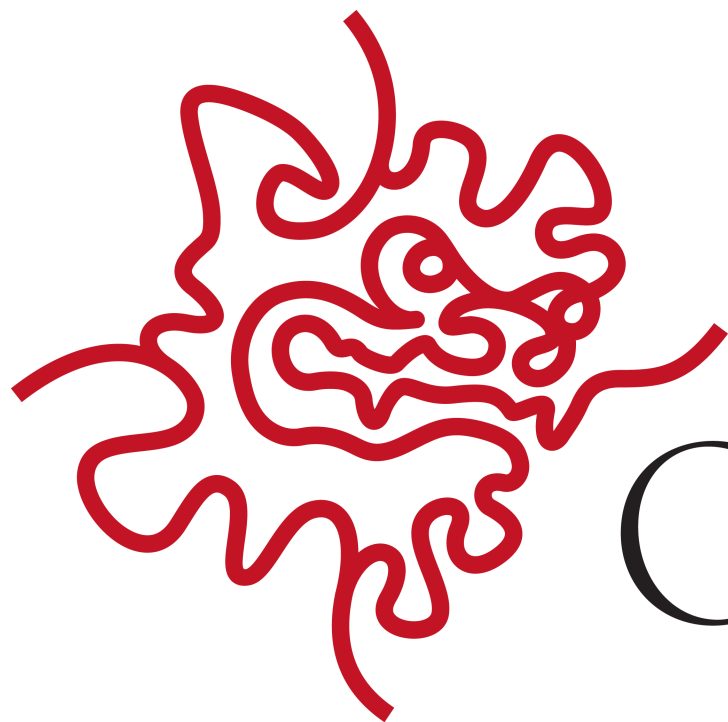




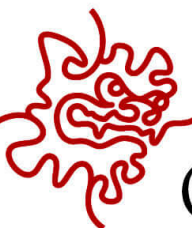
# **Skill Pill: Database Manipulation**

Session I: Introduction  
Jeremie Gillet



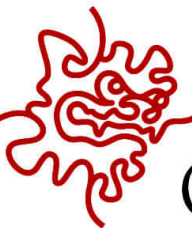
OIST

- Introduction
  - What is a database?
  - Normalization forms
  - Databases in research
  - No-SQL
- SQL Queries
  - Get data from database
- SQL Updates and DB Manipulations
  - Insert, delete, update data
  - Create, modify databases
- Advanced SQL



# What is a database?

- Database (DB): Organized collection of data
- Database Management System (DBMS): software that interacts with users, applications and the DB
  - Ex: MySQL, PostgreSQL, Microsoft Access, SQL Server, FileMaker, Oracle...
- Relational DB: dominant model for DB
  - use Structured Query Language (SQL)



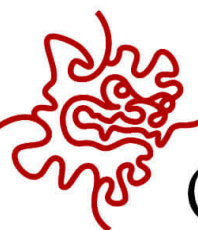
- Groups data into tables of columns (fields) and rows (records)
- The order of columns or rows doesn't matter
- Tables are *related* through keys

Skill Pill Teachers

Username	Name	Hair	Favorite Food
saiful	Saiful	Brown	3
chris	Christian	Blond	3
jeremie	Jérémie	NULL	1

Food

ID	Name	Description
1	Pizza	Best food ever
2	Tacorice	Second best food ever
3	Goya	Worst food ever



- Primary key
- Uniquely defines a record
- Can be composite
- Alternate keys may exist
- Foreign key

Skill Pill Teachers

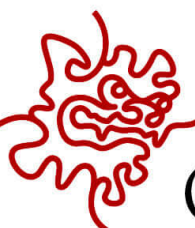
Username	Name	Hair	Favorite Food
saiful	Saiful	Brown	3
chris	Christian	Blond	3
jeremie	Jérémie	NULL	1

Skill Pill Teachers-1

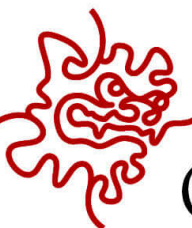
Last Name	Name	Hair	Favorite Food
Haque	Saiful	Brown	3
Butcher	Christian	Blond	3
Gillet	Jérémie	NULL	1

Food

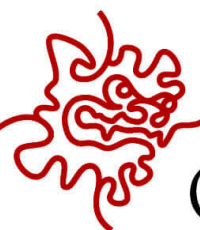
ID	Name	Description
1	Pizza	Best food ever
2	Tacorice	Second best food ever
3	Goya	Worst food ever



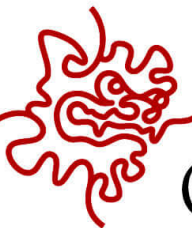
- Rules for structuring data in a relational DB
- General idea:
  - Isolate one concept per table
  - No redundant data
  - Improve data integrity
- 3 Normal Forms (actually more...)



Student	Advisor contact	Topic	Advisor	Advisor Department
Albert	5553452	Painting	Fernandez	Arts
Bill	+1-555-8261, +15551113	Physics	Goober, Hilt	Physics, Physics
Connie	(0)555 3452	Painting; Mosaic	Fernandez	Arts
Darren	/	Quantum Painting	Gober	Physics
Ellie	555 23 23	Food additives, Pizza toppings, Mushroom picking	Kelly	Chemistry
Fernando	555-23-23	Analytical chemistry	Kely	Chemistry
Gustave	5553452	Not yet decided	Fernandez	
Ellie	555 23 23	Food additives	Kelly	Chemistry



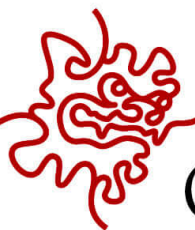
- Single value in a single cell
- No repeated rows





# First Normal Form

Student	Advisor contact	Topic	Advisor	Advisor Departm
Albert	5553452	Painting	Fernandez	Arts
Bill	+1-555-8261, +15551113	Physics	Goober, Hilt	Physics, Physics
Connie	(0)555 3452	Painting; Mosaic	Fernandez	Arts
Darren	/	Quantum Painting	Gober	Physics
Ellie	555 23 23	Food additives, Pizza toppings, Mushroom picking	Kelly	Chemistry
Fernando	555-23-23	Analytical chemistry	Kely	Chemistry
Gustave	5553452	Not yet decided	Fernandez	
Ellie	555 23 23	Food additives	Kelly	Chemistry



# First Normal Form

Remove duplicates, reorder (just for clarity)

Student	Advisor contact	Topic	Advisor	Advisor Departm
Albert	5553452	Painting	Fernandez	Arts
Bill	+1-555-8261, +15551113	Physics	Goober, Hilt	Physics, Physics
Connie	(0)555 3452	Painting; Mosaic	Fernandez	Arts
Darren	/	Quantum Painting	Gober	Physics
Ellie	555 23 23	Food additives, Pizza toppings, Mushroom picking	Kelly	Chemistry
Fernando	555-23-23	Analytical chemistry	Kely	Chemistry
Gustave	5553452	Not yet decided	Fernandez	
Ellie	555 23 23	Food additives	Kelly	Chemistry

Student	Advisor	Topic	Advisor Departme	Advisor contact
Albert	Fernandez	Painting	Arts	5553452
Bill	Goober, Hilt	Physics	Physics, Physics	+1-555-8261, +15551113
Connie	Fernandez	Painting; Mosaic	Arts	(0)555 3452
Darren	Gober	Quantum Painting	Physics	/
Ellie	Kelly	Food additives, Pizza toppings, Mushroom picking	Chemistry	555 23 23
Fernando	Kely	Analytical chemistry	Chemistry	555-23-23
Gustave	Fernandez	Not yet decided		5553452

# First Normal Form

Single value in single cell

Remove duplicates, reorder (just for clarity)

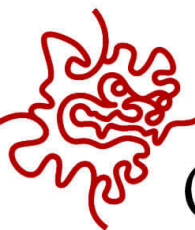
Student	Advisor	Topic	Advisor Departme	Advisor contact
Albert	Fernandez	Painting	Arts	5553452
Bill	Goober, Hilt	Physics	Physics, Physics	+1-555-8261, +15551113
Connie	Fernandez	Painting; Mosaic	Arts	(0)555 3452
Darren	Gober	Quantum Painting	Physics	/
Ellie	Kelly	Food additives, Pizza toppings, Mushroom picking	Chemistry	555 23 23
Fernando	Kely	Analytical chemistry	Chemistry	555-23-23
Gustave	Fernandez	Not yet decided		5553452

Student	Advisor	Topic	Advisor Departme	Advisor contact
Albert	Fernandez	Painting	Arts	5553452
Bill	Hilt	Physics	Physics	15551113
Bill	Goober	Physics	Physics	+1-555-8261
Connie	Fernandez	Painting	Arts	(0)555 3452
Connie	Fernandez	Mosaic	Arts	(0)555 3452
Darren	Gober	Quantum Painting	Physics	/
Ellie	Kelly	Food additives	Chemistry	555 23 23
Ellie	Kelly	Pizza toppings	Chemistry	555 23 23
Ellie	Kelly	Mushroom picking	Chemistry	555 23 23
Fernando	Kely	Analytical chemistry	Chemistry	555-23-23
Gustave	Fernandez	Not yet decided		5553452

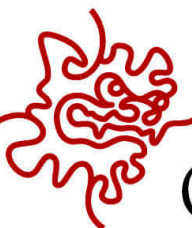
# Exercise

Turn this table into NFI

Customer ID	First Name	Surname	Telephone Number
123	Pooja	Singh	555-861-2025, 192-122-1111
456	San	Zhang	(555) 403-1659 Ext. 53; 182-929-2929
789	John	Doe	555-808-9633



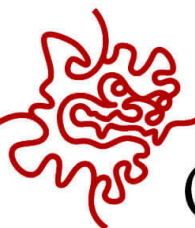
- Be in First Normal Form
- If the key is composite, cell values cannot depend of only a part of the key



# Second Normal Form

NF1

Student	Advisor	Topic	Advisor Dpt	Advisor contact
Albert	Fernandez	Painting	Arts	5553452
Bill	Hilt	Physics	Physics	15551113
Bill	Goober	Physics	Physics	+1-555-8261
Connie	Fernandez	Painting	Arts	(0)555 3452
Connie	Fernandez	Mosaic	Arts	(0)555 3452
Darren	Gober	Quantum Painting	Physics	/
Ellie	Kelly	Food additives	Chemistry	555 23 23
Ellie	Kelly	Pizza toppings	Chemistry	555 23 23
Ellie	Kelly	Mushroom picking	Chemistry	555 23 23
Fernando	Kely	Analytical chemistry	Chemistry	555-23-23
Gustave	Fernandez	Not yet decided		5553452





# Second Normal Form

NF1

Student	Advisor	Topic	Advisor Dpt	Advisor contact
Albert	Fernandez	Painting	Arts	5553452
Bill	Hilt	Physics	Physics	15551113
Bill	Goober	Physics	Physics	+1-555-8261
Connie	Fernandez	Painting	Arts	(0)555 3452
Connie	Fernandez	Mosaic	Arts	(0)555 3452
Darren	Gober	Quantum Painting	Physics	/
Ellie	Kelly	Food additives	Chemistry	555 23 23
Ellie	Kelly	Pizza toppings	Chemistry	555 23 23
Ellie	Kelly	Mushroom picking	Chemistry	555 23 23
Fernando	Kely	Analytical chemistry	Chemistry	555-23-23
Gustave	Fernandez	Not yet decided		5553452

Student

Student	Topic	Advisor
Albert	Painting	Fernandez
Bill	Physics	Hilt
Bill	Physics	Goober
Connie	Painting	Fernandez
Connie	Mosaic	Fernandez
Darren	Quantum Painting	Gober
Ellie	Food additives	Kelly
Ellie	Pizza toppings	Kelly
Ellie	Mushroom picking	Kelly
Fernando	Analytical chemistry	Kely
Gustave	Not yet decided	Fernandez

Advisor

Advisor	Dpt	Advisor contact
Fernandez	Arts	5553452
Fernandez	Arts	(0)555 3452
Gober	Physics	/
Goober	Physics	+1-555-8261
Hilt	Physics	15551113
Kelly	Chemistry	555 23 23
Kely	Chemistry	555-23-23

# Second Normal Form

Student

Student	Topic	Advisor
Albert	Painting	Fernandez
Bill	Physics	Hilt
Bill	Physics	Goober
Connie	Painting	Fernandez
Connie	Mosaic	Fernandez
Darren	Quantum Painting	Gober
Ellie	Food additives	Kelly
Ellie	Pizza toppings	Kelly
Ellie	Mushroom picking	Kelly
Fernando	Analytical chemistry	Kely
Gustave	Not yet decided	Fernandez

Advisor

Advisor	Dpt	Advisor contact
Fernandez	Arts	5553452
Fernandez	Arts	(0)555 3452
Gober	Physics	/
Goober	Physics	+1-555-8261
Hilt	Physics	15551113
Kelly	Chemistry	555 23 23
Kely	Chemistry	555-23-23

Student-1

Student	Advisor
Albert	Fernandez
Bill	Hilt
Connie	Fernandez
Darren	Gober
Ellie	Kelly
Fernando	Kely
Gustave	Fernandez

Topics

Topic
Analytical chemistry
Food additives
Mosaic
Mushroom picking
Painting
Physics
Pizza toppings
Quantum Painting

Student - topic

Student	Topic
Albert	Painting
Bill	Physics
Connie	Painting
Connie	Mosaic
Darren	Quantum Painting
Ellie	Food additives
Ellie	Pizza toppings
Ellie	Mushroom picking
Fernando	Analytical chemistry

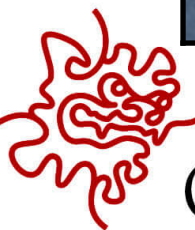




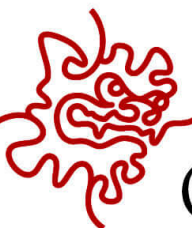
# Exercise

Turn this table into NF2

Manufacturer	Model	Model full name	Manufacturer country
Forte	X-Prime	Forte X-Prime	Italy
Forte	Ultraclean	Forte Ultraclean	Italy
Dent-o-Fresh	EZbrush	Dent-o-Fresh EZbrush	USA
Hoch	Toothmaster	Hoch Toothmaster	Germany
Hoch	X-Prime	Hoch X-Prime	Germany



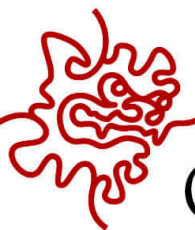
- Be in Second Normal Form (cell values must depend on the whole key)
- Cell values must **directly** depend on nothing but the whole key



# Third Normal Form

NF2 Advisor

Advisor	Advisor Department	Advisor Room	Advisor Room Floor
Fernandez	Arts	A203	2
Goober	Physics	P503	5
Hilt	Physics	P121	1
Kelly	Chemistry	C322	3
Kelly	Physics	P234	2



# Third Normal Form

NF2 Advisor

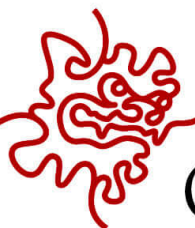
Advisor	Advisor Department	Advisor Room	Advisor Room Floor
Fernandez	Arts	A203	2
Goober	Physics	P503	5
Hilt	Physics	P121	1
Kelly	Chemistry	C322	3
Kelly	Physics	P234	2

Split department

Advisor	Advisor Department	Advisor Room
Fernandez	Arts	A203
Goober	Physics	P503
Hilt	Physics	P121
Kelly	Chemistry	C322
Kelly	Physics	P234

Department

Room	Room Floor
A203	2
P503	5
P121	1
C322	3
P234	2



# Exercise

Turn this table into NF3

Tournament	Year	Winner	Winner's date of birth
Indiana Invitational	1998	Al Fredrickson	21 July 1975
Cleveland Open	1999	Bob Albertson	28 September 1968
Des Moines Masters	1999	Al Fredrickson	21 July 1975
Indiana Invitational	1999	Chip Masterson	14 March 1977

