

# Lab 2 Tasks

## Task 1: Operational Anomalies

You are given the following relation: **Student**

SID	Name	Address	Subject
41	Adam	Athole Gardens	CS
42	Alex	Hyndland Ave	Maths
43	Stuart	University Ave	Maths
41	Adam	Athole Gardens	Physics

**1.1: Identify** an anomaly over updating the address of student with SID = 41; provide an explanation.

**1.2: Identify** an anomaly over dropping the subject of student with SID = 42; provide an explanation.

**1.3: Identify** an anomaly over inserting a student with SID = 44, who has not selected yet some Subjects; provide an explanation.

**1.4:** Consider the following relation. **Identify** the NF of this table. Normalize this table in 1NF (if not already) and **identify** any possible problems after this normalization.

Student	Age	Subject
Chris	15	Biology, Maths
Philip	14	Maths
Stella	17	Maths

**1.5: Identify** the NF of the following relation. Can you identify any possible anomalies?

### Tournament Winners

<u>Tournament</u>	<u>Year</u>	Winner	Winner Date of Birth
Des Moines Masters	1998	Chip Masterson	14 March 1977
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

## Task 2: Normalisation to 2NF

Consider the FD: **Product\_ID**  $\rightarrow$  **Product\_Description** and the relation **Order** with PK = {Order\_No, Product\_ID}:

### Order

<u>Product_ID</u>	<u>Order_No</u>	Product_Description
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**2.1: Identify** the NF of the relation *Order* and normalize it to avoid potential anomalies.

Consider the relation: **Student** with PK = {Stud\_ID, Course\_ID} and the FDs: FD1: **Stud\_ID**  $\rightarrow$  **Name** and FD2: **Course\_ID**  $\rightarrow$  **Units**

### STUDENT

<u>Stud_ID</u>	Name	<u>Course_ID</u>	Units
101	Lennon	MSI 250	3.00
101	Lennon	MSI 415	3.00
125	Johnson	MSI 331	3.00

**2.2: Identify** the NF of the relation *Student* and normalize it to avoid potential anomalies.

Consider the relation: **Student\_Grade\_Report** (StudentNo, StudentName, CourseNo, CourseName, InstructorNo, InstructorName, Grade)

**2.3: Split** the relation *Student\_Grade\_Report* into a set of 2NF relations.

Consider the relation **R(ABCDE)** below:

A	B	C	D	E
a1	b1	c1	d1	e1
a2	b1	C2	d2	e1
a3	b2	C1	d1	e1
a4	b2	C2	d2	e1
a5	b3	C3	d1	e1

Table R

**2.4:** What kind of **dependencies** can we observe among the attributes in relation R(ABCDE)? Which is the possible candidate key?

### Task 3: Normalization to 3NF

**Context Description:** An engineering company supplies temporary specialized staff to bigger companies in the UK to work on their projects for certain amount of time. The table below lists the time spent by each of the company's employees at other companies to carry out their projects. The **National Insurance Number (NIN)** is unique for every member of staff.

NIN	Contract No	Hours	Employee Name	Company ID	Company Location
616681B	SC1025	72	P. White	SC115	Belfast
674315A	SC1025	48	R. Press	SC115	Belfast
323113B	SC1026	24	P. Smith	SC23	Glasgow
616681B	SC1026	24	P. White	SC23	Glasgow

**Task 3.1:** Your questions are:

1. Identify the **Normal Form (NF)** of this relation.
2. Find the **Primary Key (PK)** for this relation and explain your choice.
3. Find the **Fully Functional Dependencies** on the PK and the **Partial Dependencies** on the PK.
4. Normalise the table to 2NF (if not being in 2NF).
5. Find the **transitive** dependencies on the 2NF tables.
6. Normalise the tables to 3NF.
7. Draw/describe the **relational schema** and show the PK and FK in all the relations after normalization.

### Task 4: Normalization to BCNF

**Context Description:** We consider the following relation:

**ARTICLES**(ID, title, journal, issue, year, startpage, endpage, TR-ID)

The relation contains information on articles published in scientific journals. Each article has a unique ID, a title, and information on where to find it: name of the journal, issue of the journal, and in which pages in the journal. Also, if there are results of an article appeared as a "technical report" (TR), then the ID of this technical report should be specified by the TR-ID attribute. We have the following information on the attributes:

- For each journal, an issue with a given number is published in a single year.
- The endpage of an article is never smaller than the startpage.
- There is never (part of) more than one article on a single page.

The following is an instance of the relation ARTICLES:

ID	title	journal	issue	year	startpage	endpage	TR-ID
42	Cuckoo Hashing	JAlg	51	2004	121	133	87
33	Deterministic Dictionaries	JAlg	41	2001	69	85	62
33	Deterministic Dictionaries	JAlg	41	2001	69	85	56
39	Dictionaries in less space	SICOMP	31	2001	111	133	47
57	P vs NP resolved	JACM	51	2008	1	3	99
77	What Gödel missed	SICOMP	51	2008	1	5	98
78	What Gödel missed	Nature	2222	2008	22	22	98

**Task 4.1:** Indicate for each of the following sets of attributes whether it is a candidate key or not.

1. {ID};
2. {ID, TR-ID};
3. {ID, title, TR-ID}
4. {title};
5. {title, year};
6. {startpage, journal, issue}

**Task 4.2:** Indicate for each of the following potential functional dependencies, whether it is indeed or not.

1.  $ID \rightarrow \text{title}$ ;
2.  $\text{startpage} \rightarrow \text{endpage}$ ;
3.  $\{\text{journal}, \text{issue}\} \rightarrow \text{year}$
4.  $\text{title} \rightarrow ID$ ;
5.  $ID \rightarrow \{\text{startpage}, \text{endpage}, \text{journal}, \text{issue}\}$
6.  $\text{TR-ID} \rightarrow ID$

**Task 4.3:** Based on the Task 4.1 and Task 4.2, perform **normalization into BCNF**.