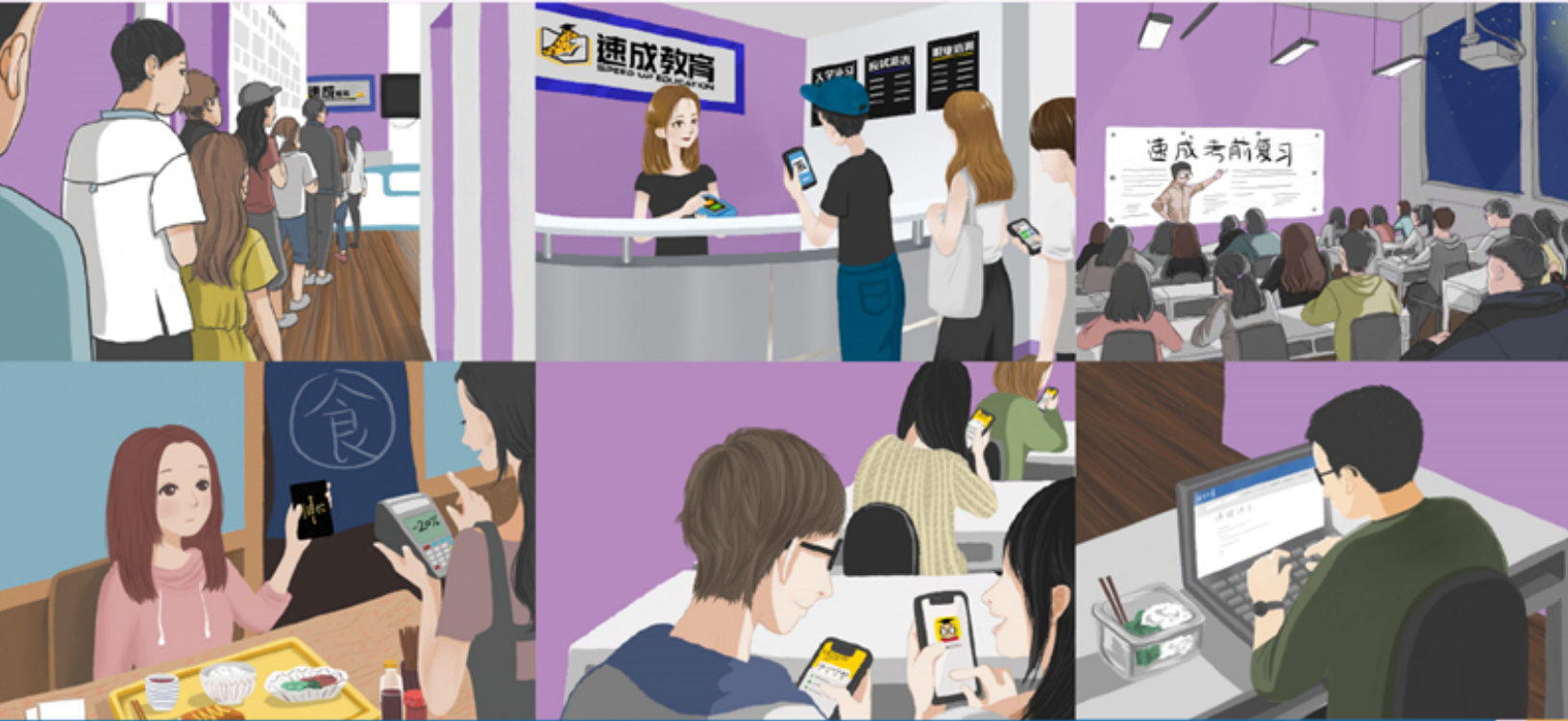# CSCB20

Introduction to Database & Web Applications

导师： **VC**

UTSC Week 02 Relational Algebra Example I | 2024/1/21

Disclaimer

This study handout is provided by Speed Up Education and its affiliated tutors. The study handout seeks to support your study process and should be used as a complement, not substitute to the university course material, lecture notes, problem, sets, past tests and other available resources.

The study handout is distributed for free to the students participating in Speed Up Education classes and is not for sale or other commercial uses whatsoever. We kindly ask you to refrain from copying or selling in part or in whole any information provided in the handout.

Thanks for choosing Speed Up Education. We wish you the best of luck in your exam.

Relational Algebra 練習

A Sample Database:

Employee

Number	Name	Age	Salary
101	Mary Smith	34	40
103	Mary Bianchi	23	35
104	Luigi Neri	38	61
105	Nico Bini	44	38
210	Marco Celli	49	60
231	Siro Bisi	50	60
252	Nico Bini	44	70
301	Steve Smith	34	70
375	Mary Smith	50	65

Supervision

Head	Emp
210	101
210	103
210	104
231	105
301	210
301	231
375	252

In fact, only the *database schema* is needed.

Employees(Number,Name,Age,Salary)
Supervision(Head,Emp)

Examples

1. "Find the numbers, names and ages of employees earning more than 40K"

2. "Find the registration numbers of the supervisors of the employees earning more than 40K."

3. "Find the names and salaries of the supervisors of the employees earning more than 40K."

4. "Find the employees earning more than their respective supervisors;
return registration numbers, names and salaries of the employees and their supervisors."

5. "Find registration numbers and names of supervisors, all of whose employees earn more than 40K."

6. "Find the employees earning **maximum** salary."

7. "Find all locations that have at **least two** employees earning more than 40K"

Example 1:

"Find the numbers, names and ages of employees earning more than 40K"

Employees(Number,Name,Age,Salary)
Supervision(Head,Emp)

Number	Name	Age
104	Luigi Neri	38
210	Marco Celli	49
231	Siro Bisi	50
252	Nico Bini	44
301	Steve Smith	34
375	Mary Smith	50

Example 2:

"Find the registration numbers of the supervisors of the employees earning more than 40K."

Employees(Number,Name,Age,Salary)
Supervision(Head,Emp)

Head
210
301
375

Number	Name	Age	Salary
101	Mary Smith	34	40
103	Mary Bianchi	23	35
104	Luigi Neri	38	61
105	Nico Bini	44	38
210	Marco Celli	49	60
231	Siro Bisi	50	60
252	Nico Bini	44	70
301	Steve Smith	34	70
375	Mary Smith	50	65

Head	Emp
210	101
210	103
210	104
231	105
301	210
301	231
375	252

Example 3:

"Find the names and salaries of the supervisors of the employees earning more than 40K."

Employees(Number,Name,Age,Salary)
Supervision(Head,Emp)

NameH	SalaryH
Marco Celli	60
Steve Smith	70
Mary Smith	65

Number	Name	Age	Salary
101	Mary Smith	34	40
103	Mary Bianchi	23	35
104	Luigi Neri	38	61
105	Nico Bini	44	38
210	Marco Celli	49	60
231	Siro Bisi	50	60
252	Nico Bini	44	70
301	Steve Smith	34	70
375	Mary Smith	50	65

Head	Emp
210	101
210	103
210	104
231	105
301	210
301	231
375	252

Example 4:

"Find the employees earning more than their respective supervisors;
return registration numbers, names and salaries of the employees and their supervisors."

Employees(Number,Name,Age,Salary)
Supervision(Head,Emp)

Number	Name	Salary	NumH	NameH	SalH
104	Luigi Neri	61	210	Marco Celli	60
252	Nico Bini	70	375	Mary Smith	65

Number	Name	Age	Salary
101	Mary Smith	34	40
103	Mary Bianchi	23	35
104	Luigi Neri	38	61
105	Nico Bini	44	38
210	Marco Celli	49	60
231	Siro Bisi	50	60
252	Nico Bini	44	70
301	Steve Smith	34	70
375	Mary Smith	50	65

Head	Emp
210	101
210	103
210	104
231	105
301	210
301	231
375	252

Example 5:

"Find registration numbers and names of supervisors, all of whose employees earn more than 40K."

Employees(Number,Name,Age,Salary)
Supervision(Head,Emp)

Number	Name
301	Steve Smith
375	Mary Smith

Number	Name	Age	Salary
101	Mary Smith	34	40
103	Mary Bianchi	23	35
104	Luigi Neri	38	61
105	Nico Bini	44	38
210	Marco Celli	49	60
231	Siro Bisi	50	60
252	Nico Bini	44	70
301	Steve Smith	34	70
375	Mary Smith	50	65

Head	Emp
210	101
210	103
210	104
231	105
301	210
301	231
375	252

Example 6:

"Find the employees earning **maximum** salary."

    Employees(Number,Name,Age,Salary)
    Supervision(Head,Emp)

Number
252
301

Number	Name	Age	Salary
101	Mary Smith	34	40
103	Mary Bianchi	23	35
104	Luigi Neri	38	61
105	Nico Bini	44	38
210	Marco Celli	49	60
231	Siro Bisi	50	60
252	Nico Bini	44	70
301	Steve Smith	34	70
375	Mary Smith	50	65

Head	Emp
210	101
210	103
210	104
231	105
301	210
301	231
375	252

Example 7:

"Find all locations that have at least two employees earning more than 40K"

Employees(Number,Name,Loc,Salary)
Supervision(Head,Emp)

Assume that in the schema we have 'Loc' instead of 'Age' for this example only.

Number	Name	Age	Salary
101	Mary Smith	34	40
103	Mary Bianchi	23	35
104	Luigi Neri	38	61
105	Nico Bini	44	38
210	Marco Celli	49	60
231	Siro Bisi	50	60
252	Nico Bini	44	70
301	Steve Smith	34	70
375	Mary Smith	50	65

Head	Emp
210	101
210	103
210	104
231	105
301	210
301	231
375	252

Helpful Tips

◆ To show "**max**" **(min)**

  ○ Pair tuples (self-join) and find those that are not the max

  ○ Then substract from all to find the max[es]

◆ To show "**k or more**":

  ○ Make all combos of k different tuples that meet the required condition

◆ To show "**exactly k**":

  ○ Find "k or more"

  ○ Find "(k+1) or more"

  ○ Then subtract "(k+1) or more" from "k or more"