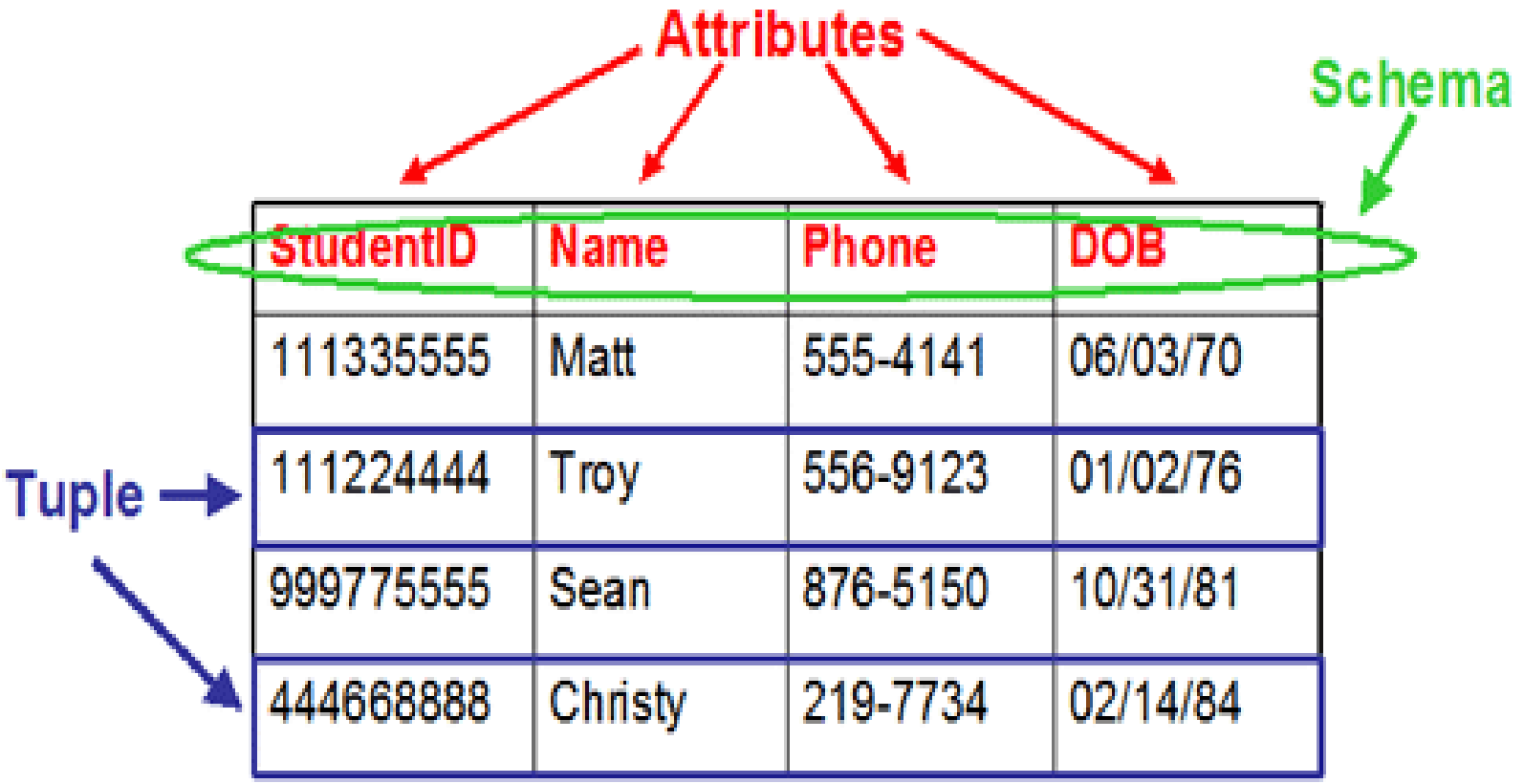
Relational Modeling
In-class Exercises

Basics of the Relational Model

- Represent data as a two-dimensional table called a relation



StudentID	Name	Phone	DOB
111335555	Matt	555-4141	06/03/70
111224444	Troy	556-9123	01/02/76
999775555	Sean	876-5150	10/31/81
444668888	Christy	219-7734	02/14/84

Exercise 1

Name	Login	Email	Age
Jones	Jones	jones@cs	18
Smith	Smith	smith@cs smith@gmail	19
Anna	Anna	anna@cs	19

- Is this table a valid relational instance?

Exercise 2

Name	Login	Email	Age
Jones	Jones	jones@cs	18
Smith	Smith	smith@cs	19
Anna	Anna	anna@cs	19
Anna	Anna	anna@cs	19

- Is this table a valid relational instance?

Exercise 3

Sid	Name	Login	Email	Age
53666	Jones	Jones	jones@cs	18
53688	Smith	Smith	smith@cs	19
	Anna	Anna	anna@cs	19

- Is this table a valid relational instance (assume Sid is the key)?
- Is the table below a valid relational instance (Sid is the key)?

Sid	Name	Login	Email	Age
53666	Jones	Jones	jones@cs	18
53688	Smith	Smith	smith@cs	19
54000	Anna	Anna	anna@cs	

Exercise 4

Parent	Child	Child
Jones	Anna	Betty
Bob	Alan	Steve
Cathy	Julian	Andy

- Is this table a valid relational instance?

Keys

- Superkey
- Key
- Candidate key
- Primary key

Exercise 5

Make	RegNo	Owner
Ford	JTY751	Gupta
Ford	JTZ309	Weir
GMH	KWC612	Green
Toyota	BCJ012	Gupta
GMH	ABE870	Green

- Identify ALL keys of table from the given instance

Exercise 6

Name	Event	Date
Jenny	NYC Marathon	09/01/19
Bill	Tokyo Marathon	08/09/18
Alice	NYC Marathon	08/09/18
Alice	Tokyo Marathon	08/09/18
Alice	NYC Marathon	09/01/19

- Given the following facts, list all keys of the table.
  1. The same person can attend the same events at different dates (e.g., Records 3 & 5)
  2. Two persons of the same name may attend different events on the same day (E.g., Records 3 & 4)
  3. Multiple persons can attend the same event on the same date (e.g., Records 1 & 5)
  4. No two persons of the same name can attend the same event on the same day

Exercise 7

Warehouse	Unit	Project
W1	PX7	PR1
W1	PX7	PR2
W2	PX1	PR1
W1	PX1	PR1

- Which attribute(s) form the key, given the following facts:
  1. The same units can be stored in the same warehouses for different projects (e.g, Records 1 & 2).
  2. Different units of the same project can be installed in the same warehouse (e.g., Records 1 & 4)
  3. The same units of the same projects can be stored in different warehouses (e.g., Records 3 & 4)
  4. The same units for the same project are stored in the same warehouse only once

Exercise 7 (continued)

Warehouse	Units	Project	Date
W1	PX7	PR1	01/01/18
W1	PX7	PR1	01/02/18
W2	PX1	PR1	01/01/18
W1	PX1	PR1	01/02/18

- Now the table has a new attribute “Date”
- Facts 1 -3 in the previous slides still hold
- Fact 4 is changed to be the following:
  - The same units of the same projects can be stored in the same warehouse multiple times, but must be on different dates.
- Which attribute(s) form the key?

Defining Primary Keys by SQL

- Defining primary key in SQL:

```
CREATE TABLE <name> (
   <field1> <domain>,
   <field2> <domain>,
   …
   PRIMARY KEY (field1, field2,…)
);
```

Defining Candidate Keys by SQL

- Defining candidate keys in SQL

```
CREATE TABLE <name> (
  <field1> <domain>,
  <field2> <domain>,
  …
  PRIMARY KEY (field1, field2,…),
  UNIQUE (CK1_field1, CK1_field2…),
  UNIQUE (CK2_field1, CK2_field2…),
  …
);
```

- Each UNIQUE statement corresponds to a candidate key

Defining Foreign Keys by SQL

- Defining foreign keys in SQL

```
CREATE TABLE <name> (
    ……
  FOREIGN KEY (FK1_field1, FK1_field2,…) REFERENCES Table1
  (field1, field2,…) [ON DELETE ref_option] [ON UPDATE
  ref_option],
  FOREIGN KEY (FK2_field1, FK2_field2,…) REFERENCES Table2
  (field1, field2,…) [ON DELETE ref_option] [ON UPDATE
  ref_option],
  …
  );
```

Exercise 8

Offences

RecordID	Date	Officer	Dept	Registration
143256	09/01/10	567	75	5694
987554	08/03/09	345	47	6544

Officers

PID	Name
567	Adam
345	Betty

Cars

Registration	Dept	Owner
5694	75	Cordon
6544	47	Sally

- *PID* is the key of Officers table
- *Registration* is the key of Cars table
- The referential integrity constraints are defined by using the arrows between the table.

- Questions:
  - (1) List all the foreign key constraints among these relations;
  - (2) Write the SQL statement to create table Offences, with all foreign key constraints specified.

Solution to SQL Statement

```
CREATE TABLE Offences (
        RecordID integer,
        Date DATE,
        Officer integer,
        Dept char(10),
        Registration char(10),
        PRIMARY KEY (RecordID),
        FOREIGN KEY (Officer) REFERENCES Officers(PID),
        FOREIGN KEY (Registration) REFERENCES Cars);
```

Notes:

- Since the foreign key officer of Offences table and the key PID in Officers table have different attribute names, should use FOREIGN KEY (Officer) REFERENCES Officers(PID)
- Either FOREIGN KEY (Registration) REFERENCES Cars or FOREIGN KEY (Registration) REFERENCES Cars (Registration) is correct, as the foreign key has the same name as the key of Cars table