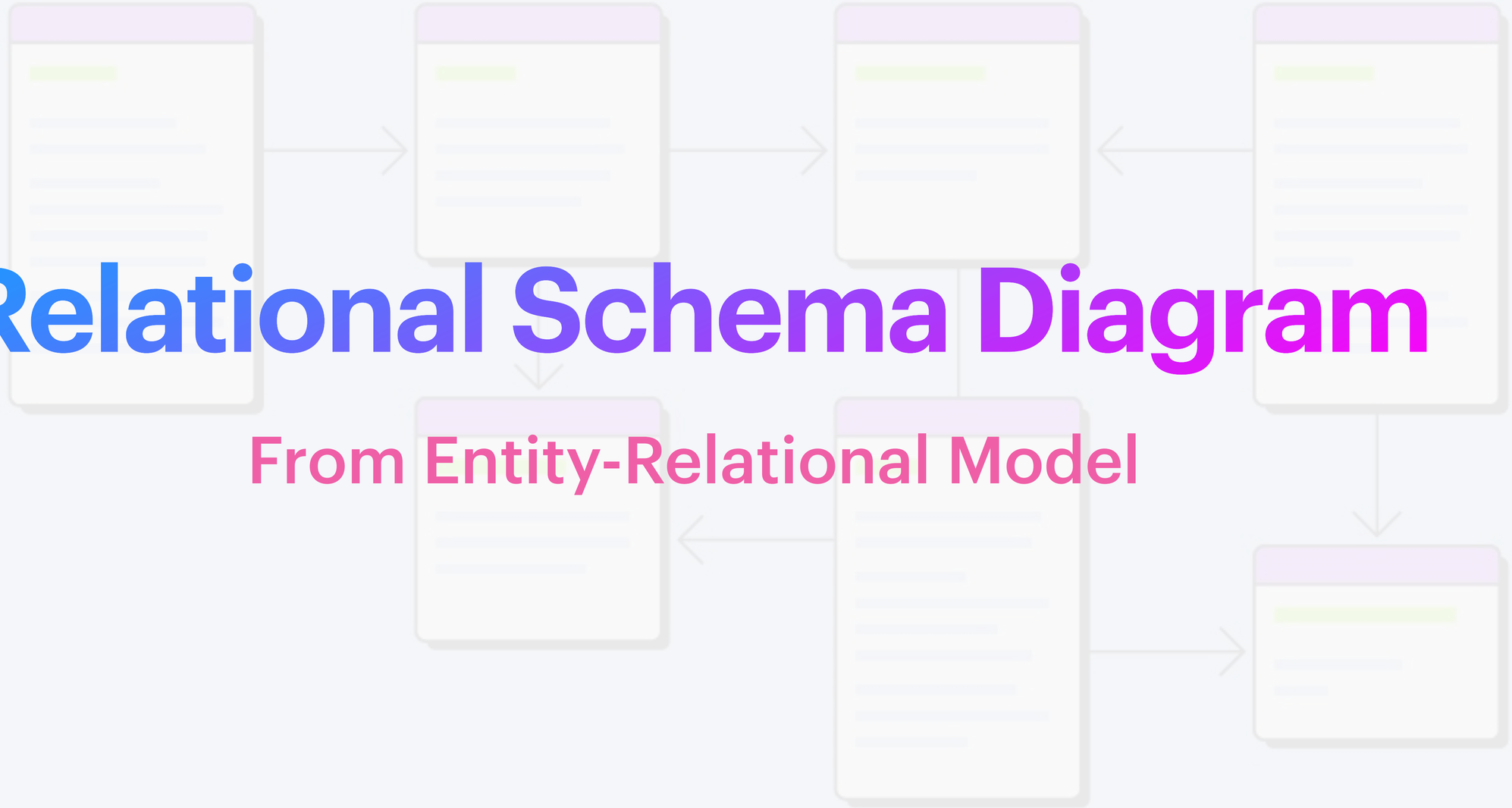

Relational Schema Diagram

From Entity-Relational Model

Anis Uddin Ahmad

How RDBMS Represents DATA

ID	Name	DOB	Email	Department
1003	Rahman	03-08-1988	rahman@company.com	HR
1004	Sattar	01-02-1993	sattar@company.com	AUDIT
1007	Gafur	13-04-2003	gafur@company.com	HR

How RDBMS Represents DATA

Table: a collection of data elements organised in terms of *rows* and *columns*

ID	Name	DOB	Email	Department
1003	Rahman	03-08-1988	rahman@company.com	HR
1004	Sattar	01-02-1993	sattar@company.com	AUDIT
1007	Gafur	13-04-2003	gafur@company.com	HR

employees

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Table: a collection of data elements organised in terms of *rows* and *columns*

Row: a single entry in a table (AKA: Tuple, Record)

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1003	Rahman	03-08-1988	rahman@company.com	HR
1004	Sattar	01-02-1993	sattar@company.com	AUDIT
1007	Gafur	13-04-2003	gafur@company.com	HR

employees

How RDBMS Represents DATA

Table: a collection of data elements organised in terms of *rows* and *columns*

Row: a single entry in a table (AKA: Tuple, Record)

Attribute: a distinct piece of information in a record (AKA: Cell, Field)

ID	Name	DOB	Email	Department
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1004	Sattar	01-02-1993	sattar@company.com	AUDIT
1007	Gafur	13-04-2003	gafur@company.com	HR

employees

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Column: a list of values belonging to a particular field

ID	Name	DOB	Email	Department
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1007	Gafur	13-04-2003	gafur@company.com	HR

employees

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employees

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Table: a collection of data elements organised in terms of *rows* and *columns*

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Column: a list of values belonging to a particular field

ID	Name	DOB	Email	Department
1003	Rahman	03-08-1988	rahman@company.com	HR
1004	Sattar	01-02-1993	sattar@company.com	AUDIT
1007	Gafur	13-04-2003	gafur@company.com	HR

Degree

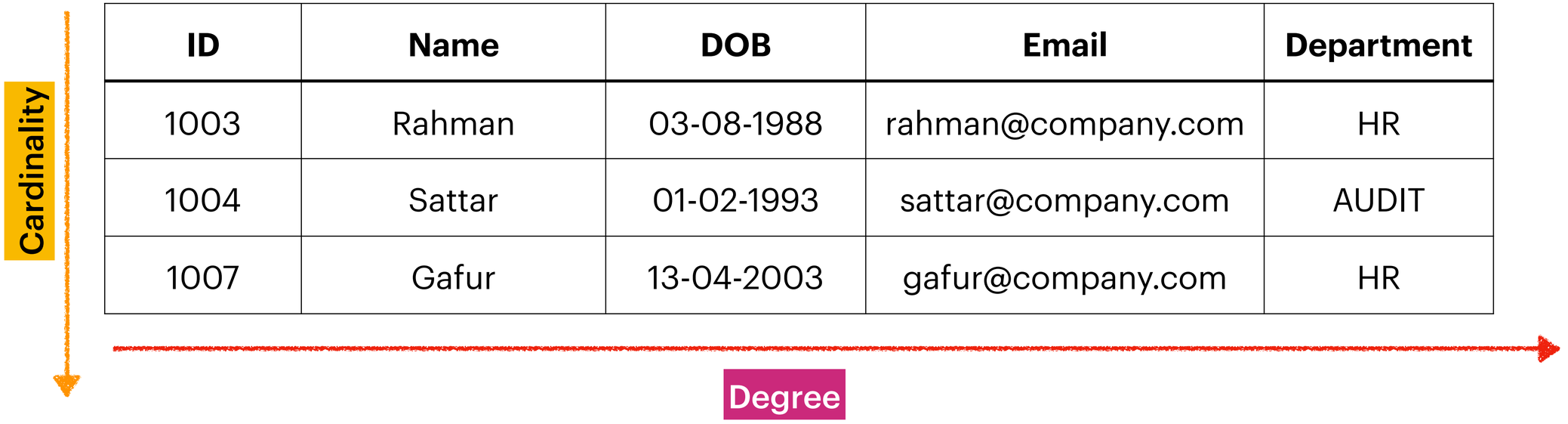
How RDBMS Represents DATA

Table: a collection of data elements organised in terms of *rows* and *columns*

Row: a single entry in a table (AKA: Tuple, Record)

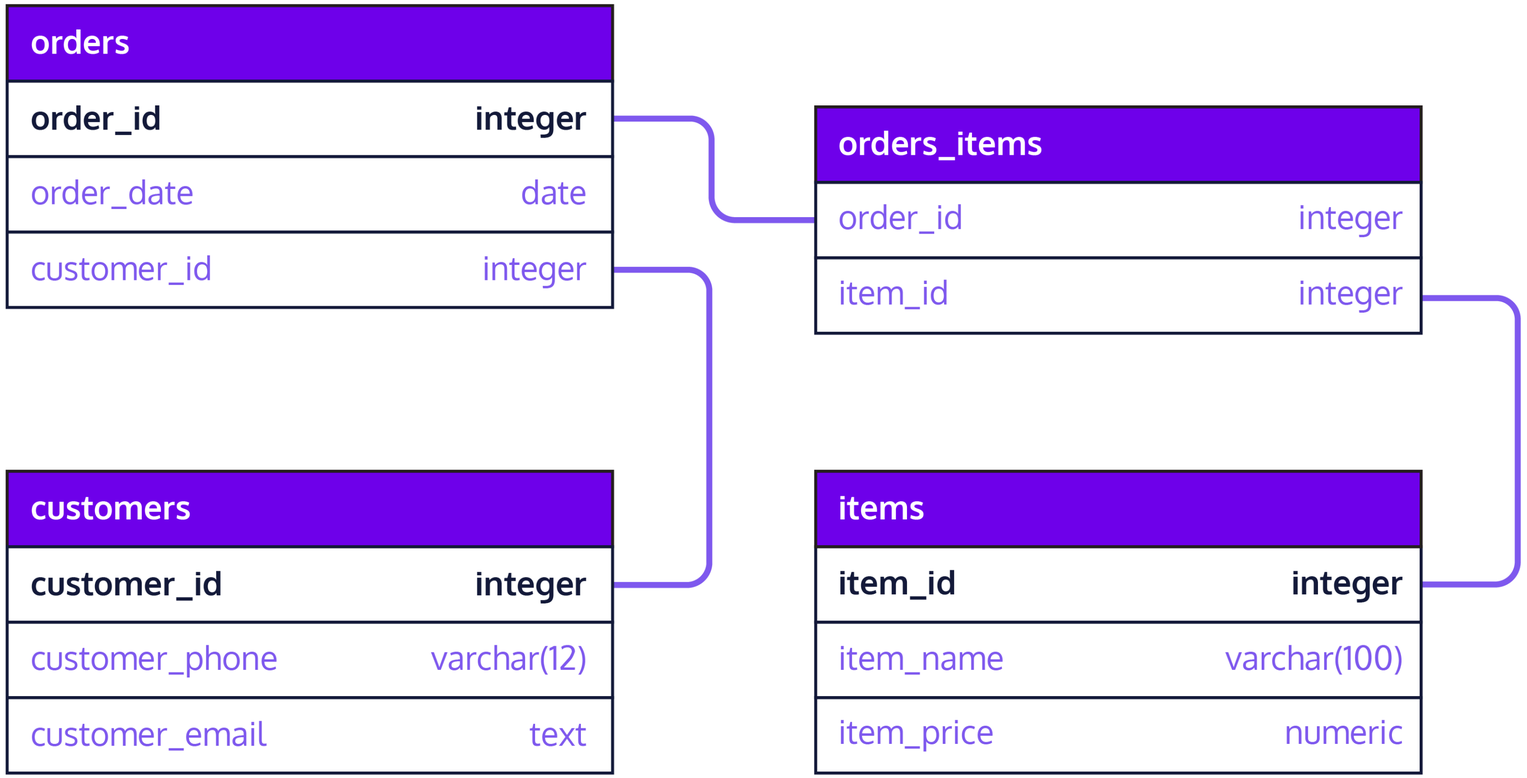
Attribute: a distinct piece of information in a record (AKA: Cell, Field)

Column: a list of values belonging to a particular field

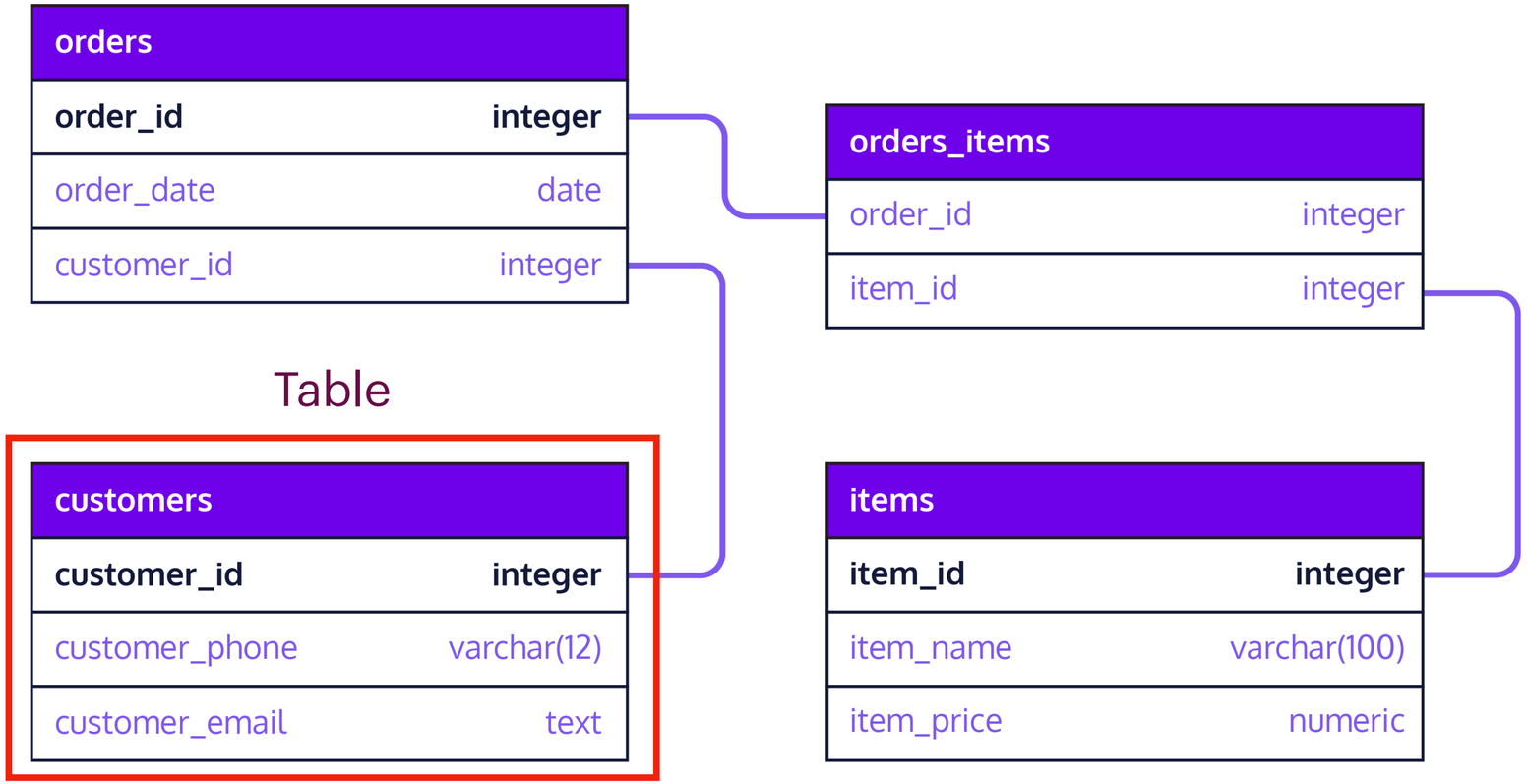


ID	Name	DOB	Email	Department
1003	Rahman	03-08-1988	rahman@company.com	HR
1004	Sattar	01-02-1993	sattar@company.com	AUDIT
1007	Gafur	13-04-2003	gafur@company.com	HR

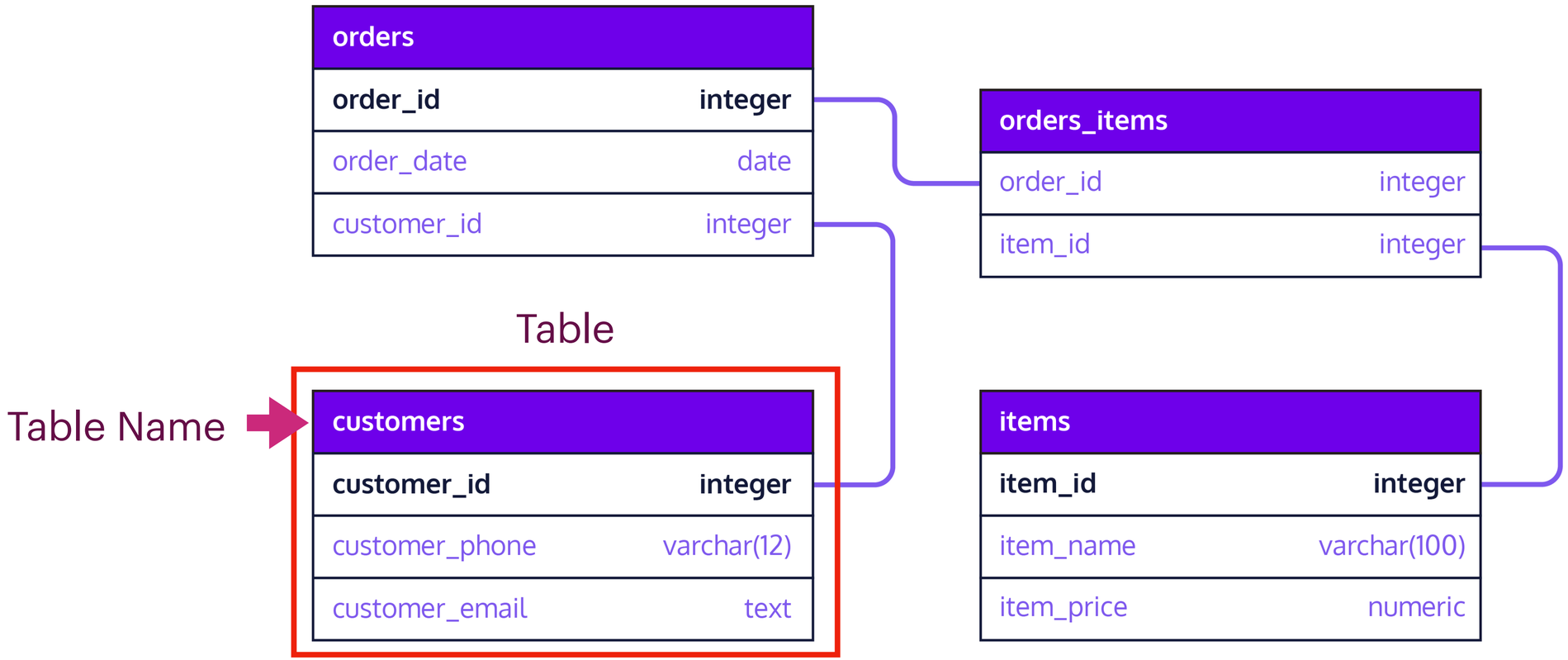
Relational Schema



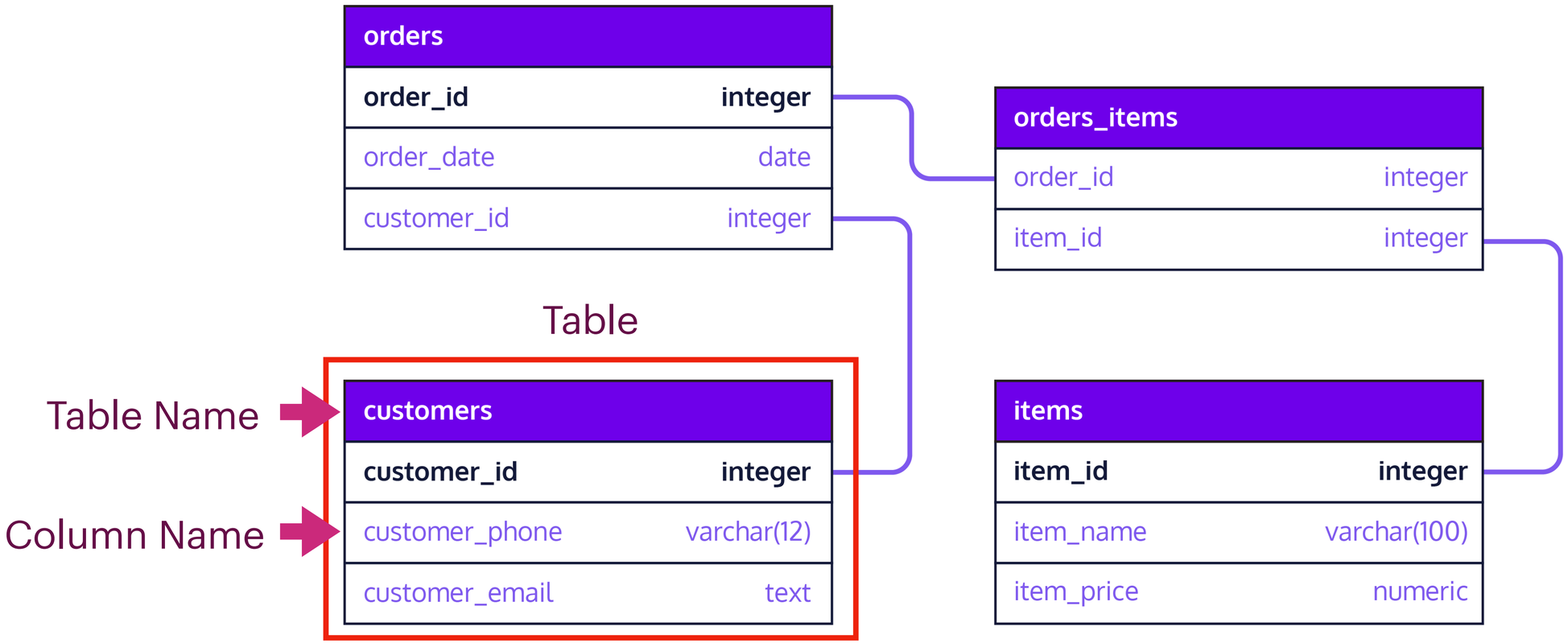
Relational Schema



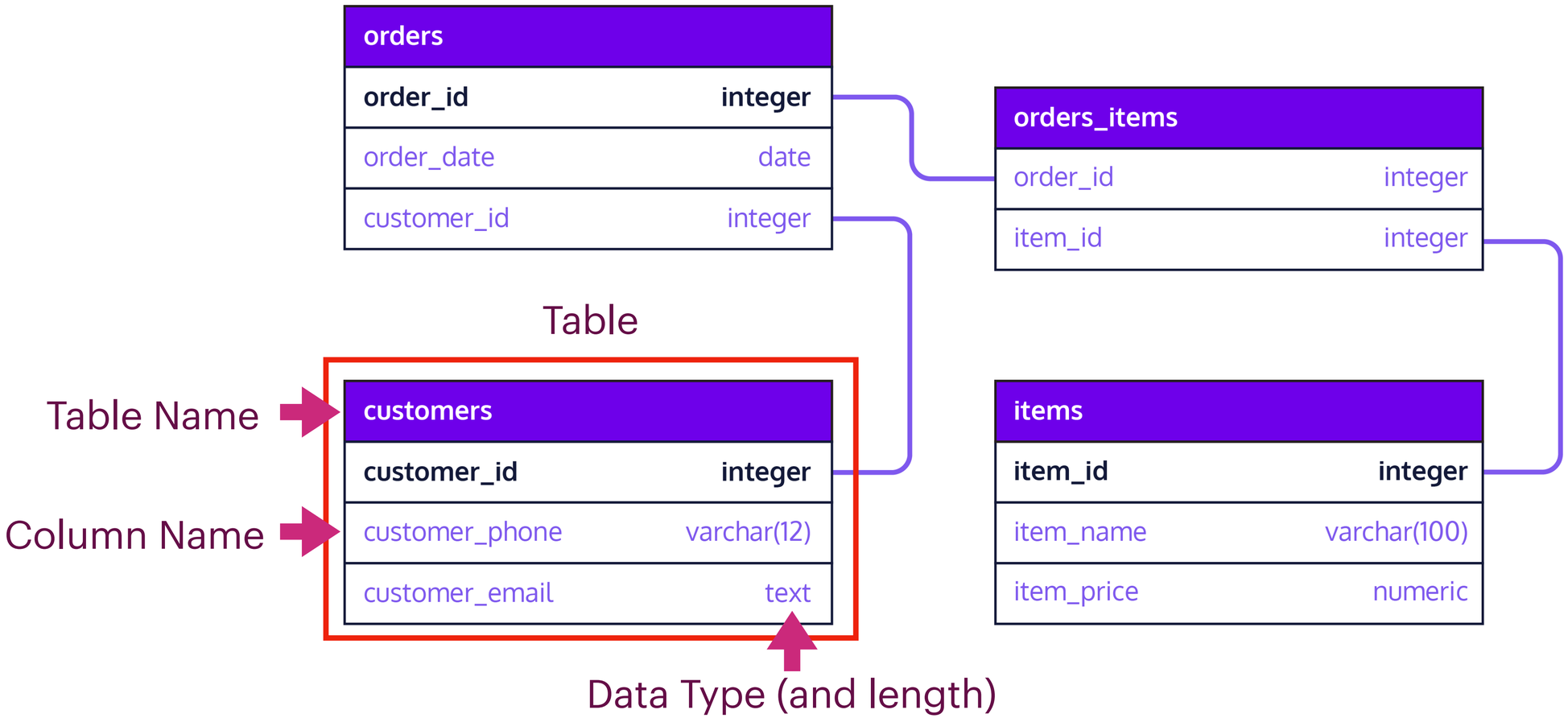
Relational Schema



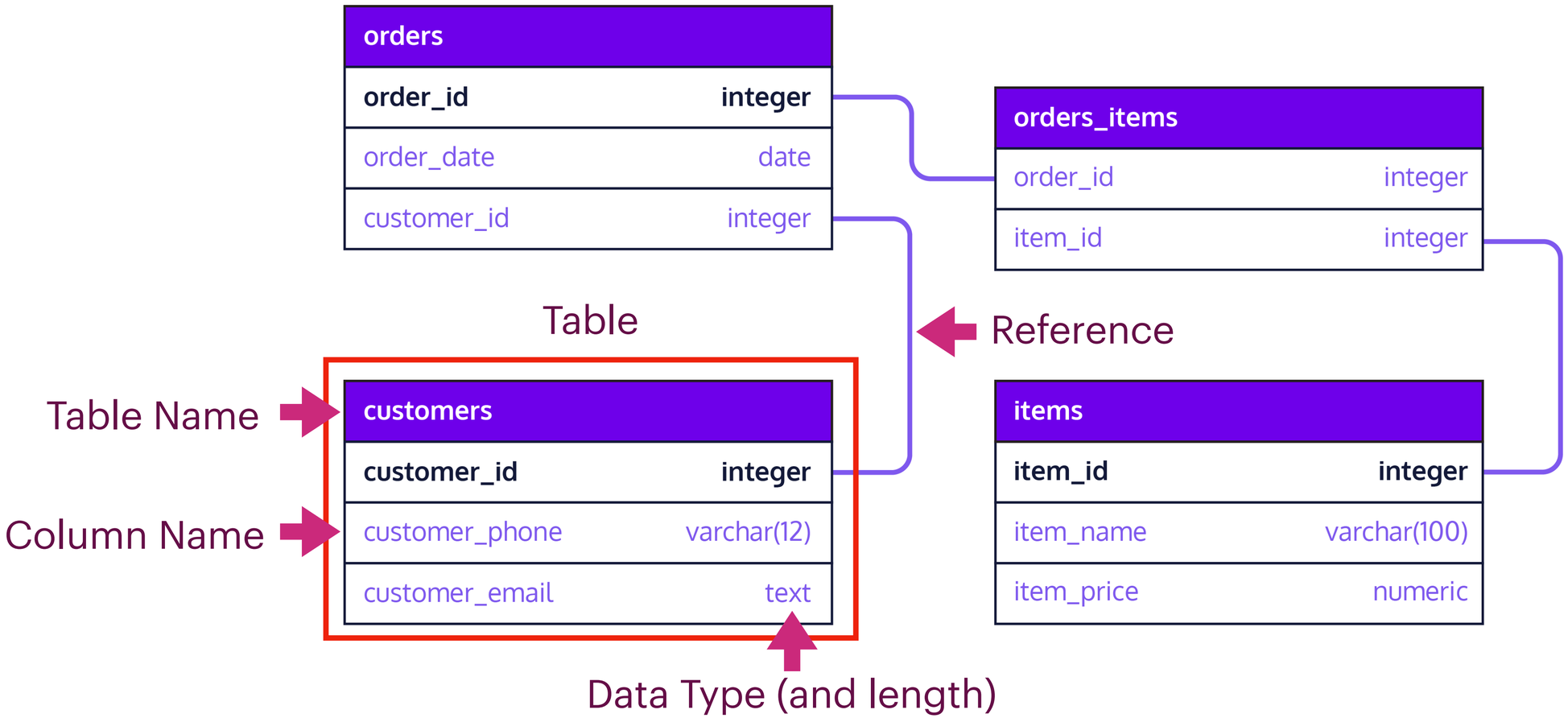
Relational Schema



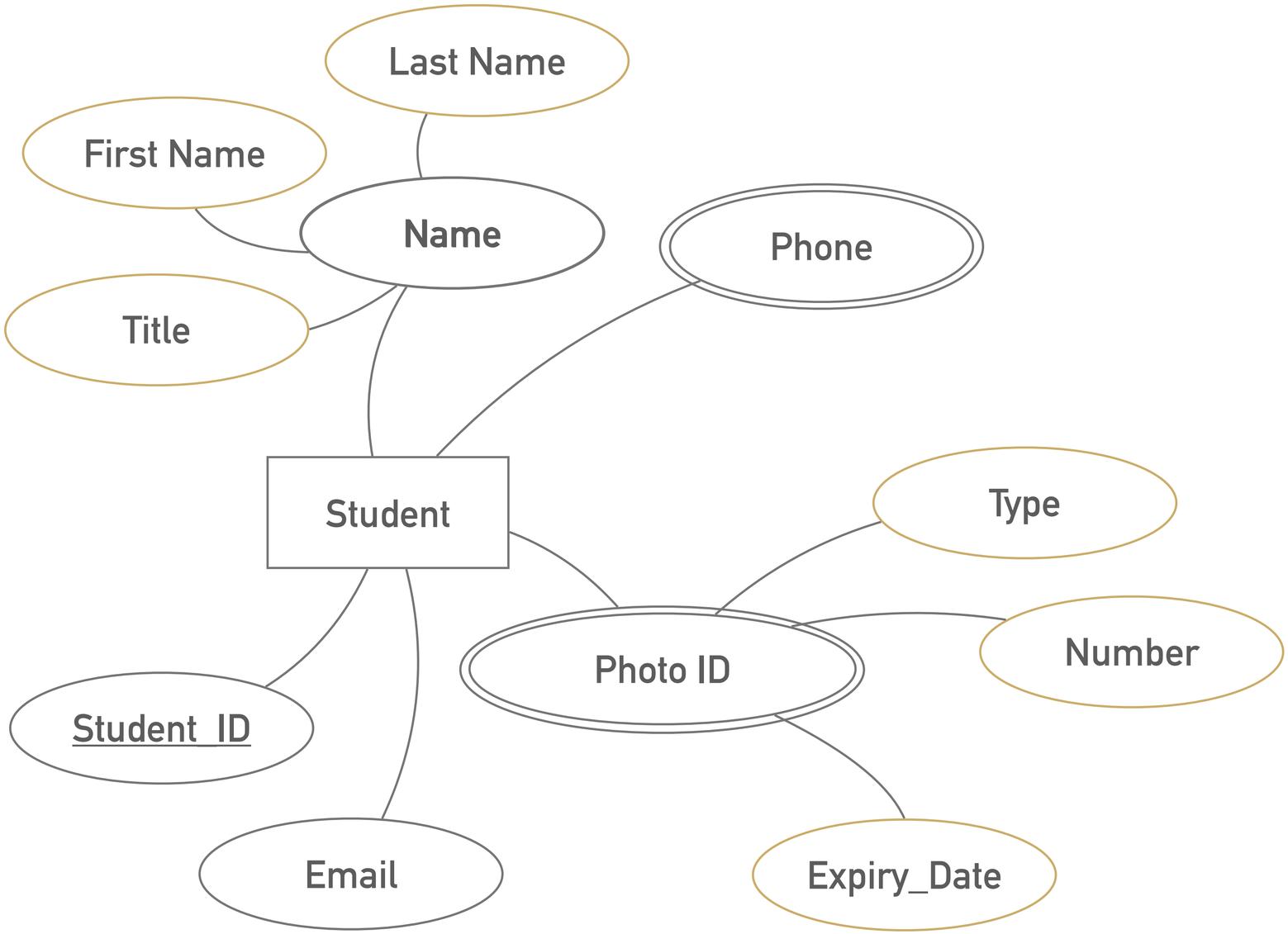
Relational Schema



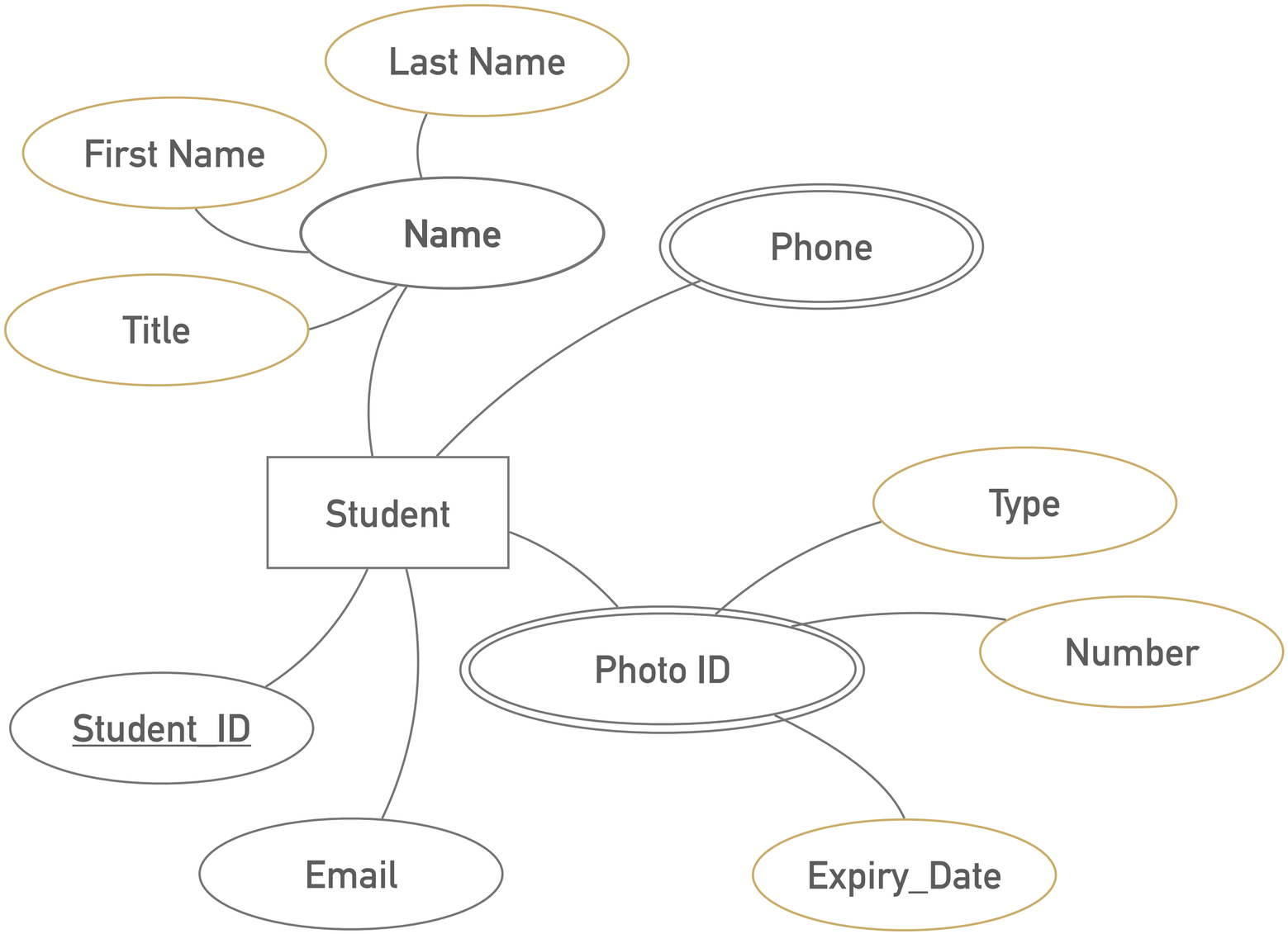
Relational Schema



ERD to DB Schema - Entity

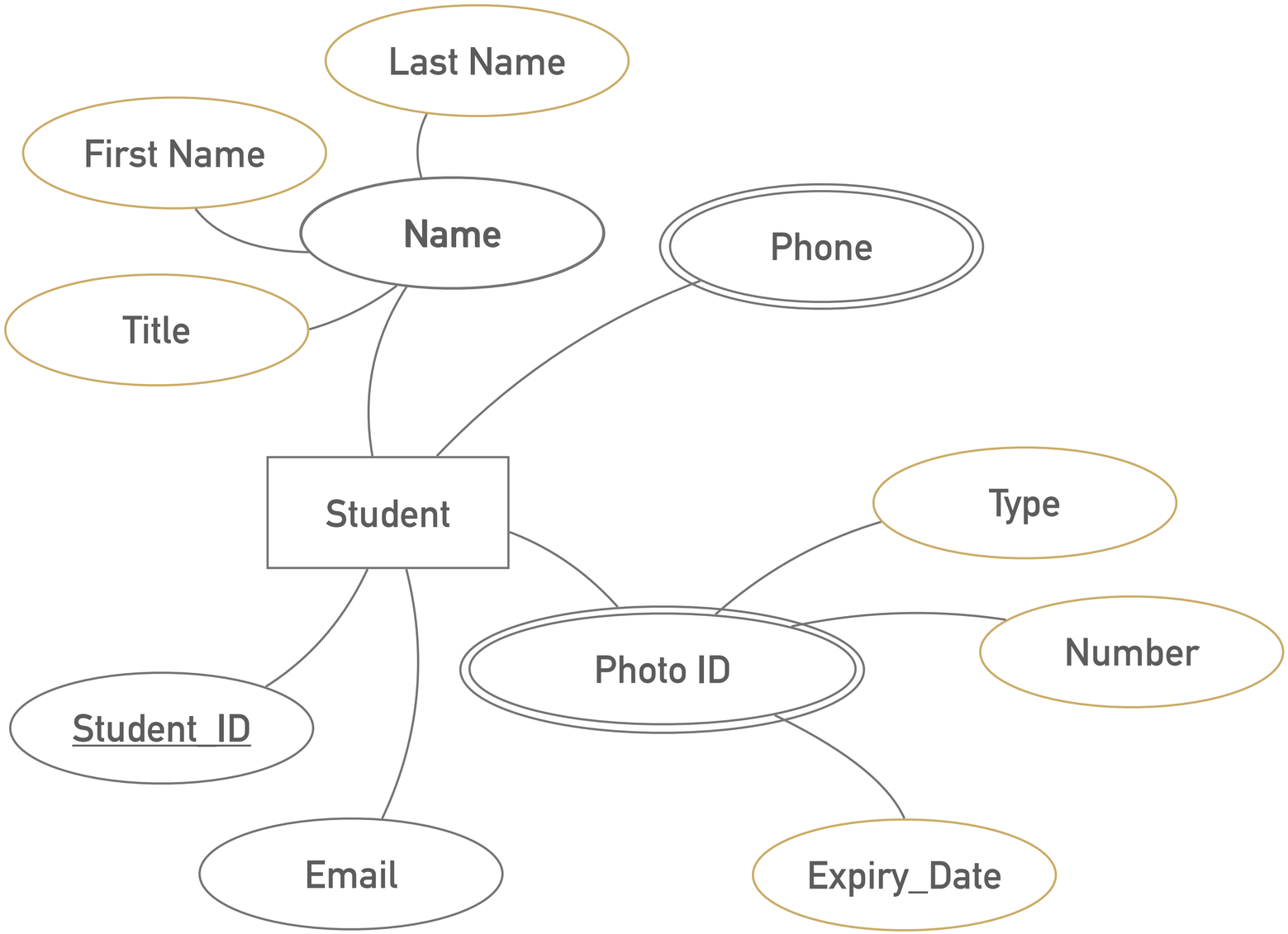


ERD to DB Schema - Entity



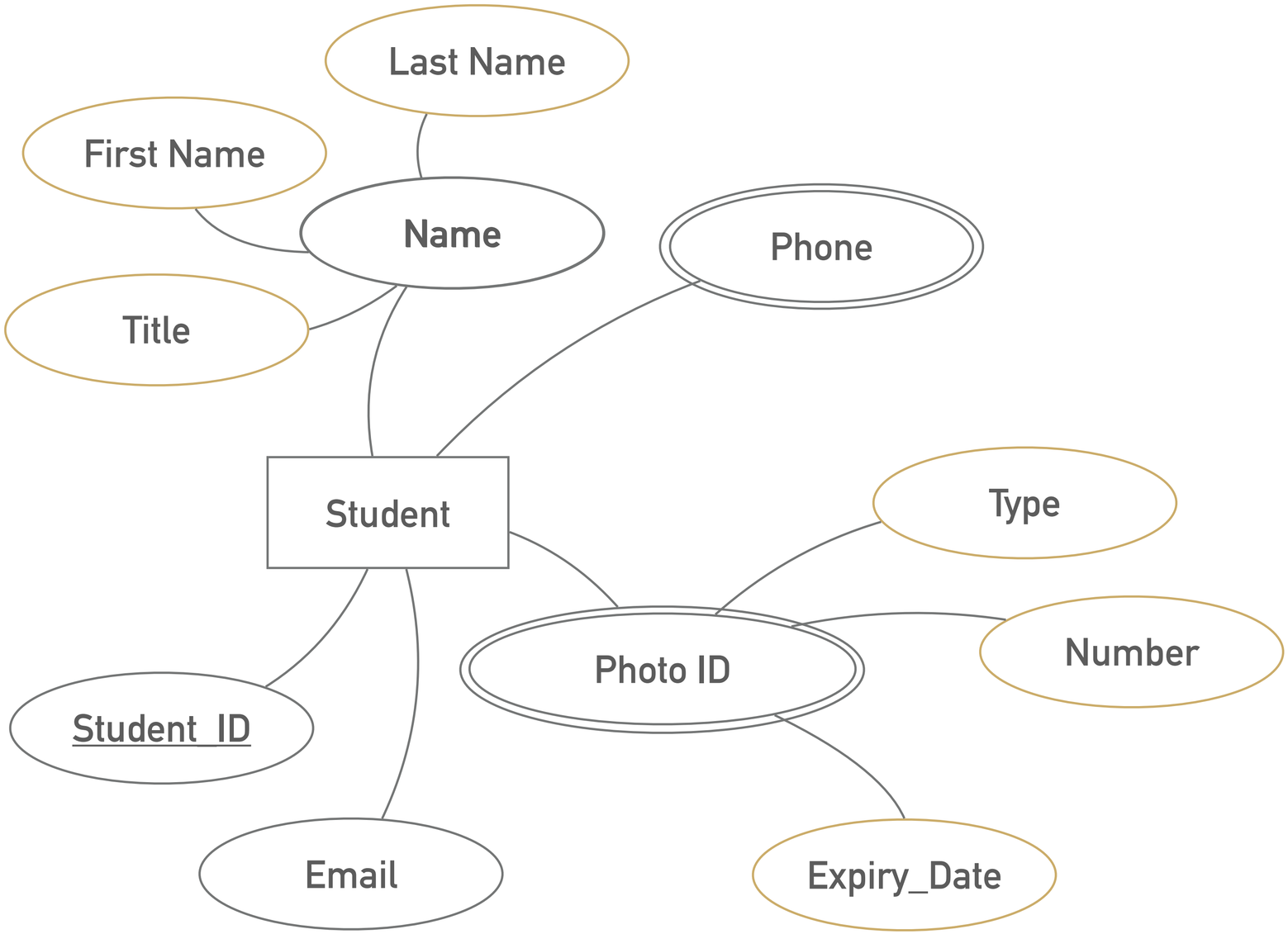
Student

ERD to DB Schema - Attributes



Student
student_id
email

ERD to DB Schema - Attributes



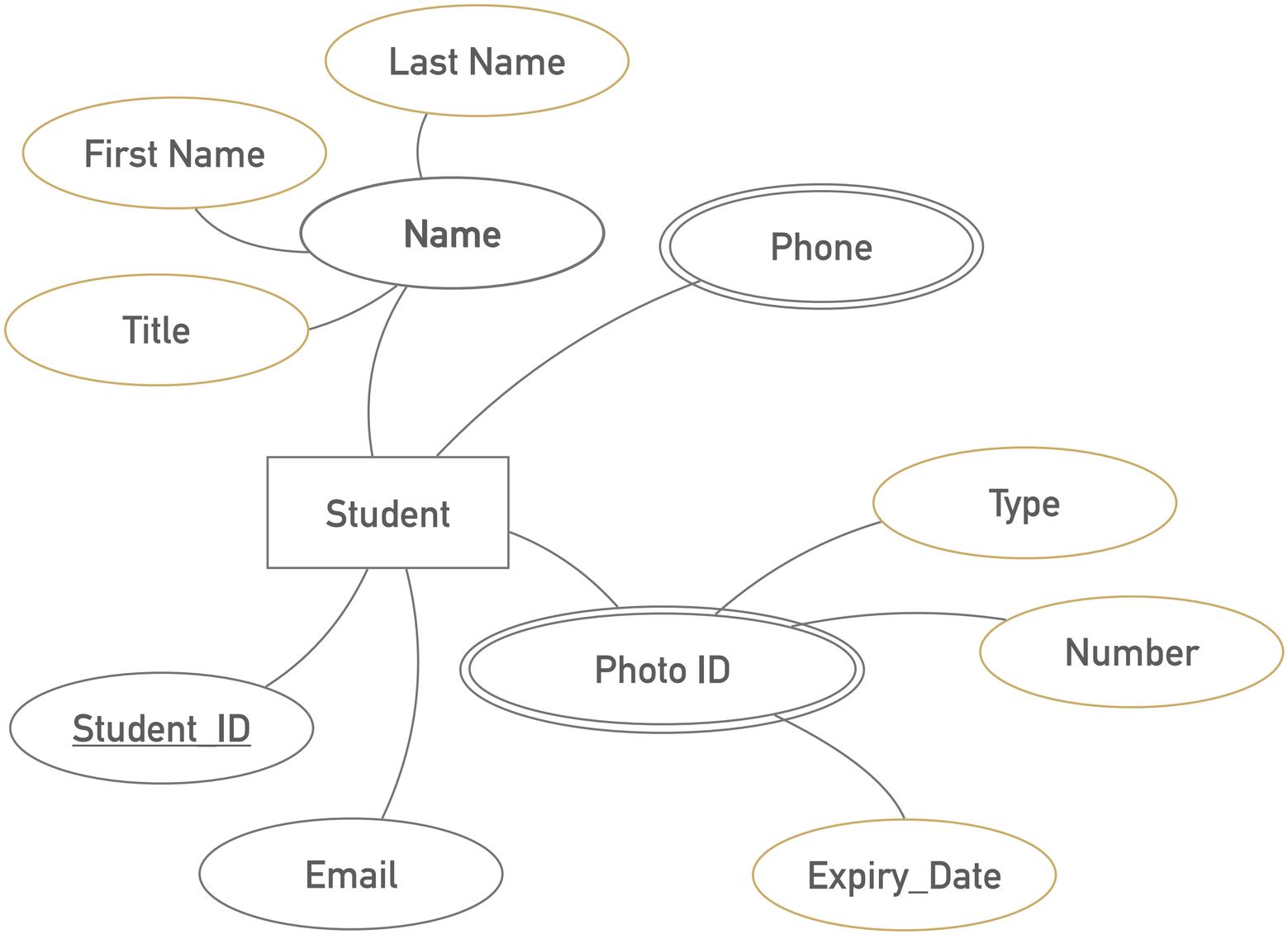
students
student_id
email
first_name
last_name
title

ERD to DB Schema - Attributes

students
student_id
email
first_name
last_name
title

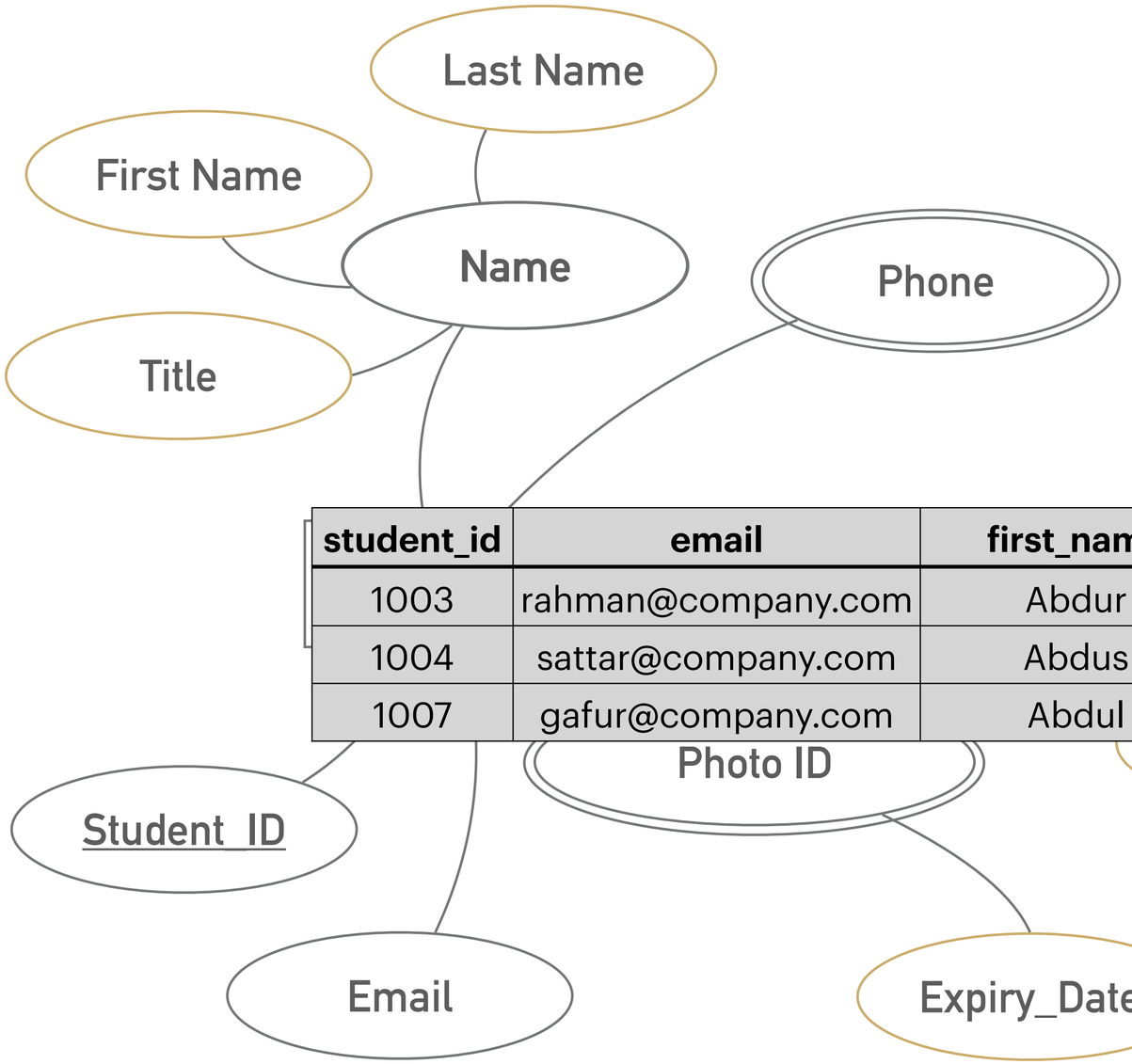
student_id	email	first_name	last_name	title	
1003	rahman@company.com	Abdur	Rahman	Mr.	
1004	sattar@company.com	Abdus	Sattar	Mr.	
1007	gafur@company.com	Abdul	Gafur	Mr.	

ERD to DB Schema - Attributes



students
student_id
email
first_name
last_name
title
phone_number

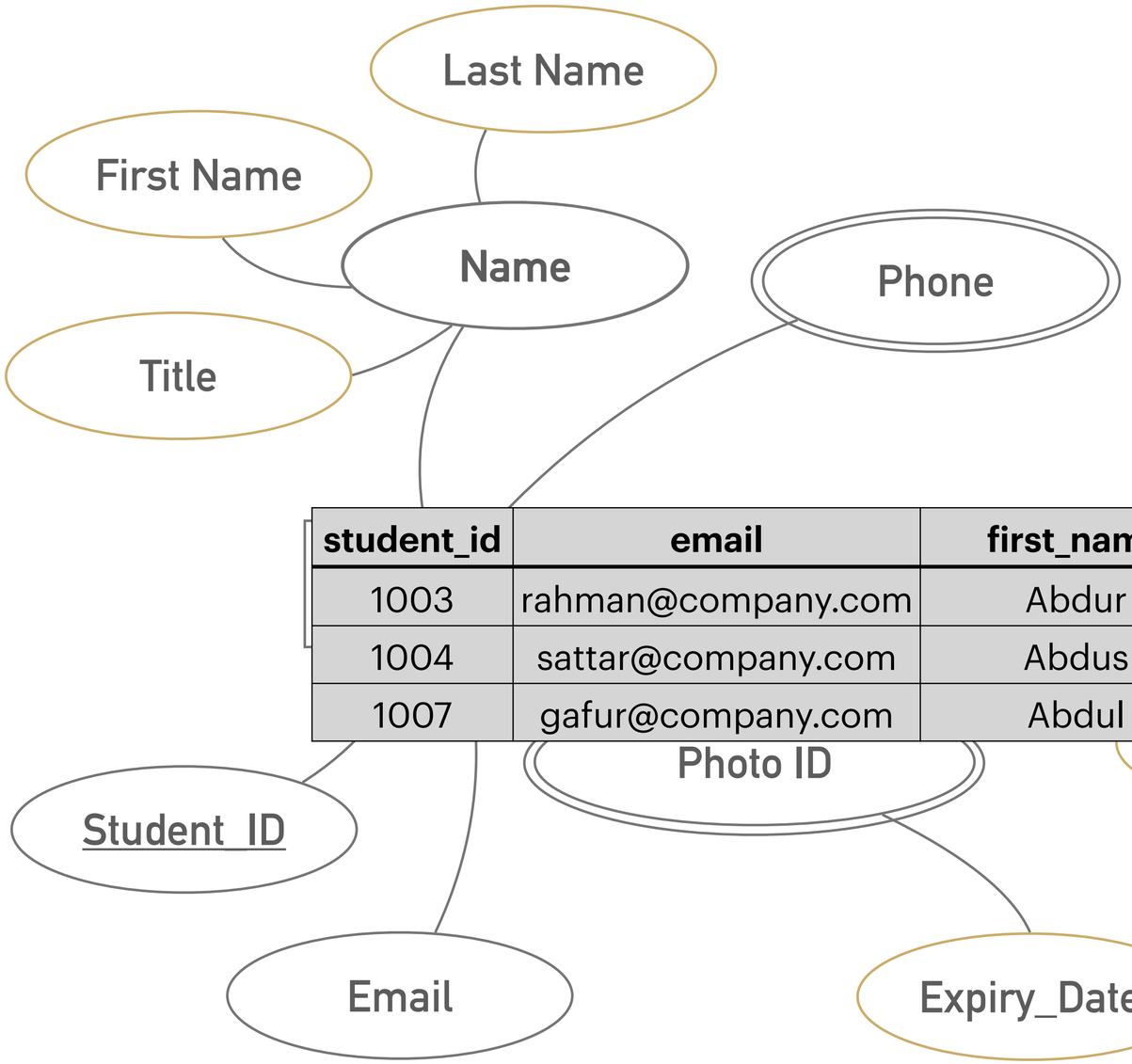
ERD to DB Schema - Attributes



students
student_id
email
first_name
last_name
title
phone_number

student_id	email	first_name	last_name	title	phone_number
1003	rahman@company.com	Abdur	Rahman	Mr.	017...
1004	sattar@company.com	Abdus	Sattar	Mr.	018...
1007	gafur@company.com	Abdul	Gafur	Mr.	+819, 017

ERD to DB Schema - Attributes

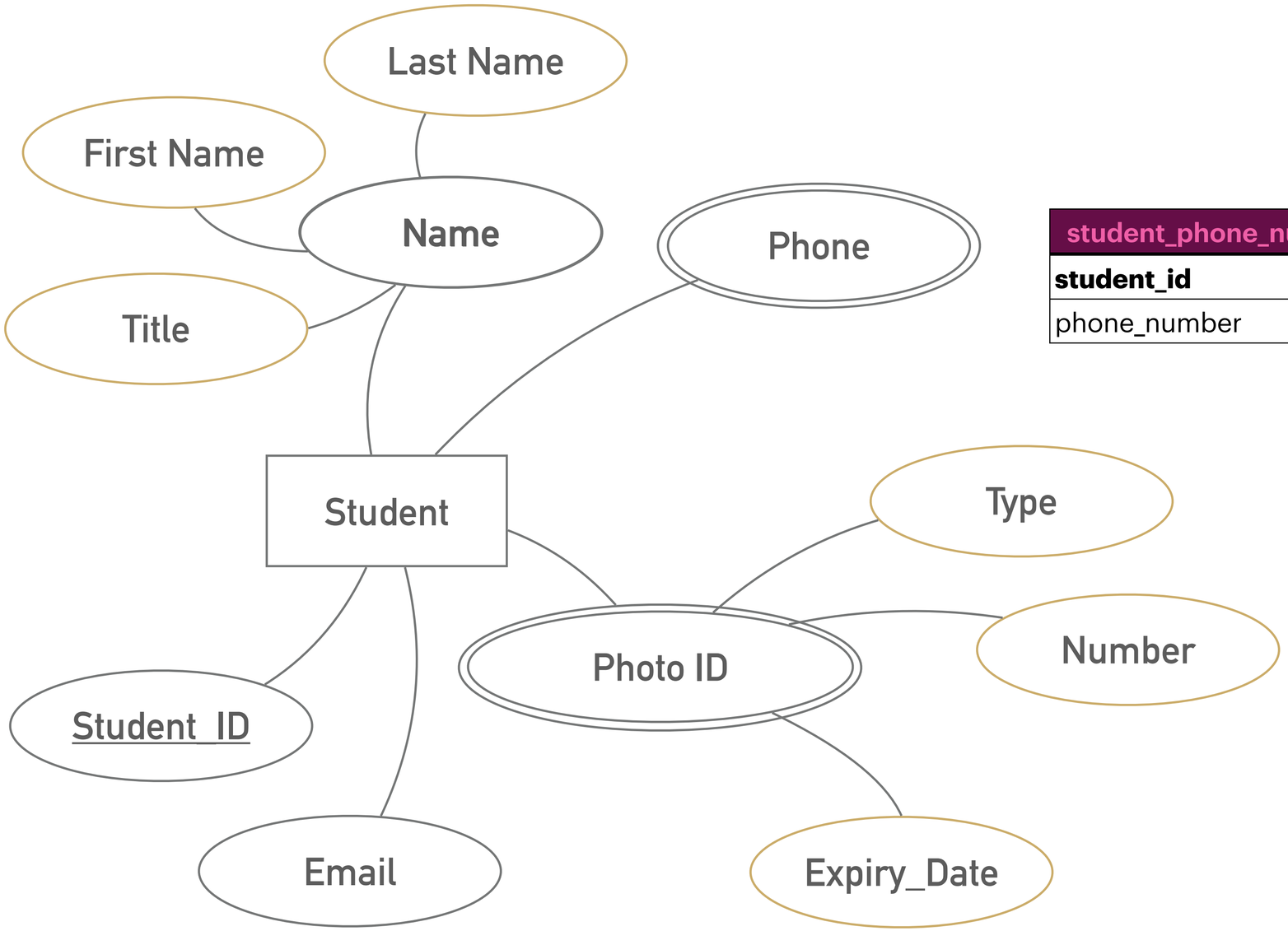


students
student_id
email
first_name
last_name
title
phone_number

student_id	email	first_name	last_name	title	phone_number
1003	rahman@company.com	Abdur	Rahman	Mr.	017...
1004	sattar@company.com	Abdus	Sattar	Mr.	018...
1007	gafur@company.com	Abdul	Gafur	Mr.	+819, 017

Violation of 1NF

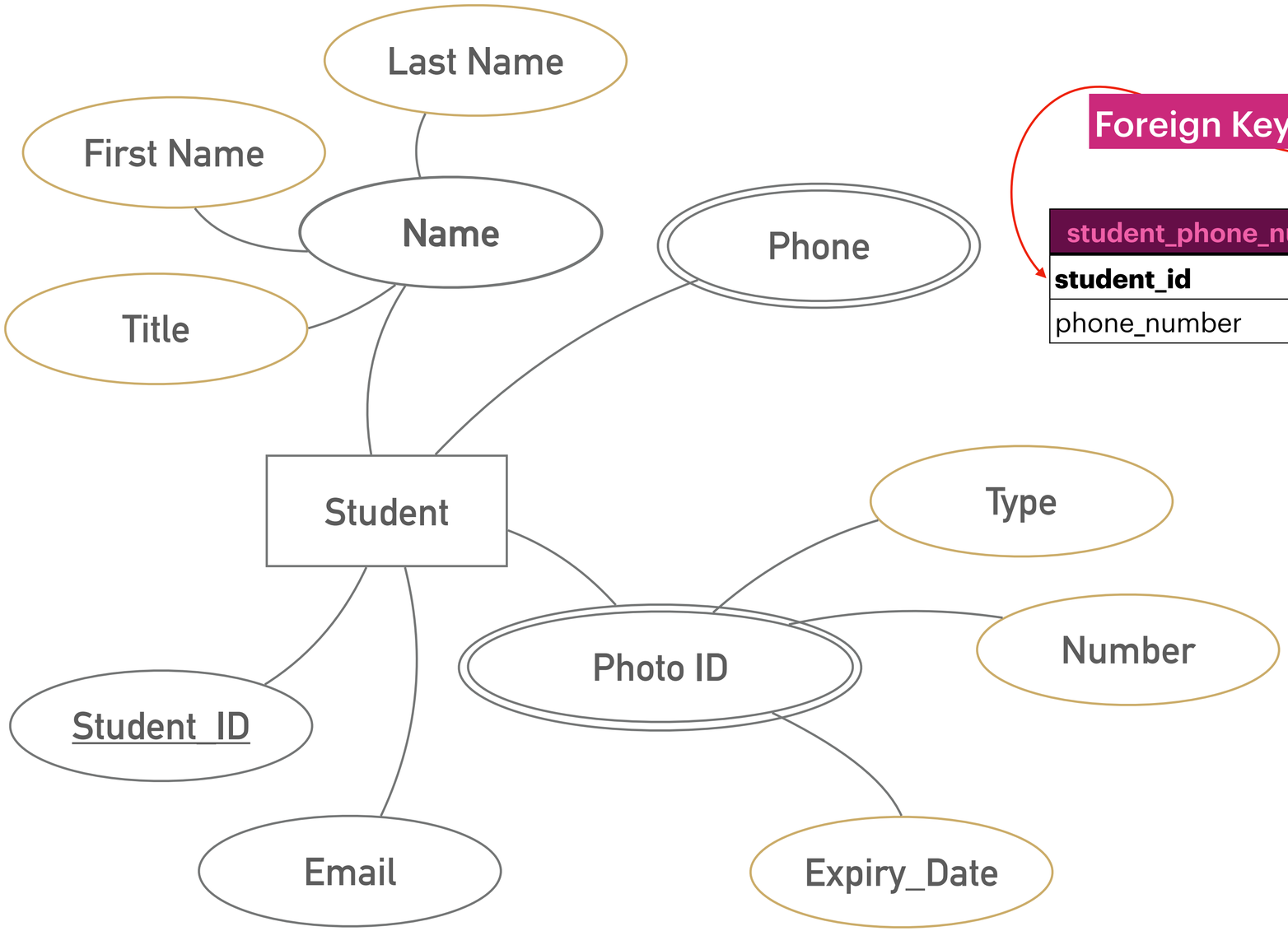
ERD to DB Schema - Attributes



student_phone_numbers
student_id
phone_number

students
student_id
email
first_name
last_name
title

ERD to DB Schema - Attributes

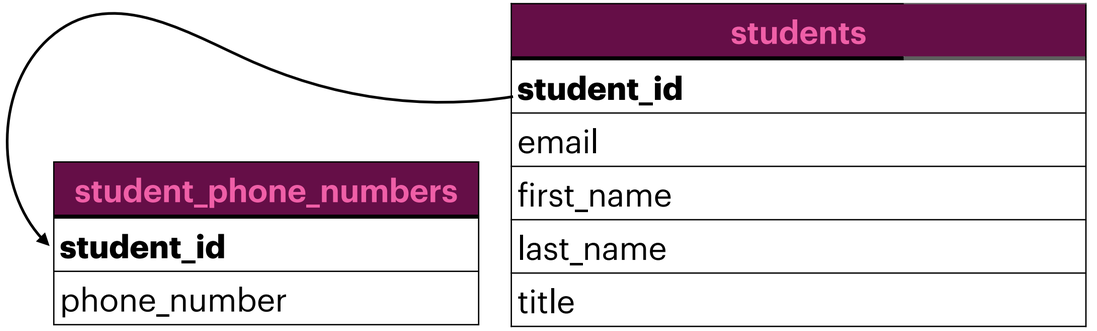


Foreign Key

students
student_id
email
first_name
last_name
title

student_phone_numbers
student_id
phone_number

ERD to DB Schema - Attributes



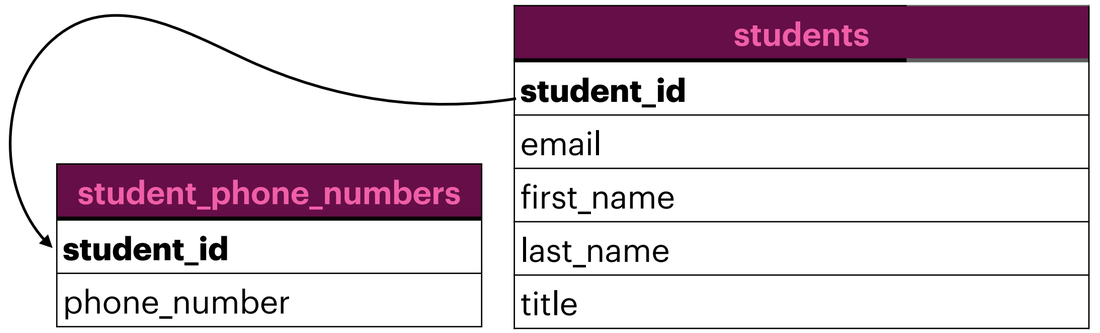
student_id	email	first_name	last_name	title
1003	rahman@company.com	Abdur	Rahman	Mr.
1006	sattar@company.com	Abdus	Sattar	Mr.
1007	gafur@company.com	Abdul	Gafur	Mr.

students

student_id	phone_number
1006	88017000333
1003	88018000444
1007	88017000555
1007	88017000666

student_phone_numbers

ERD to DB Schema - Attributes



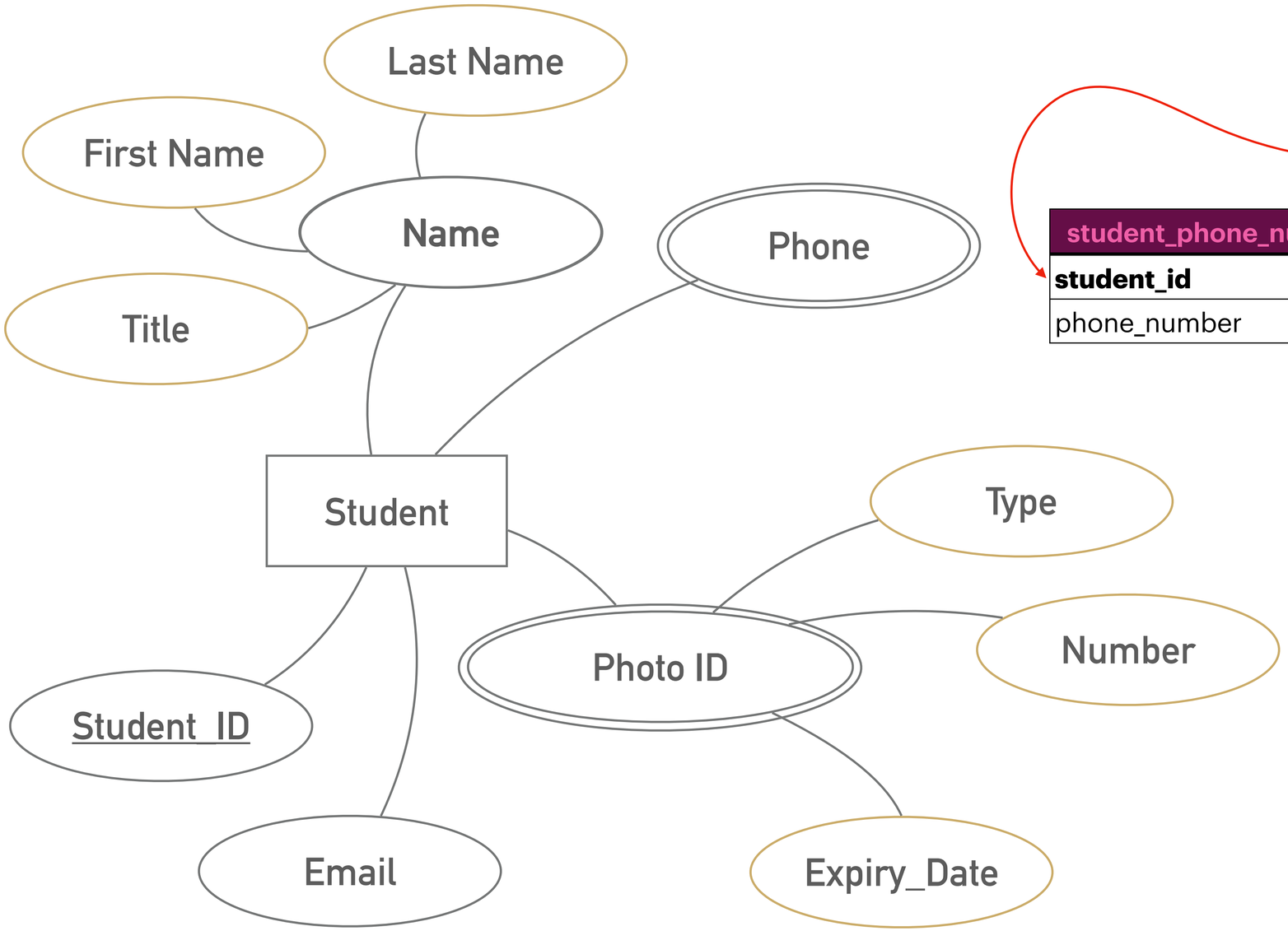
student_id	email	first_name	last_name	title
1003	rahman@company.com	Abdur	Rahman	Mr.
1006	sattar@company.com	Abdus	Sattar	Mr.
1007	gafur@company.com	Abdul	Gafur	Mr.

students

student_id	phone_number
1006	88017000333
1003	88018000444
1007	88017000555
1007	88017000666

student_phone_numbers

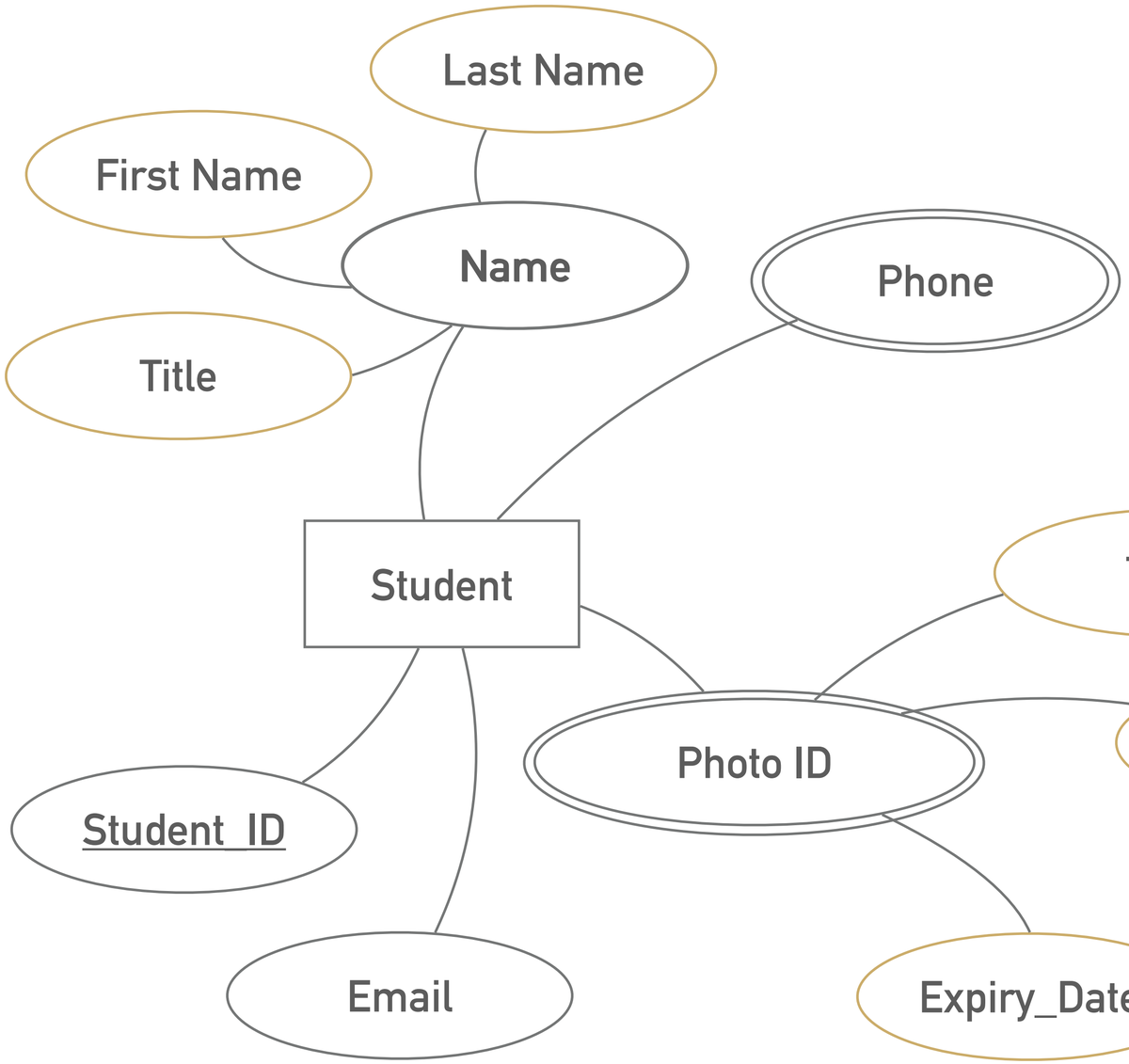
ERD to DB Schema - Attributes



students
student_id
email
first_name
last_name
title

student_phone_numbers
student_id
phone_number

ERD to DB Schema - Attributes

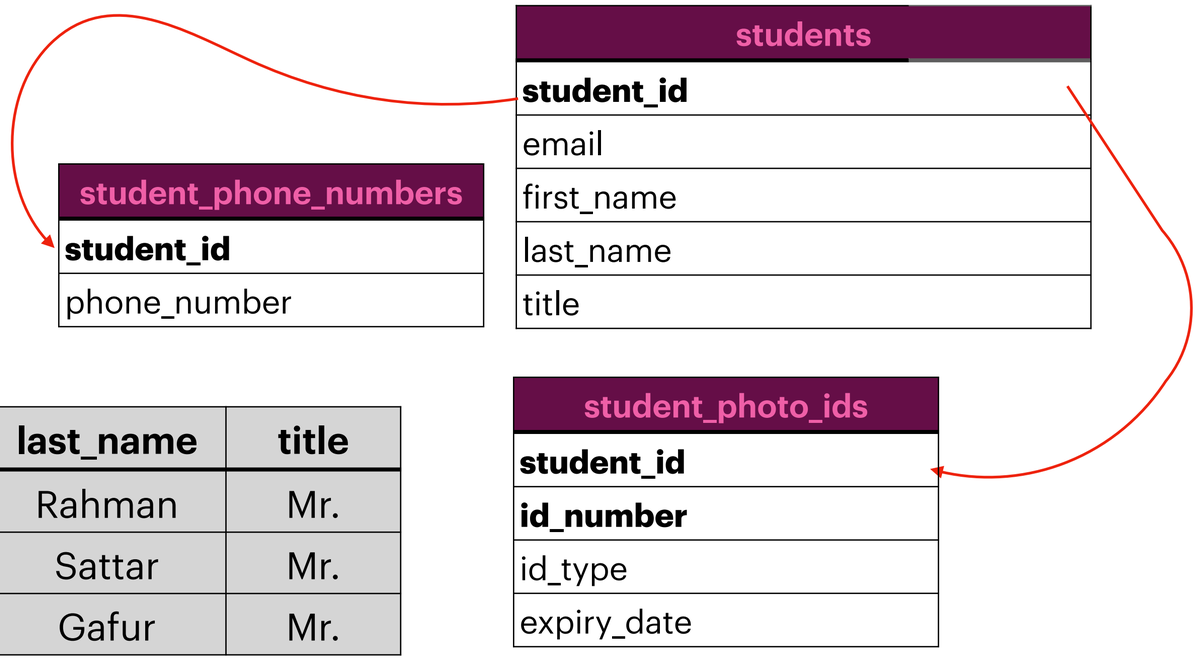


students
student_id
email
first_name
last_name
title

student_phone_numbers
student_id
phone_number

student_photo_ids
student_id
id_number
id_type
expiry_date

ERD to DB Schema - Attributes



student_id	email	first_name	last_name	title
1003	rahman@company.com	Abdur	Rahman	Mr.
1006	sattar@company.com	Abdus	Sattar	Mr.
1007	gafur@company.com	Abdul	Gafur	Mr.

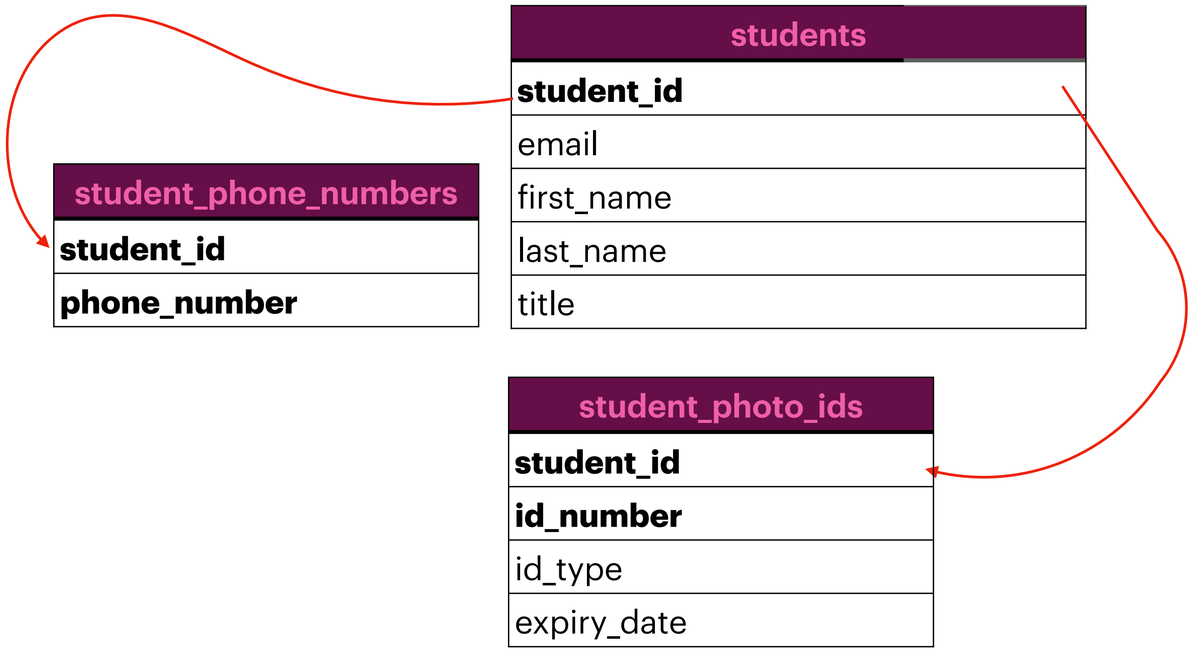
students

student_id	id_type	id_number	expiry_date
1006	NID	151617181888	
1006	PASSPORT	AXB084333	04-12-2024
1007	PASSPORT	AXB084444	04-03-2025

student_photo_ids

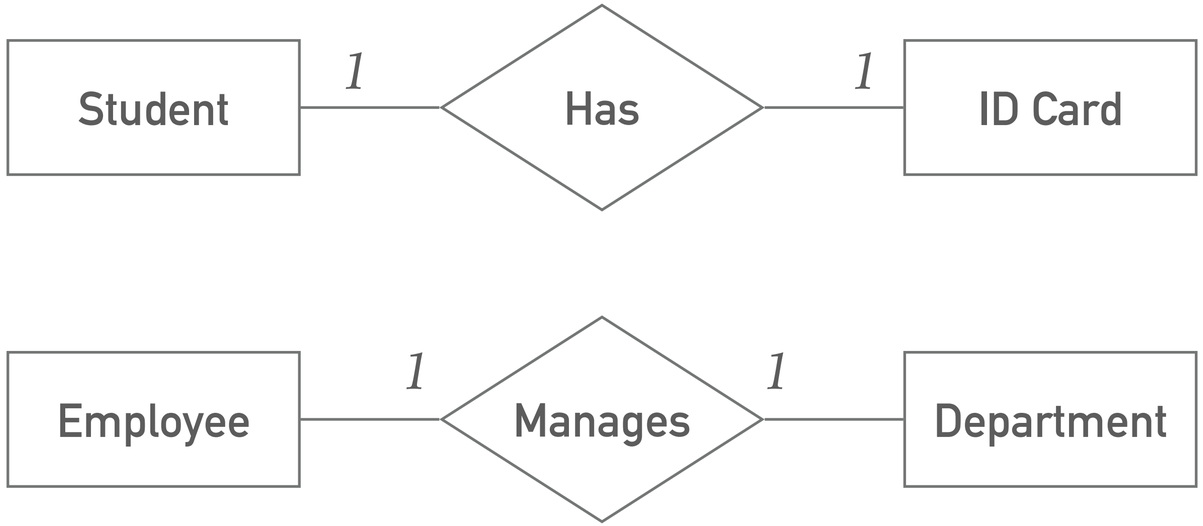
ERD to DB Schema - Recap

In ER Diagram	In Schema Diagram
Entity	Table
Attribute	Field
Multivalued Attribute	Table with foreign key
Composite Attribute	Field for Components
Complex Attribute	Table with foreign key



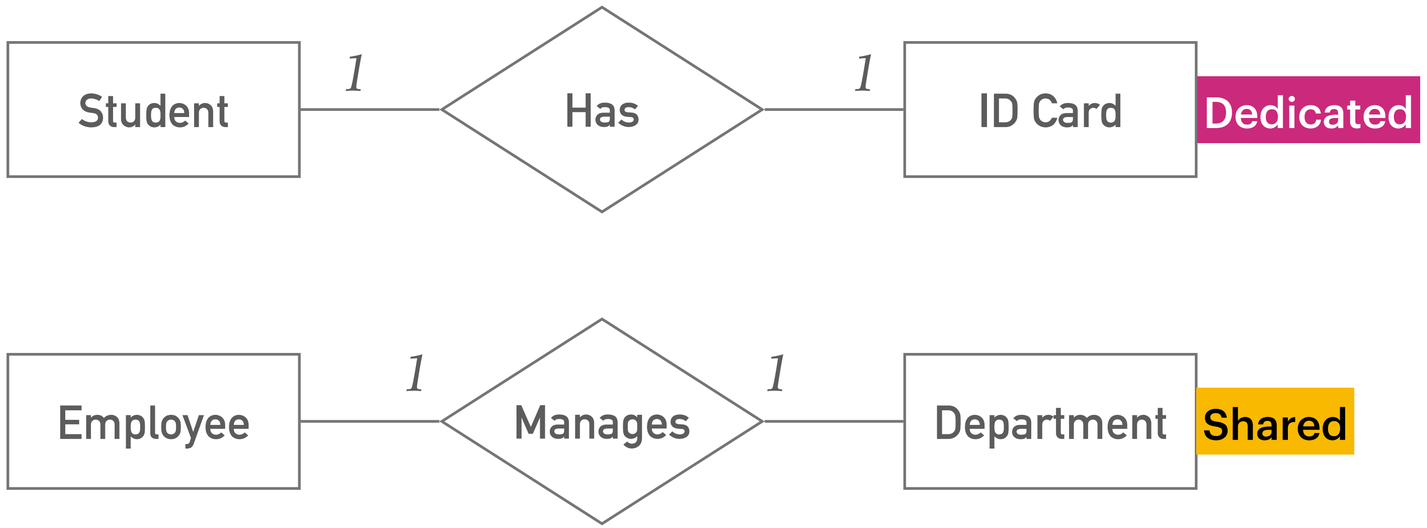
ERD to DB Schema - Relations

One to One



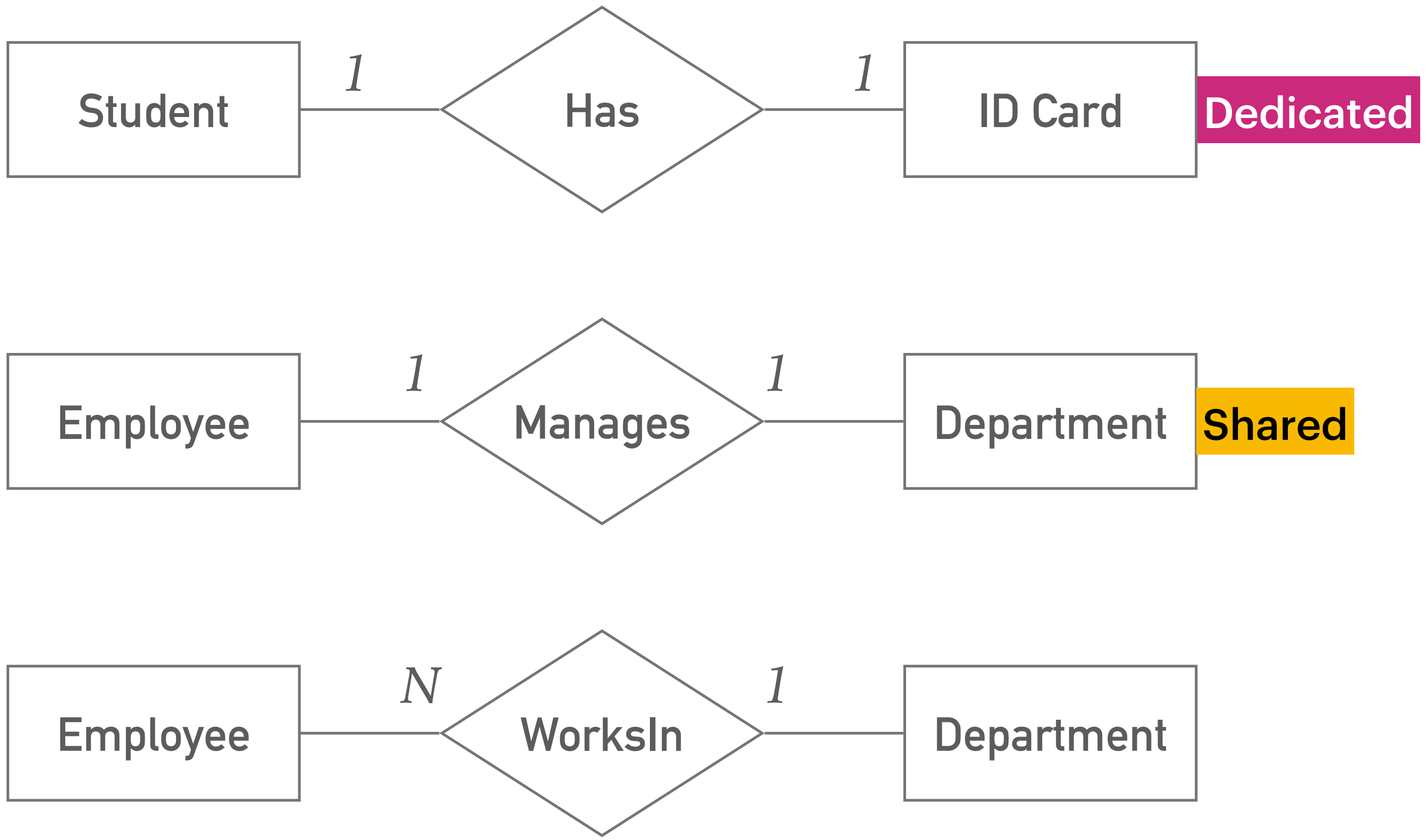
ERD to DB Schema - Relations

One to One



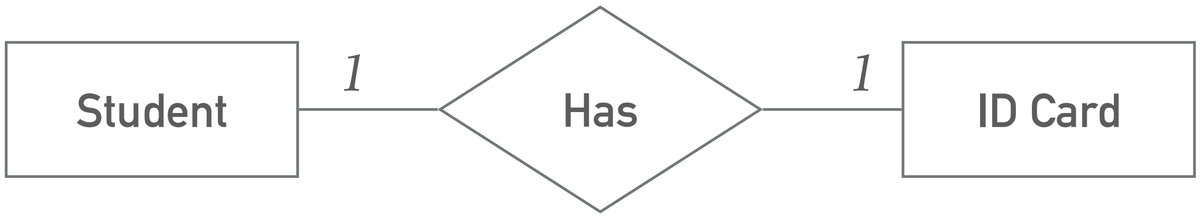
ERD to DB Schema - Relations

One to One



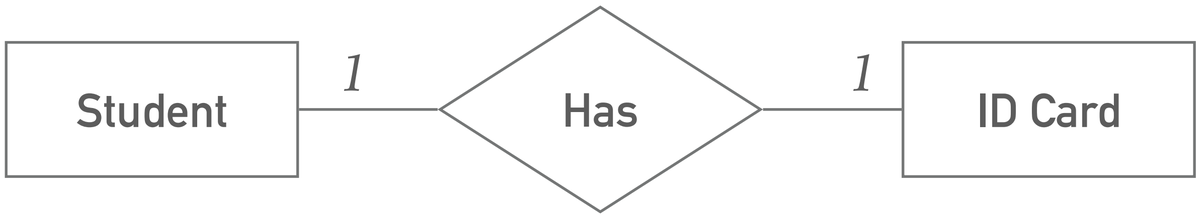
ERD to DB Schema - Relations

One to One



ERD to DB Schema - Relations

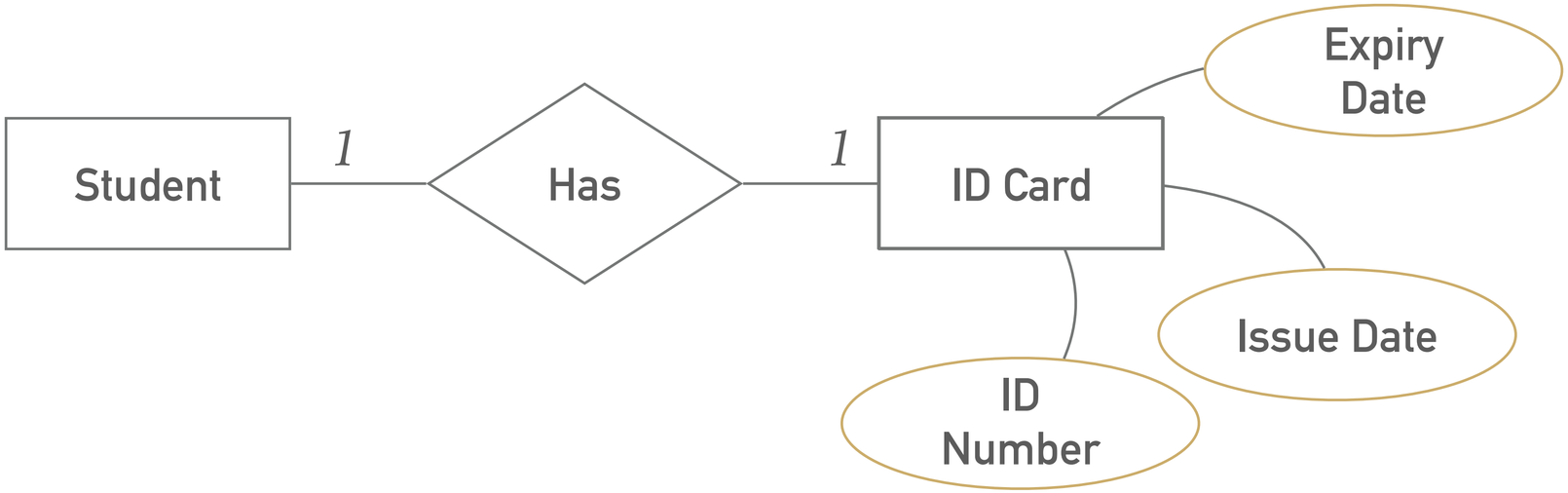
One to One



students
student_id
email
first_name
last_name
title

ERD to DB Schema - Relations

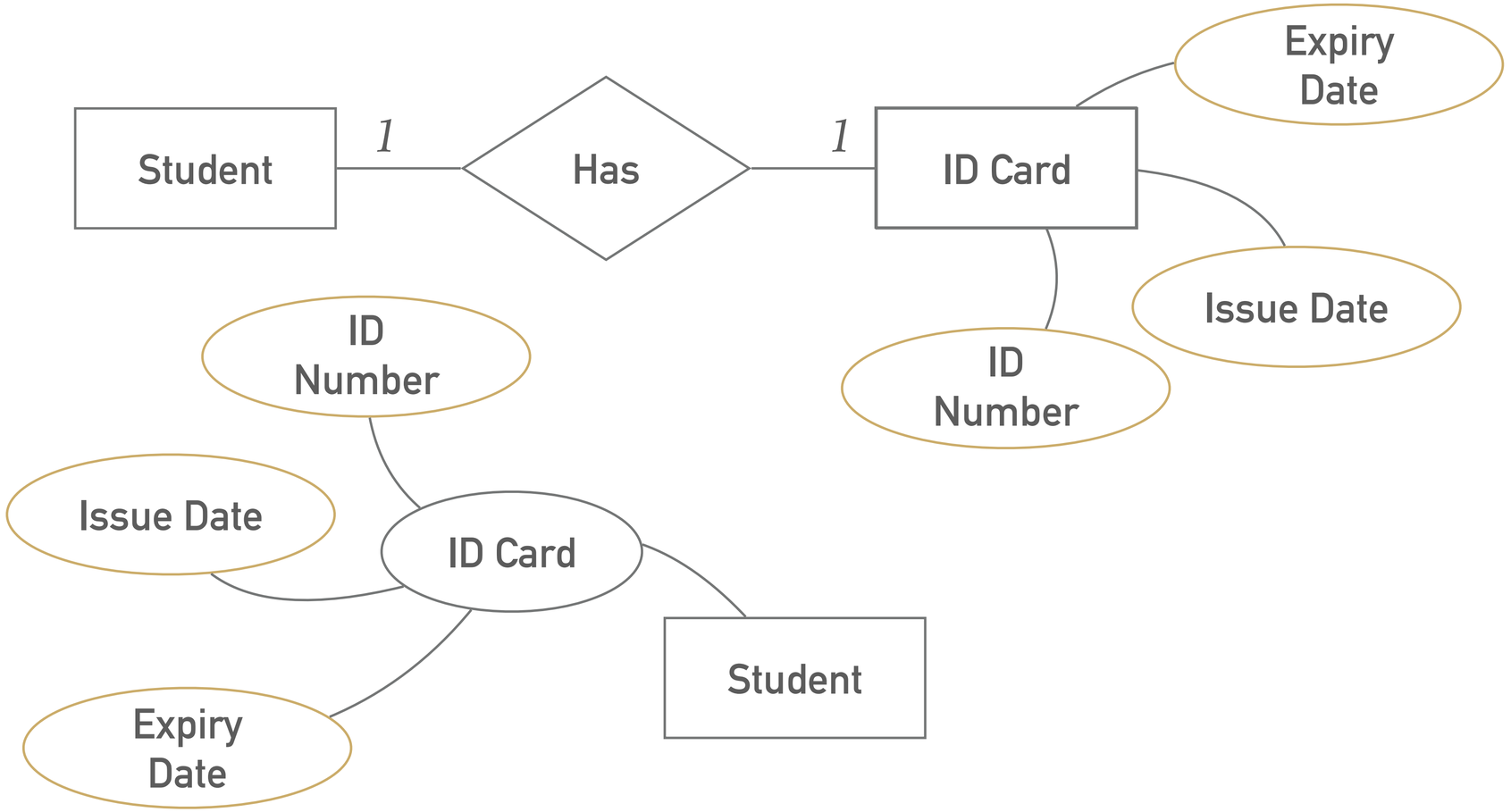
One to One



students
student_id
email
first_name
last_name
title

ERD to DB Schema - Relations

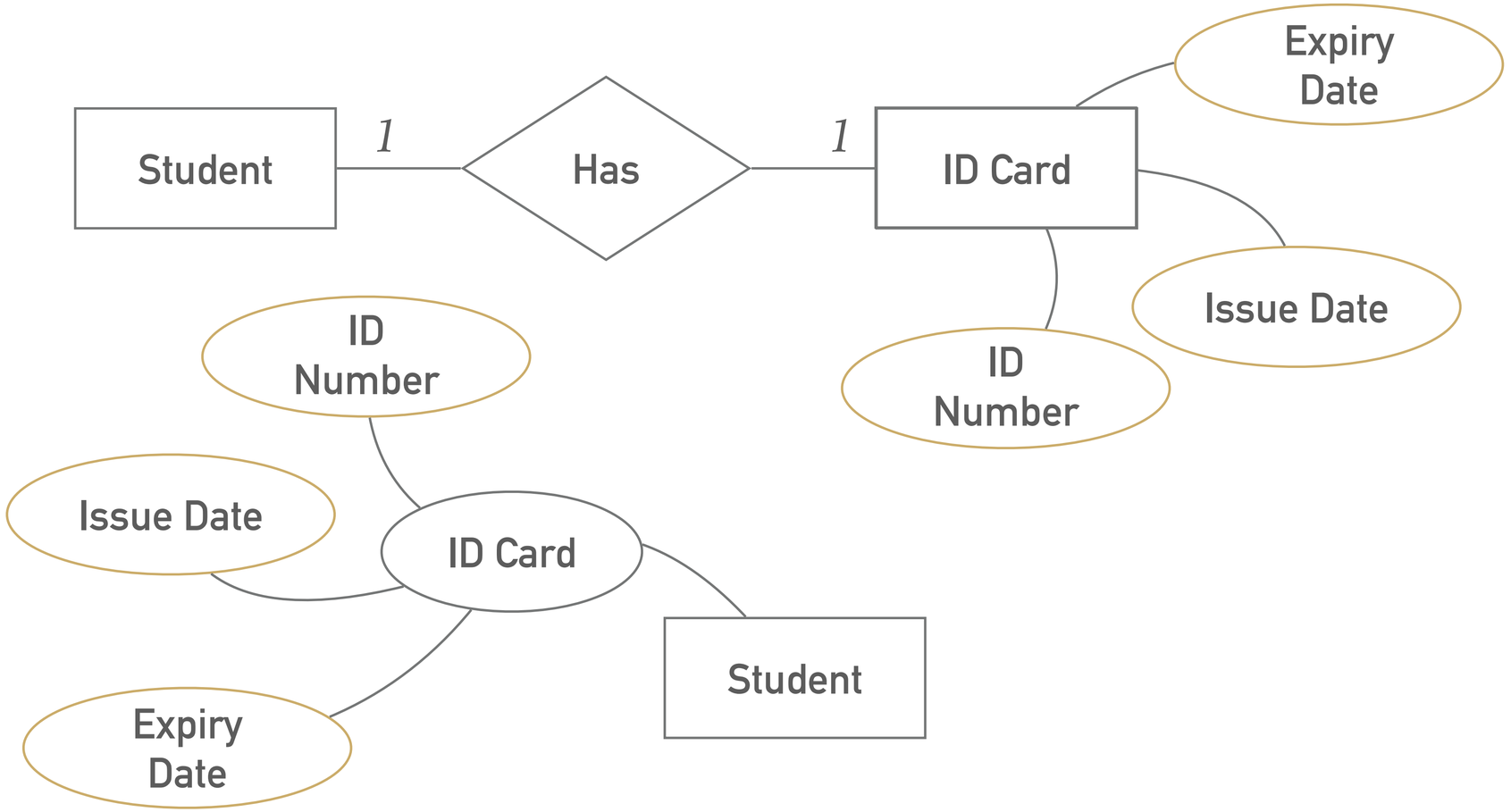
One to One



students
student_id
email
first_name
last_name
title

ERD to DB Schema - Relations

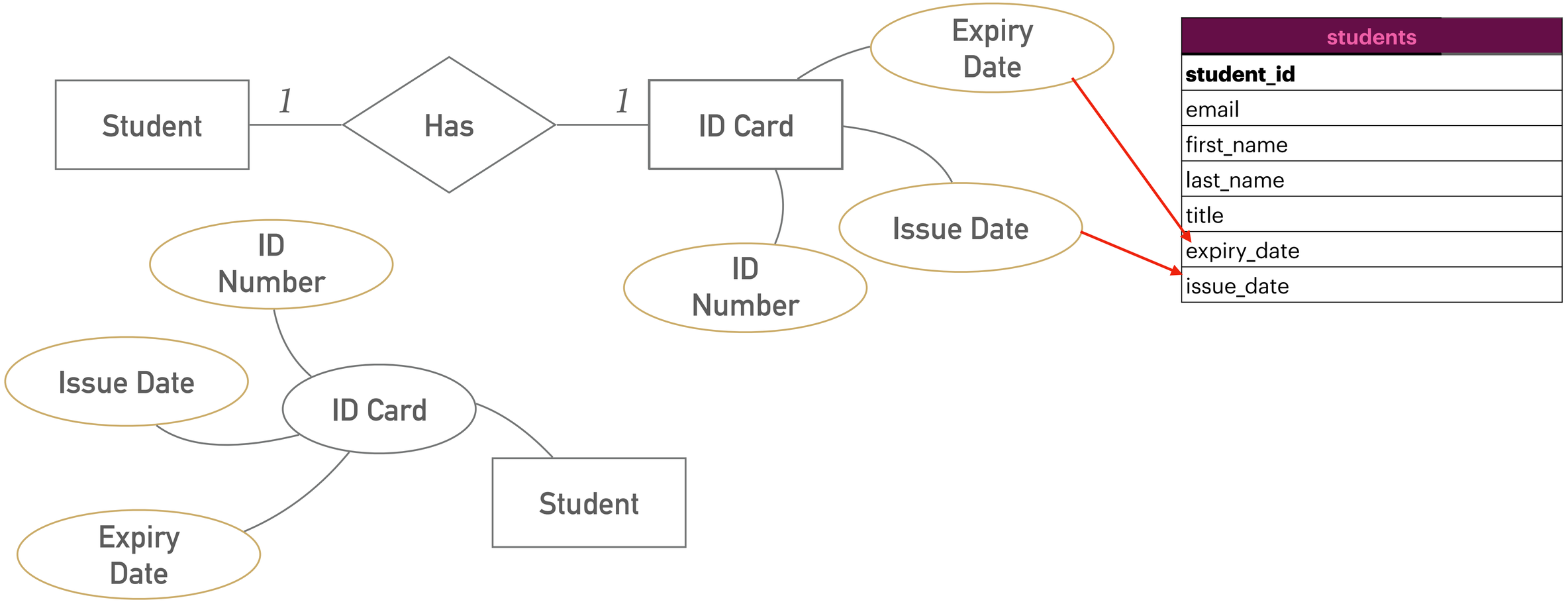
One to One



students
student_id
email
first_name
last_name
title
expiry_date
issue_date

ERD to DB Schema - Relations

One to One



students
student_id
email
first_name
last_name
title
expiry_date
issue_date

ERD to DB Schema - Relations

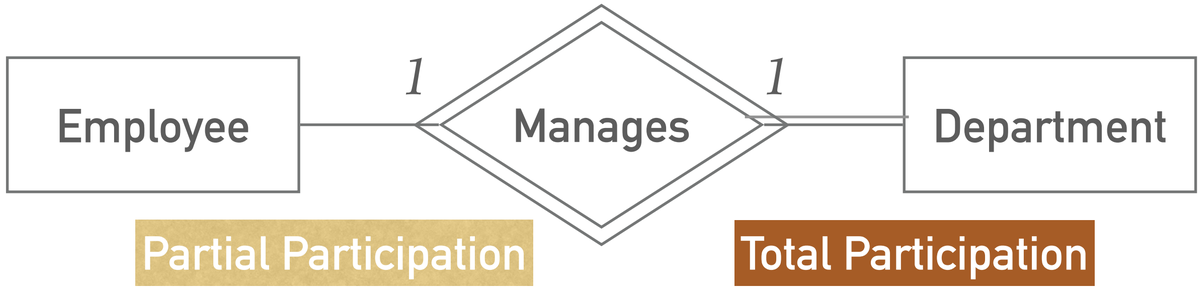
One to One

employees
employee_id
email
name
phone

departments
department_id
name

ERD to DB Schema - Relations

One to One



employees
employee_id
email
name
phone

departments
department_id
name

ERD to DB Schema - Relations

One to One

employees
employee_id
email
name
phone

departments
department_id
name
managed_by

ERD to DB Schema - Relations

One to Many

employees
employee_id
email
name
phone

departments
department_id
name
managed_by

ERD to DB Schema - Relations

One to Many

employees
employee_id
email
name
phone
department_id

departments
department_id
name
managed_by

ERD to DB Schema - Relations

One to Many

id	name	email	phone	department_id
1003	Abdur Rahman	rahman@company.com	88017...	101
1006	Abdus Sattar	sattar@company.com	88016...	101
1007	Abdul Gafur	gafur@company.com	88019...	104

employees

id	name
101	HR
102	Accounts
103	Marketing
104	Audit

departments

ERD to DB Schema - Relations

One to Many

id	name	email	phone	department_id
1003	Abdur Rahman	rahman@company.com	88017...	101
1006	Abdus Sattar	sattar@company.com	88016...	101
1007	Abdul Gafur	gafur@company.com	88019...	104

employees

id	name
101	HR
102	Accounts
103	Marketing
104	Audit

departments

ERD to DB Schema - Relations

One to Many

id	name	email	phone
1003	Abdur Rahman	rahman@company.com	88017...
1006	Abdus Sattar	sattar@company.com	88016...
1007	Abdul Gafur	gafur@company.com	88019...

employees

id	name	user_id
101	HR	1003, 1006
102	Accounts	
103	Marketing	
104	Audit	1007

departments

What if we try the other way around? 🤔

ERD to DB Schema - Relations

One to Many

id	name	email	phone
1003	Abdur Rahman	rahman@company.com	88017...
1006	Abdus Sattar	sattar@company.com	88016...
1007	Abdul Gafur	gafur@company.com	88019...

employees

X

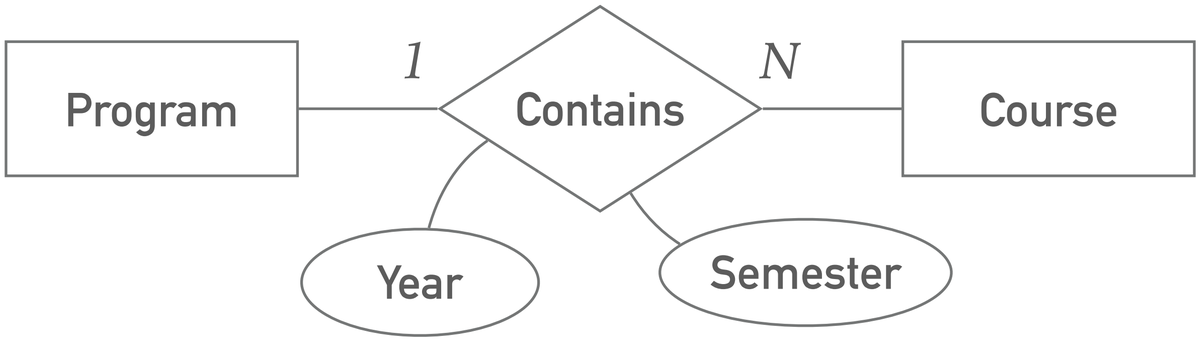
id	name	user_id
101	HR	1003, 1006
102	Accounts	
103	Marketing	
104	Audit	1007

departments

What if we try the other way around? 🤔

ERD to DB Schema - Relations

One to Many - with attribute

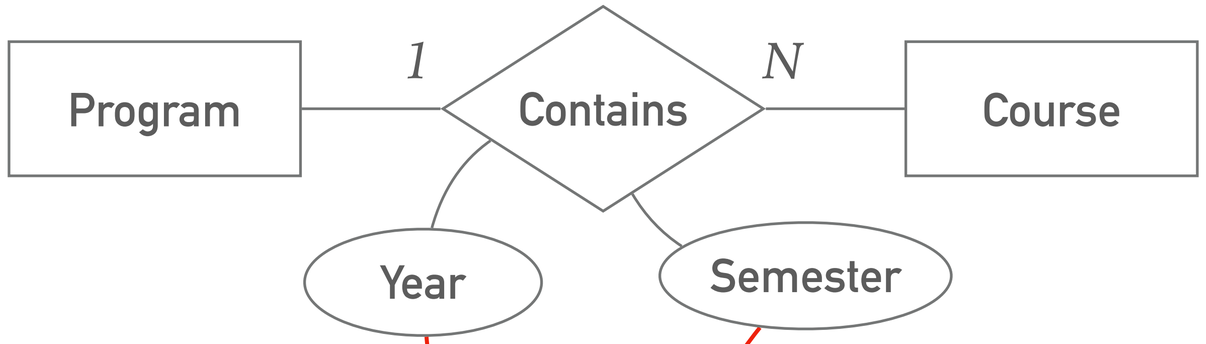


program
id
name
total_credit
program_head_id

course
id
name
credit_point

ERD to DB Schema - Relations

One to Many - with attribute



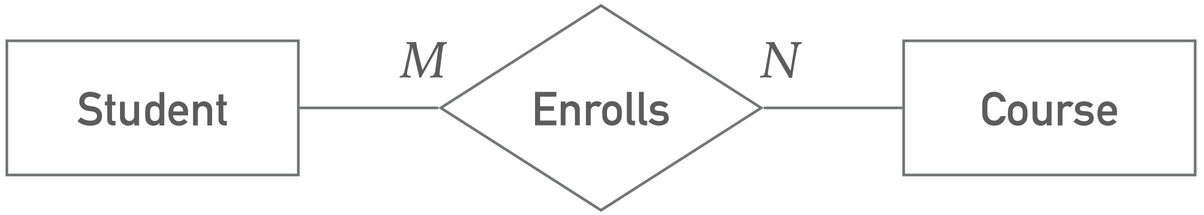
program
id
name
total_credit
program_head_id

course
id
program_id
name
credit_point
semister
year

One-To-Many: Relation attributes goes to the MANY side

ERD to DB Schema - Relations

Many to Many

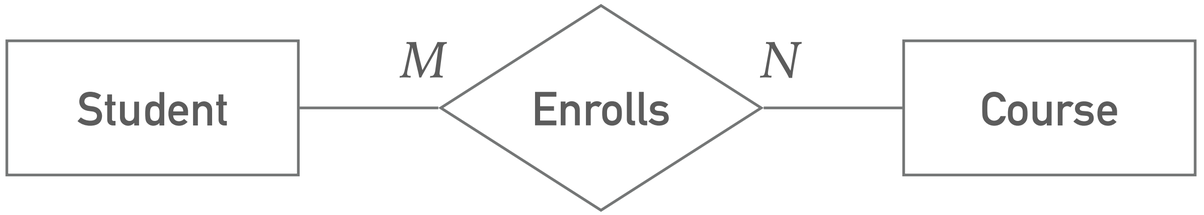


students
id
email
name
phone

courses
id
name
description

ERD to DB Schema - Relations

Many to Many



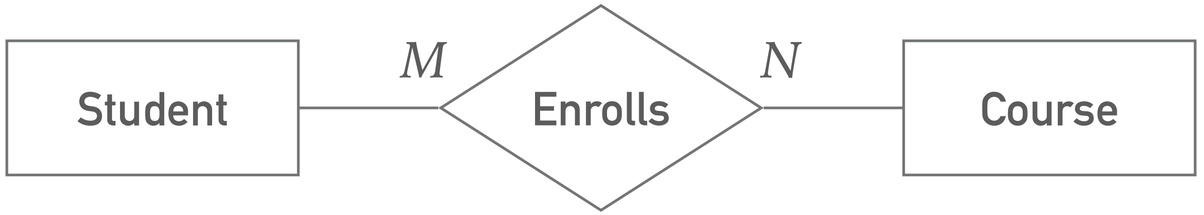
students
id
email
name
phone

enrollments
student_id
course_id

courses
id
name
description

ERD to DB Schema - Relations

Many to Many



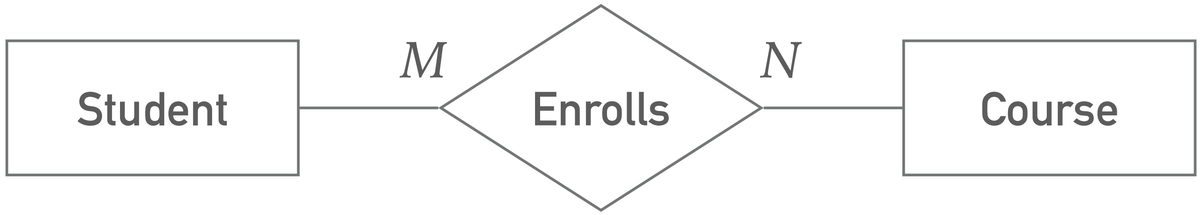
students
id
email
name
phone

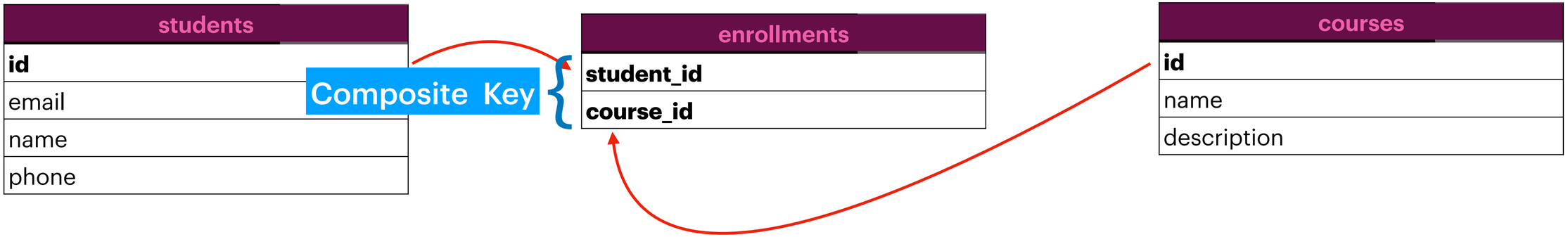
enrollments
student_id
course_id

courses
id
name
description

ERD to DB Schema - Relations

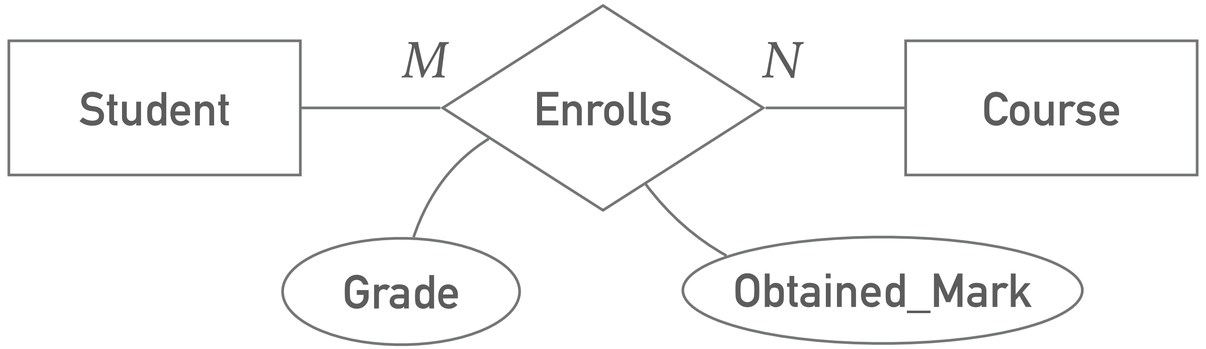
Many to Many





ERD to DB Schema - Relations

Many to Many - with Attribute



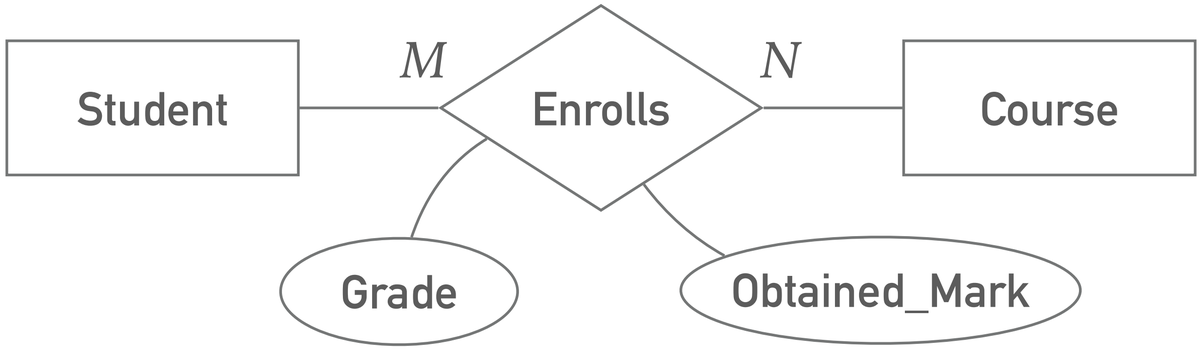
students
id
email
name
phone

enrollments
student_id
course_id

courses
id
name
description

ERD to DB Schema - Relations

Many to Many - with Attribute



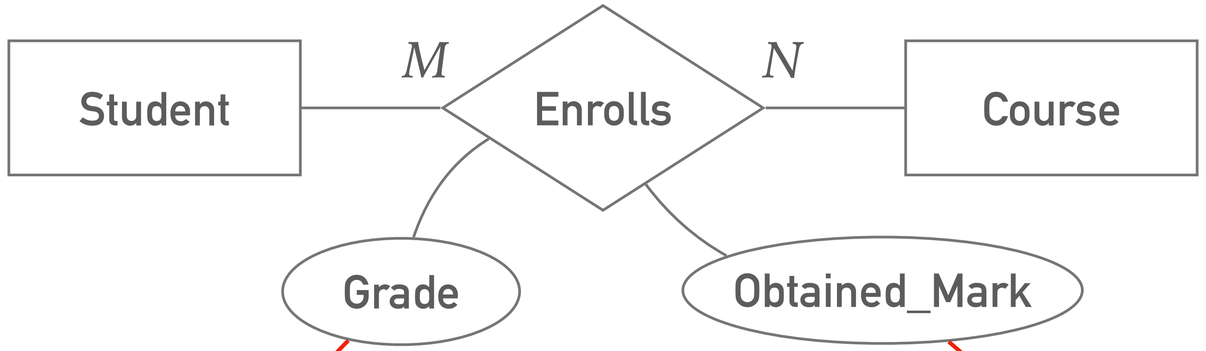
students
id
email
name
phone

enrollments
student_id
course_id
grage_point
mark_percentage

courses
id
name
description

ERD to DB Schema - Relations

Many to Many - with Attribute



students
id
email
name
phone

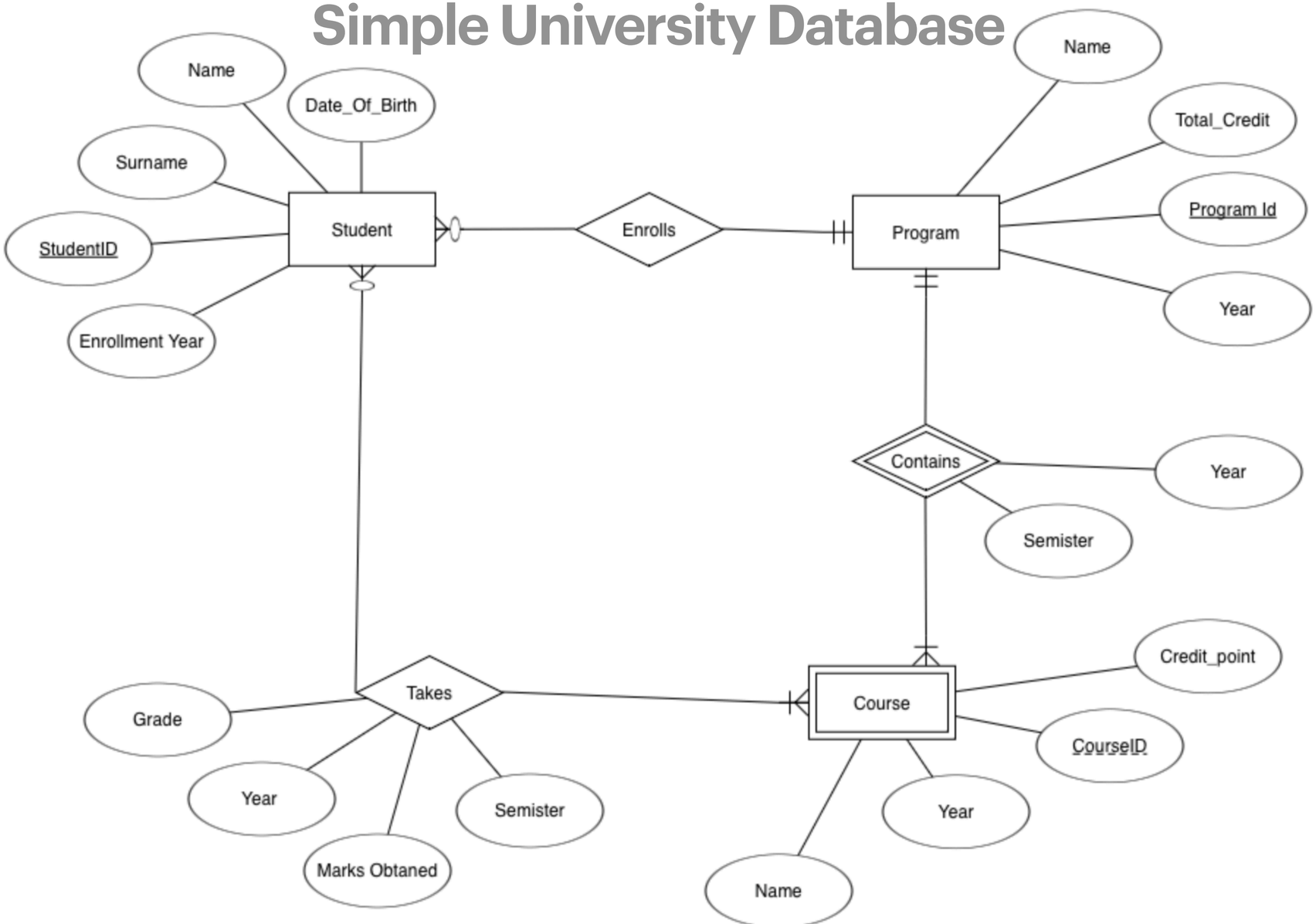
enrollments
student_id
course_id
grage_point
mark_percentage

courses
id
name
description

Many-To-Many: Relation attributes goes to the JOIN table

Practice Time

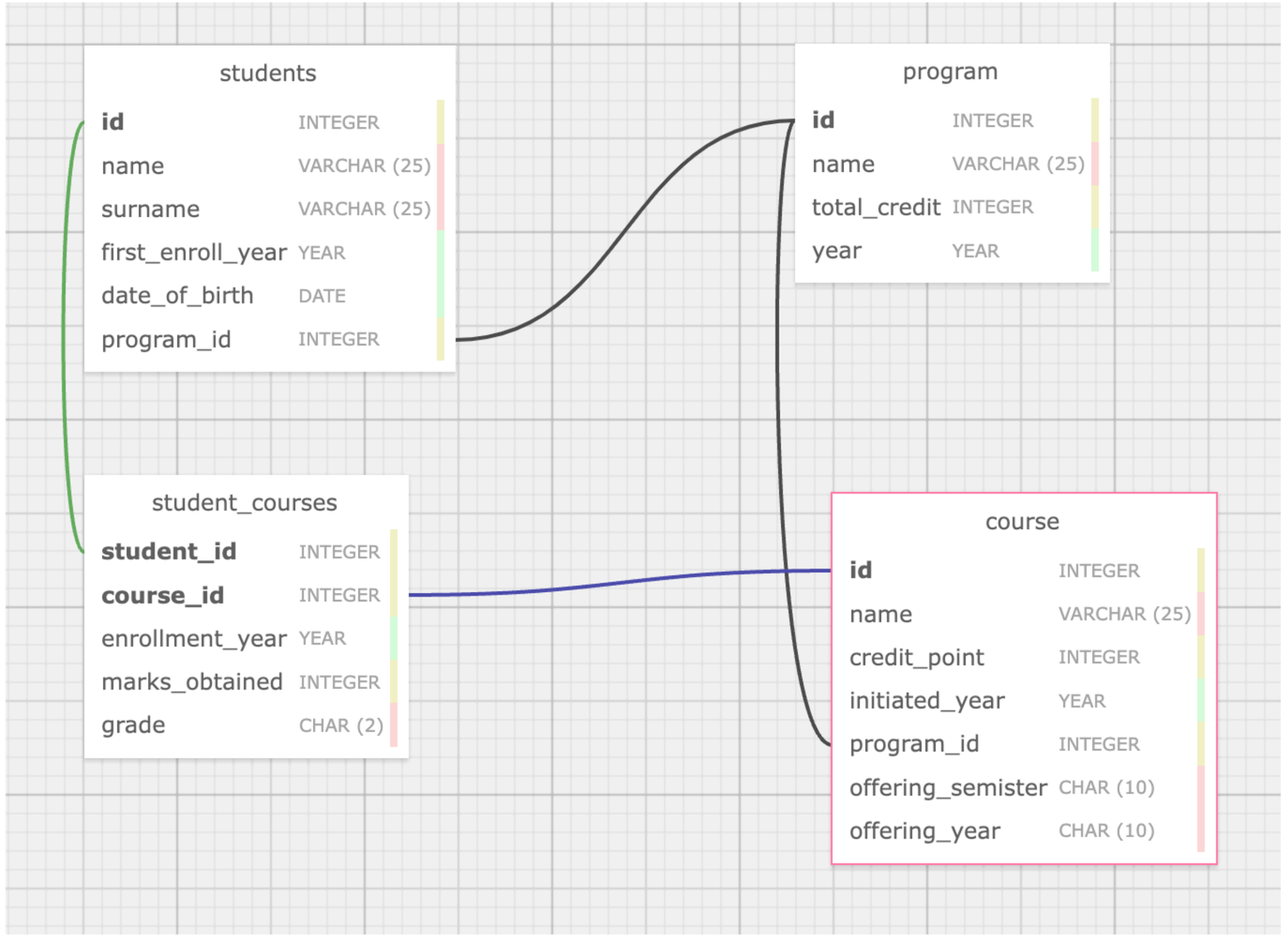
Simple University Database



Practice Time

Simple University Database

Here is the diagram we drew live in class:



https://github.com/ondras/wwwsqldesigner

https://sql.toad.cz

Questions?