

# Normalization exercises

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**Note:** For each of the following exercises complete the following tasks:

1. (Complete after lesson 1) Find what normal form each of the following tables satisfies. Motivate the answer according to the definition of normal forms seen in class.
2. (Complete after lesson 2) Apply the normalization algorithms seen in class to each table. Use intermediate refinements, i.e. if the table is in 1NF first normalize in 2NF and, if necessary, in BCNF.

**Exercise 1 - Lockers** The attribute `locker` is multivalued and `id` is unique within the multivalued attribute.

locker					
<u>teacher_id</u>	name	surname	locker		
			id	key_num	size

**Exercise 2 - Library** The attribute `borrowed_books` is multivalued and the combination { `author`, `title`, `date` } is unique within this attribute.

library						
<u>card_num</u>	name	surname	borrowed_books			
			author	title	date	return_date

**Exercise 3 - Books** The following functional dependencies are defined on the table:

- `author`  $\rightarrow$  `author_bdate`
- `title`  $\rightarrow$  `genre`, `pages`, `section`

books					
<u>author</u>	<u>title</u>	genre	author_bdate	pages	section

**Exercise 4 - Houses** The following functional dependencies are defined on the table:

- $\text{postal\_code} \rightarrow \text{price, size}$
- $\text{owner} \rightarrow \text{owner\_account}$

houses						
<u>owner</u>	<u>postal_code</u>	address			price	size
		city	street	number		

**Exercise 5 - Port** The following functional dependencies are defined on the table:

- $\text{ship\_name} \rightarrow \text{docked\_at, country, weight, class}$
- $\text{docked\_at} \rightarrow \text{country}$
- $\text{captain} \rightarrow \text{cpt\_license}$

port						
<u>ship_name</u>	<u>captain</u>	<u>cpt_license</u>	weight	class	docked_at	country

**Exercise 6 - Cellar** The following functional dependencies are defined on the table:

- $\text{producer} \rightarrow \text{country, location}$
- $\text{wine} \rightarrow \text{bottling\_date, price/l, grape\_variety}$
- $\text{location} \rightarrow \text{country}$
- $\text{grape\_variety} \rightarrow \text{price/l}$

Cellar						
<u>producer</u>	<u>wine</u>	bottling_date	price/l	country	location	grape_variety

**Exercise 7 - Courses** The following functional dependencies are defined on the table:

- $\text{employee\_code} \rightarrow \text{name, surname}$
- $\text{study\_points} \rightarrow \text{hours}$
- $\text{course\_code} \rightarrow \text{hours, study\_points, course\_name}$

courses						
<u>employee_code</u>	name	surname	study_points	hours	<u>course_code</u>	course_name

**Exercise 8 - Flights** The following functional dependencies are defined on the table:

- departure, arrival  $\rightarrow$  flight\_duration
- captain\_code  $\rightarrow$  captain\_name
- flight\_code  $\rightarrow$  plane\_model, departure, arrival, flight\_time

flights						
<u>flight_code</u>	plane_model	departure	arrival	flight_time	captain_name	<u>captain_code</u>

**Exercise 9 - Buildings** The following functional dependencies are defined on the table:

- material  $\rightarrow$  maximum\_pressure, specific\_weight
- building\_length, building\_width, building\_height  $\rightarrow$  tax\_rate
- building\_type\_code  $\rightarrow$  building\_length, building\_width, building\_height

buildings					
<u>building_type_code</u>	<u>component_type</u>	<u>material</u>	building_length	building_width	building_height
tax_rate		maximum_pressure		specific_weight	