INF1343, Week 6

Implementing a Database with SQL

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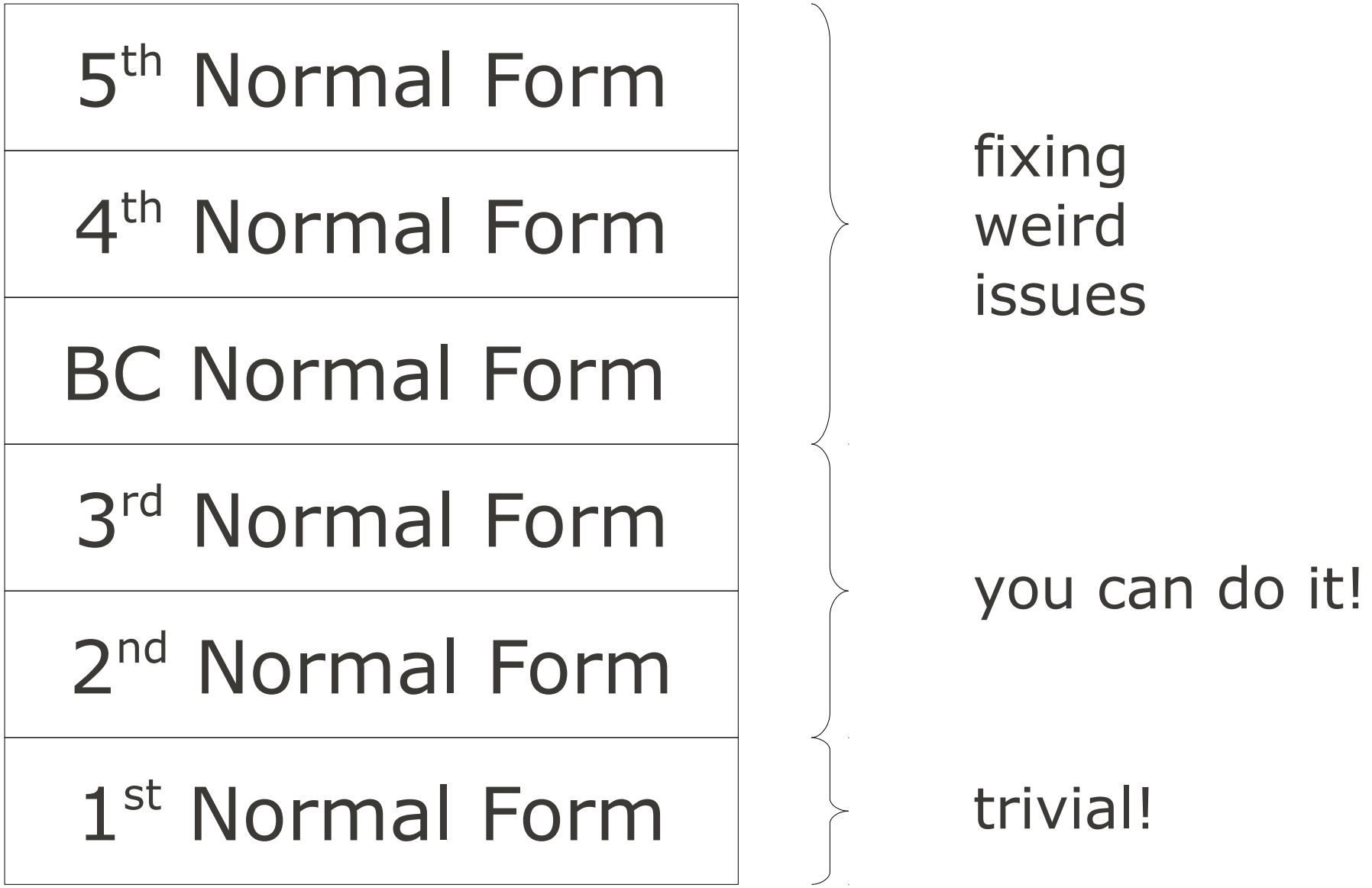
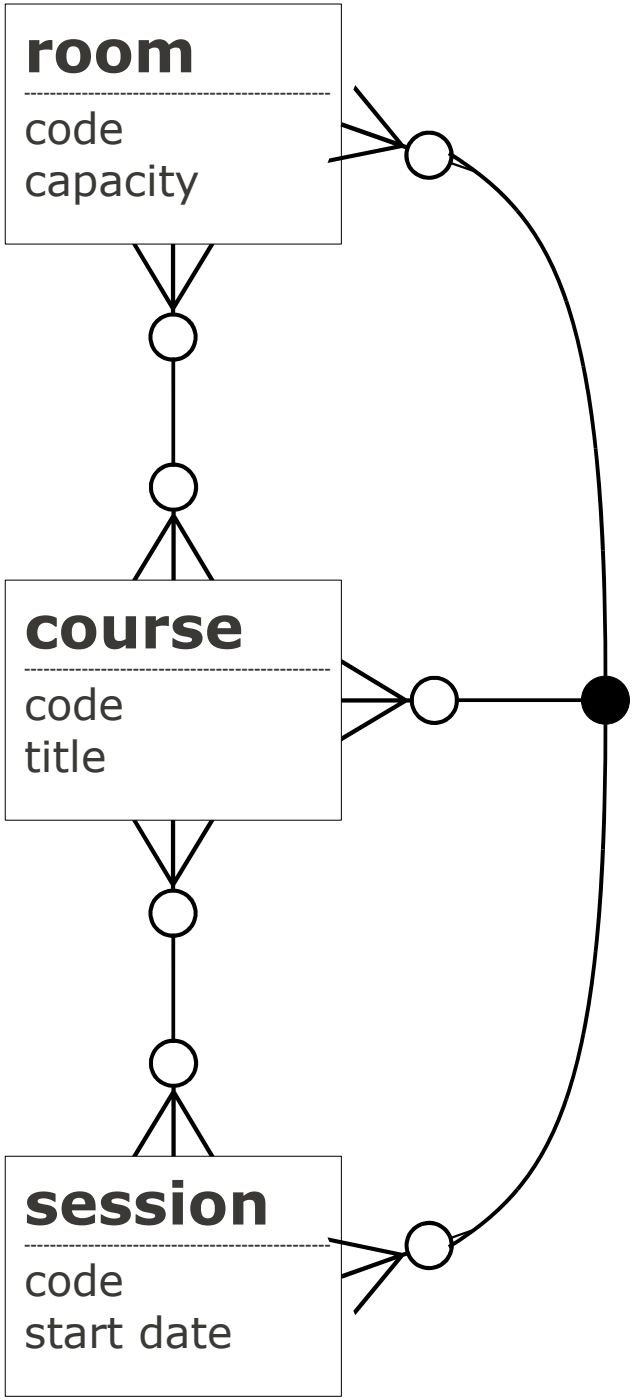
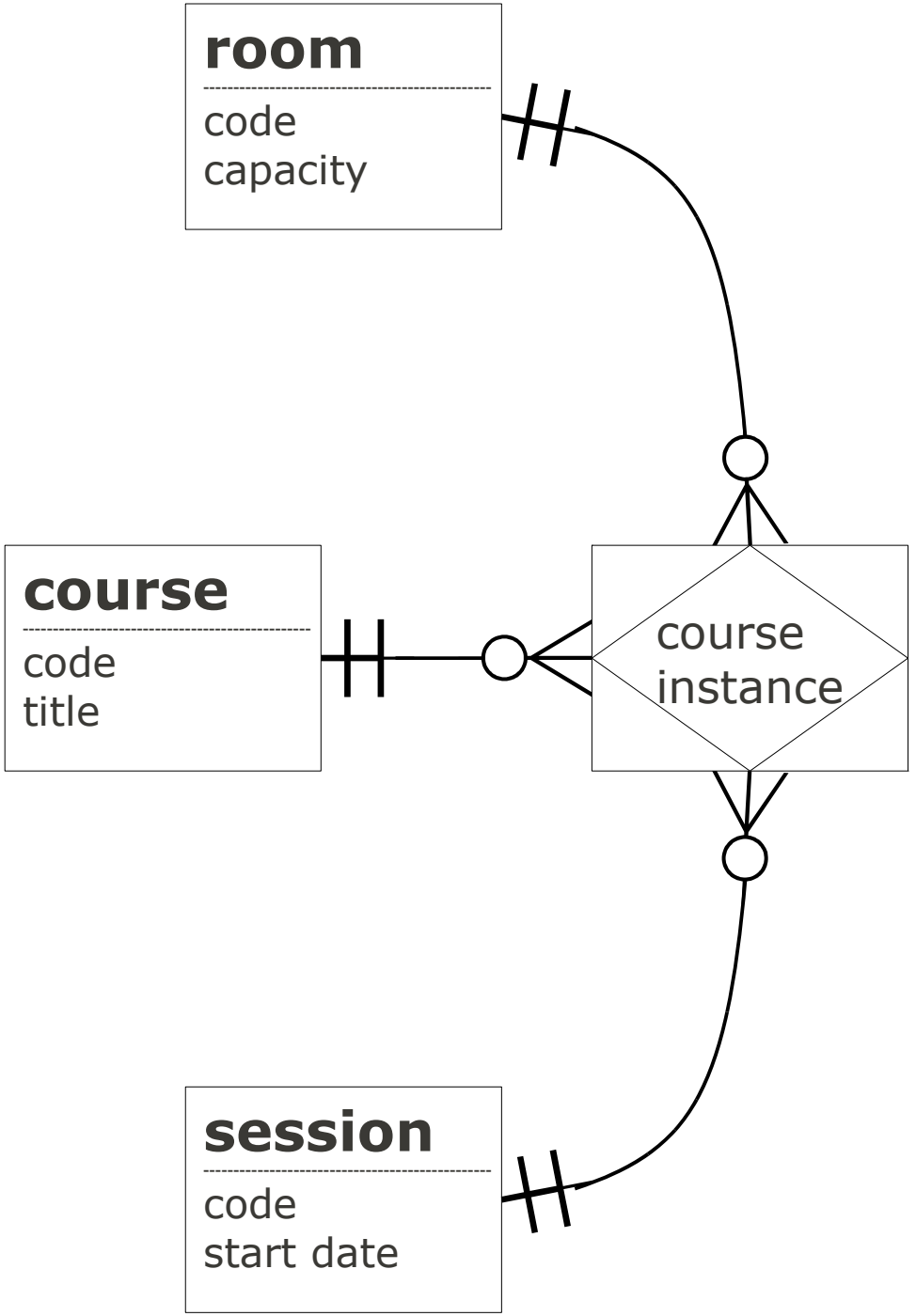
Normal Forms

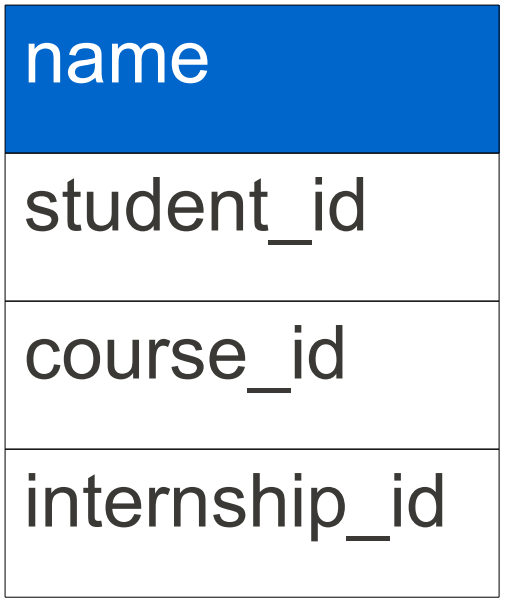


4NF

Mistaking binary relationships for ternary


room
code
capacity
course
code
title
session
code
start date

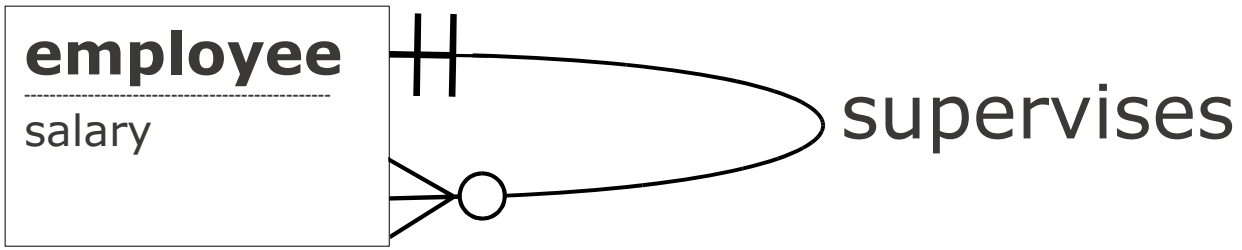

room
code
capacity
course
code
title
course
instance
session
code
start date


name
student_id
course_id
internship_id

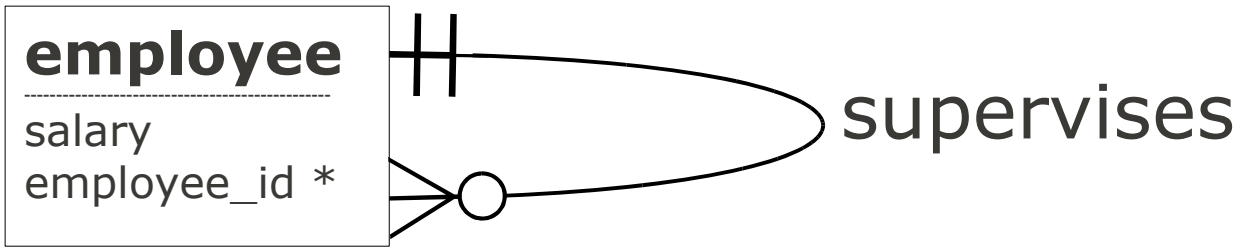
5NF

“We could break it up yet more”

Recursive Relationships



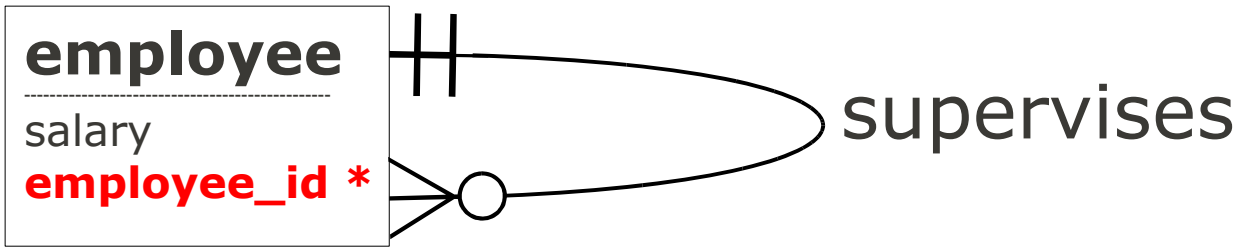
Recursive Relationships



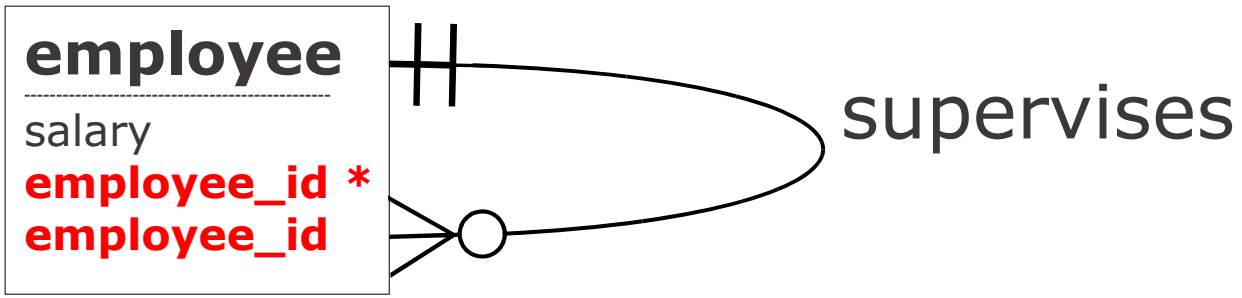
Step 3

"For each entity that is at the 'many' end of one or more relationships, include the primary key of each parent entity in the table as foreign keys."

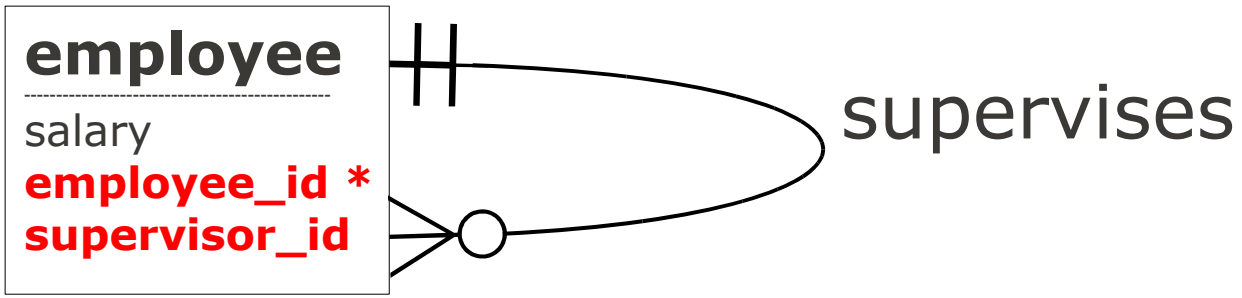
Recursive Relationships



Recursive Relationships



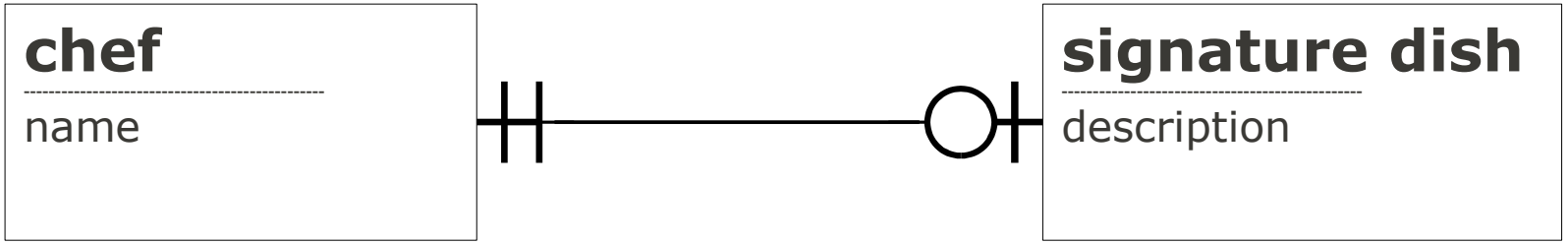
Recursive Relationships



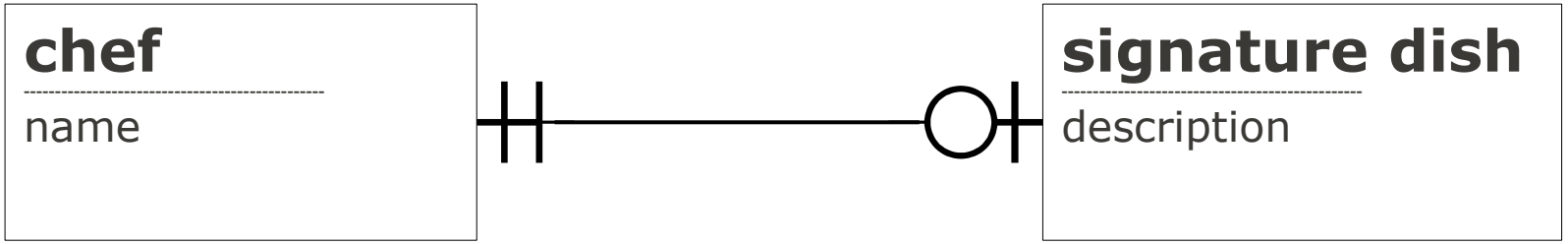
employee

name	type	null	key
employee_id	int	NO	PRI
supervisor_id	int		
salary	decimal		

1-1 Relationships



Option 1: Merge

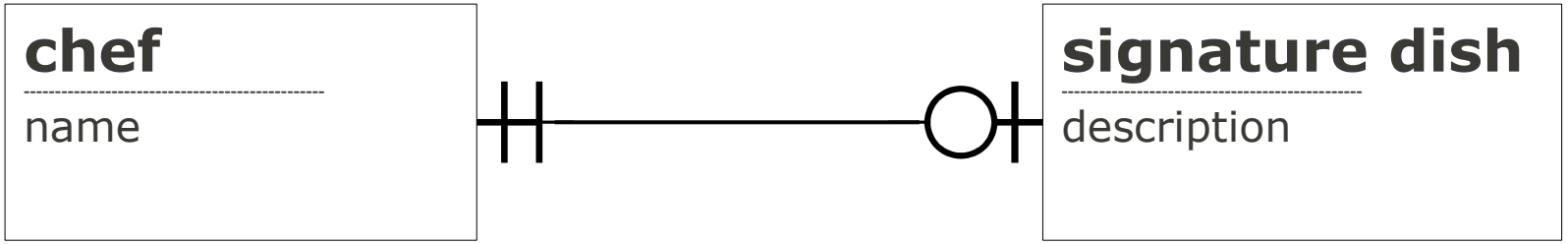


Option 1: Merge

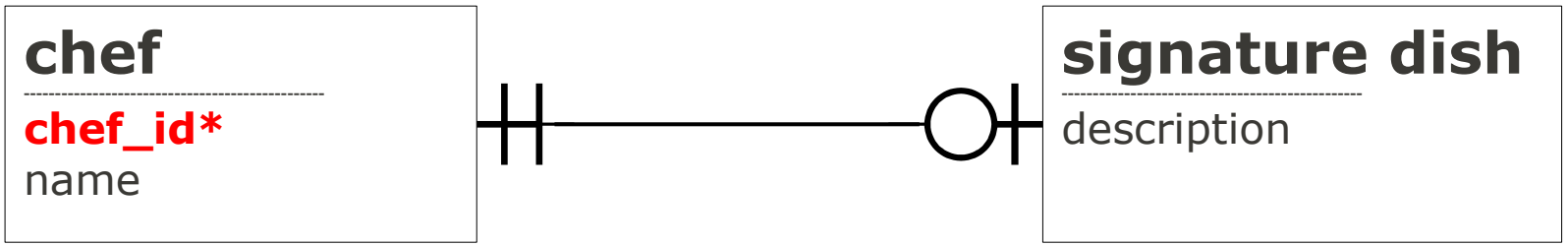
chef

name	type	null	key
chef_id	int	NO	PRI
name	varchar(100)		
signature_dish_description	varchar(1000)		

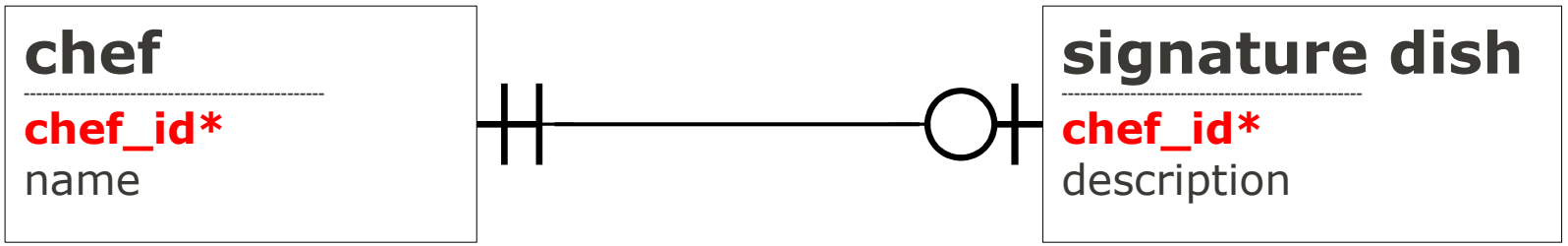
Option 2: FK as PK



Option 2: FK as PK



Option 2: FK as PK



Option 2: FK as PK

signature dish

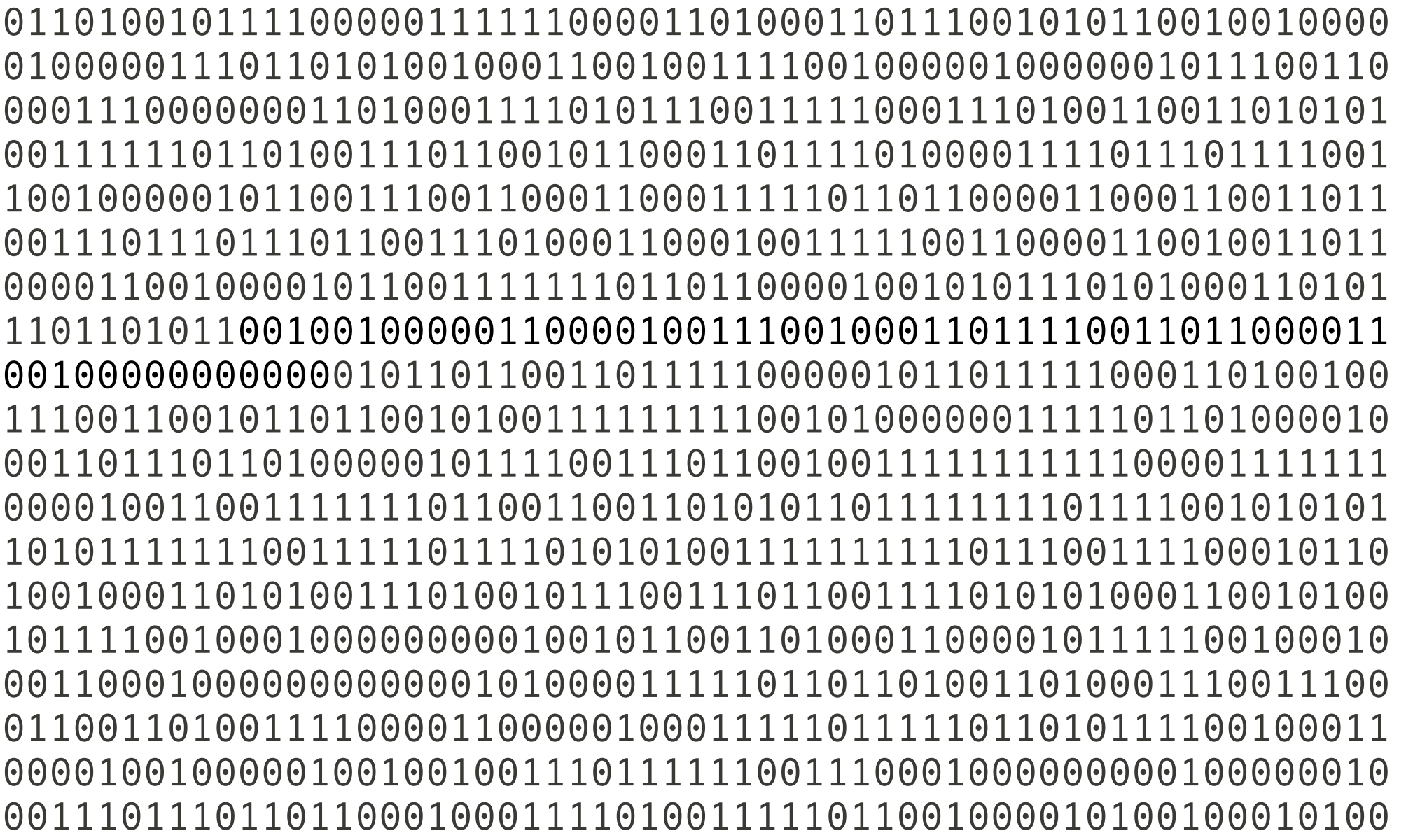
name	type	null	key
chef_id	int	NO	PRI
description	varchar(1000)		

Questions?

Implementation

- Create a database/schema
- Define domains
- Create the tables

Domains / Data Types



Domains / Data Types

Domains / Data Types

11011010110010010000011000010011100100011011110011011000011
00100000000000001011011001101111100000101101111100011010010 0

"Harold\n"?

1300457425722198016?

130045742.5722198016?

$0.523730480154 8 * 10^{-36}$?

String (Text)

`CHAR(n)`	`BINARY(n)`
`VARCHAR(n)`	`VARBINARY(n)`
`TEXT`	`BLOB`

`ENUM`

Numeric

INTEGER
UNSIGNED
SMALLINT
BIGINT

NUMERIC(n,m)
DECIMAL(n,m)

BOOLEAN

REAL
DOUBLE PRECISION
FLOAT(m,d)

Date and Time

DATE
TIME
DATETIME
TIMESTAMP

Extensions

Spatial:

POINT

POLYGON

LINESTRING

GEOMETRY

Type Casting

Explicit casting:

```
CAST(weight AS INTEGER)
```

Implicit casting:

```
WHERE weight > "25"
```

Beware:

3.2 < 25

“3.2” > “25”

Create a Database

```
create database «name»;
```

For instance:

```
create database university;
```

```
Query OK, 1 row affected (0.00 sec)
```

Delete a Database

```
drop database «name»;
```

For instance:

```
drop database university;
```

```
Query OK, 0 rows affected (0.01 sec)
```

Create a Table

```
create table «name»;
```

For instance:

```
use university;
create table student;
```

```
ERROR 1113 (42000): A table must have at least 1 column
```

Create a Table

```
create table «name»
  («column» «vartype»);
```

For instance:

```
  create table student
    (student_id int);
```

```
Query OK, 0 rows affected (0.02 sec)
```

Create a Table

```
create table «name» (
 «column1» «vartype1»,
 «column2» «vartype2»
);
```

For instance:

```
 create table student (
  student_id int,
  last_name varchar(100)
 );
```

```
ERROR 1050 (42S01): Table 'student' already exists
```

Delete a Table

```
drop table «name»;
```

For instance:

```
drop table student;
```

```
Query OK, 0 rows affected (0.00 sec)
```

Create a Table

```
create table «name»> (
 «column1» «vartype1»,
 «column2» «vartype2»
);
```

For instance:

```
 create table student (
  student_id int,
  last_name varchar(100)
 );
```

```
Query OK, 0 rows affected (0.02 sec)
```

Required Fields

```
create table student (
  student_id int not null,
  last_name varchar(100)
);
```

Primary Keys

```
create table student (
  student_id int not null,
  last_name varchar(100),
  primary key (student_id)
);
```

```
mysql> describe student;
+-------------+--------------+------+-----+---------+-------+
| Field       | Type         | Null | Key | Default | Extra |
+-------------+--------------+------+-----+---------+-------+
| student_id  | int(11)      | NO   | PRI | NULL    |       |
| last_name   | varchar(100) | YES  |     | NULL    |       |
+-------------+--------------+------+-----+---------+-------+
2 rows in set (0.00 sec)
```

Foreign Keys

```
create table enrollment (
  student_id int not null,
  foreign key (student_id)
      references
      student(student_id),
  instance_id int not null
);
```

A dirty secret: MySQL 5.0 ignores FKs!

FKs with InnoDB

```
create table enrollment (
  student_id int not null,
  foreign key (student_id)
      references
      student(student_id),
  instance_id int not null
)  engine=InnoDB;
```

(We'll need to re-create the student table first.)

Load Some Data!

```
insert into student values
(1, "Kenobi");
insert into enrollment values
(1, 2);
```

```
Query OK, 1 row affected (0.00 sec)

mysql> select * from student;
+-------------+------------+
| student_id | last_name |
+-------------+------------+
|           1 | Kenobi     |
+-------------+------------+
1 row in set (0.00 sec)
```

From a File

```
load data
infile "/tmp/students.csv"
into table student;
```

Using SCP

scp = secure **c**o**p**y (or **s**sh + **cp**)
copy files over an ssh connection

Hint: You will usually be running this in your **local** bash session (i.e. on your laptop/desktop).

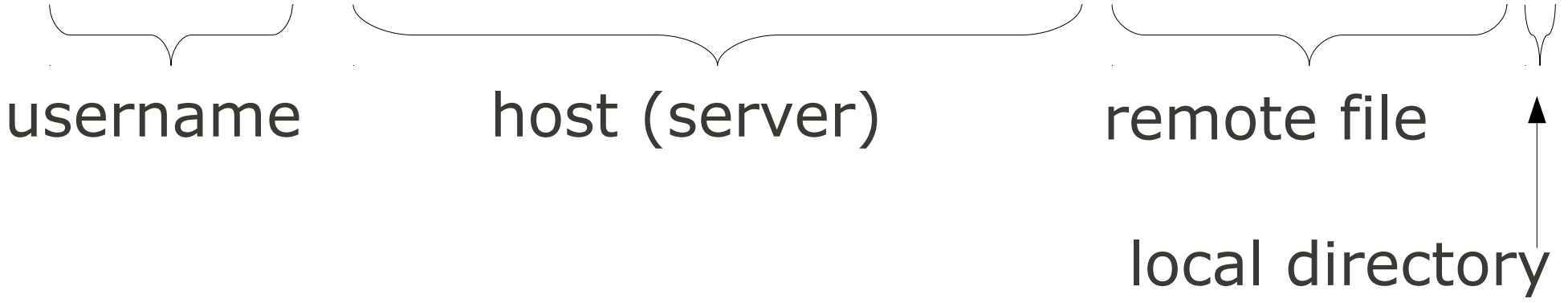
Hint: Windows users can use WinSCP instead.

Remote to Local

scp user@host:/remote/file /local/dir

e.g.:

scp kenobio7@yoda.ischool.utoronto.ca:~/humans.txt .



Local to Remote

scp /local/file user@host:/remote/dir

e.g.:

scp students.csv kenobio7@yoda.ischool.utoronto.ca:~/

Permissions

```
chmod a+r /tmp/students.csv
```

Editing Code Locally

Windows: **Notepad++**
Mac: **TextWrangler**
Linux: **gedit** (or emacs, vi)

Key feature: syntax highlighting

Comma-Separated

```
load data
infile "/tmp/students.csv"
into table student
fields terminated by ",";
```

```
Query OK, 1 row affected (0.00 sec)

mysql> select * from student;
+------------+-----------+
| student_id | last_name |
+------------+-----------+
|          1 | Kenobi    |
+------------+-----------+
1 row in set (0.00 sec)

mysql> load data infile "/tmp/students.csv" into table
student;
ERROR 1062 (23000): Duplicate entry '1' for key 1
```

Deleting Data

```
delete from student;
```

Deleting Select Data

```
delete from student
where ... ;
```

ON DELETE

```
create table enrollment (
  student_id int not null,
  foreign key (student_id)
      references
      student(student_id)
      on delete cascade,
  instance_id int not null
) engine=InnoDB;
```

Data

1273	Smith	Robert
1274	Ivanov	Boris
1275	Almeida	João

Easier

```
Smith     Robert
Ivanov    Boris
Almeida   João
```

Auto-Increment

```
create table student (
  student_id int not null
              auto_increment,
  last_name varchar(100),
  primary key (student_id)
) engine=InnoDB;
```

Auto-Increment

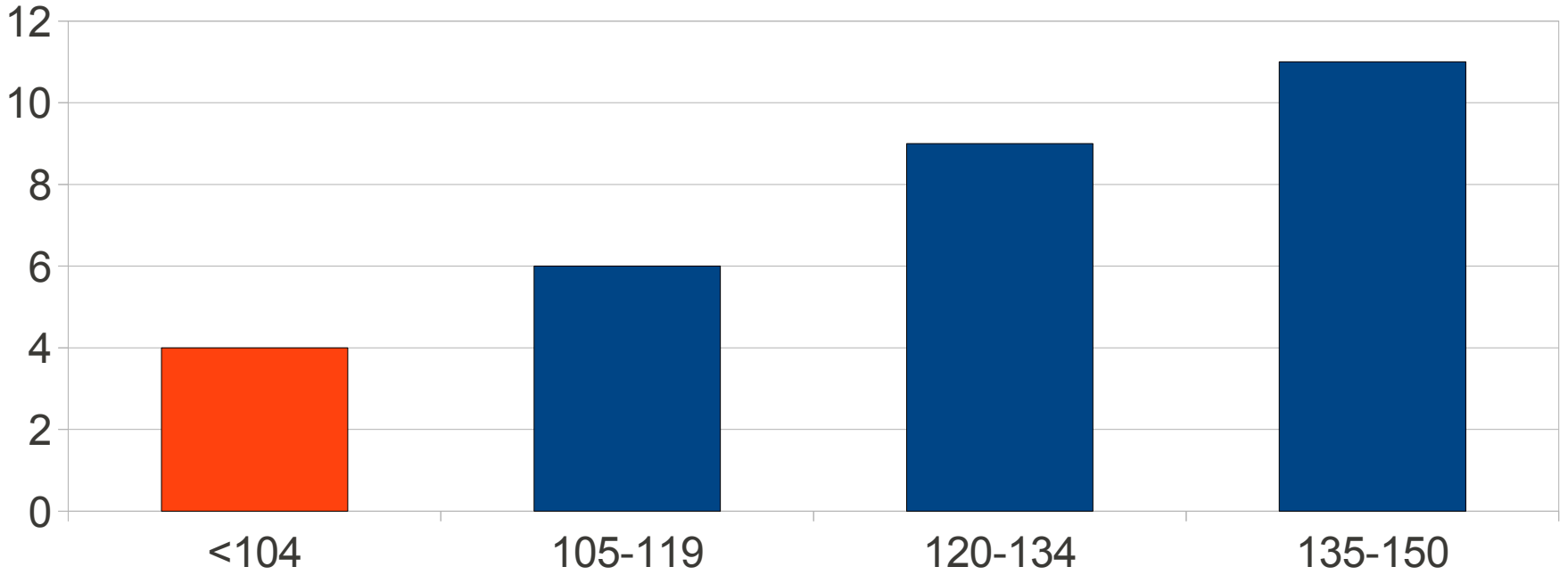
```
insert into student values
(NULL, "Kenobi");

insert into student (last_name)
values ("Kenobi");
```

Auto-Increment

```
load data
infile "/tmp/students.csv"
into table student;
```

Questions?

Assignment 1



See the answer sheet on the website.