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CSCI 3287

#### HW 4

**1) Using the database described in figure 1.2 (page 8 from the textbook), specify the following queries as relational algebra expressions:**

a. Retrieve the transcript—a list of all courses and grades—of ‘Smith’

i. Find ‘Smith’ in STUDENT:

1.  $\sigma_{\text{Name}='Smith'}(\text{STUDENT})$

2. ‘Smith’ is associated with Student\_number 17

ii. Join with GRADE\_REPORT to get tuples associated with ‘Smith’:

1.  $\sigma_{\text{Student\_number}=17}(\text{GRADE\_REPORT})$

iii. Join with COURSE to get Course\_number:

1.  $\sigma_{\text{Student\_number}=17}(\text{GRADE\_REPORT}) \bowtie \text{SECTION}$

iv. Join with COURSE to get Course\_name:

1.  $(\sigma_{\text{Student\_number}=17}(\text{GRADE\_REPORT}) \bowtie \text{SECTION}) \bowtie \text{COURSE}$

v. Projection: Retrieve Course\_name and Grade:

1.  $\pi_{\text{Course\_name}, \text{Grade}}((\sigma_{\text{Student\_number}=17}(\text{GRADE\_REPORT}) \bowtie \text{SECTION}) \bowtie \text{COURSE})$

b. List the names of students who took the section of the ‘Database’ course offered in fall 2008 and their grades in that section

i. Find Course\_number of ‘Database’ in COURSE:

1.  $\sigma_{\text{Course\_name}='Database'}(\text{COURSE})$

ii. Extract Course\_number (CS3380) and find any sections that match:

1.  $\sigma_{\text{Course\_number}='CS3380' \wedge \text{Semester}='Fall' \wedge \text{Year}=08}(\text{SECTION})$

iii. Extract Section\_identifier (135) and find matching students in GRADE\_REPORT:

1.  $\sigma_{\text{Section\_identifier}=135}(\text{GRADE\_REPORT})$

iv. Join with STUDENT to get Name:

1.  $(\sigma_{\text{Section\_identifier}=135}(\text{GRADE\_REPORT}) \bowtie \text{STUDENT})$

v. Projection: Retrieve Name and Grade:

1.  $\pi_{\text{Name}, \text{Grade}}(\sigma_{\text{Section\_identifier}=135}(\text{GRADE\_REPORT}) \bowtie \text{STUDENT})$

c. List the prerequisites of the ‘Database’ course

- i. Find Course\_number of 'Database' (CS3380):

1.  $\sigma_{\text{Course\_number}='CS3380'}(\text{PREREQUISITE})$

- ii. Projection to get Prerequisite\_number:

1.  $\pi_{\text{Prerequisite\_number}}(\sigma_{\text{Course\_number}='CS3380'}(\text{PREREQUISITE}))$

- d. Display the content of the RESULT relation for query “b” above

- i. Brown, A

#### STUDENT

Name	Student_number	Class	Major
Smith	17	1	CS
Brown	8	2	CS

#### COURSE

Course_name	Course_number	Credit_hours	Department
Intro to Computer Science	CS1310	4	CS
Data Structures	CS3320	4	CS
Discrete Mathematics	MATH2410	3	MATH
Database	CS3380	3	CS

#### SECTION

Section_identifier	Course_number	Semester	Year	Instructor
85	MATH2410	Fall	07	King
92	CS1310	Fall	07	Anderson
102	CS3320	Spring	08	Knuth
112	MATH2410	Fall	08	Chang
119	CS1310	Fall	08	Anderson
135	CS3380	Fall	08	Stone

#### GRADE\_REPORT

Student_number	Section_identifier	Grade
17	112	B
17	119	C
8	85	A
8	92	A
8	102	B
8	135	A

#### PREREQUISITE

Course_number	Prerequisite_number
CS3380	CS3320
CS3380	MATH2410
CS3320	CS1310

**Figure 1.2**  
A database that stores student and course information.

2) Using the database below, specify the following queries as relational algebra expressions:

a. List of products (id, name and quantity) to be delivered to stores/clients in Colorado

i. Find clients in Colorado:

1.  $\sigma_{\text{State}='CO'}(\text{CLIENT})$

ii. Extract Client\_id:

1.  $\pi_{\text{Client\_id}}(\sigma_{\text{State}='CO'}(\text{CLIENT}))$

iii. Find the invoices for these clients:

1.  $\text{INVOICE} \bowtie \pi_{\text{Client\_id}}(\sigma_{\text{State}='CO'}(\text{CLIENT}))$

iv. Extract Invoice\_number:

1.  $\pi_{\text{Invoice\_number}}(\text{INVOICE} \bowtie \pi_{\text{Client\_id}}(\sigma_{\text{State}='CO'}(\text{CLIENT})))$

v. Find the products and quantities from ITEM:

1.  $\text{ITEM} \bowtie \pi_{\text{Invoice\_number}}(\text{INVOICE} \bowtie \pi_{\text{Client\_id}}(\sigma_{\text{State}='CO'}(\text{CLIENT})))$

vi. Join with PRODUCT to get product descriptions:

1.  $(\text{ITEM} \bowtie \pi_{\text{Invoice\_number}}(\text{INVOICE} \bowtie \pi_{\text{Client\_id}}(\sigma_{\text{State}='CO'}(\text{CLIENT})))) \bowtie \text{PRODUCT}$

vii. Projection to get Product\_id, Description, and Quantity:

1.  $\pi_{\text{Product\_id}, \text{Description}, \text{Quantity}}((\text{ITEM} \bowtie \pi_{\text{Invoice\_number}}(\text{INVOICE} \bowtie \pi_{\text{Client\_id}}(\sigma_{\text{State}='CO'}(\text{CLIENT})))) \bowtie \text{PRODUCT})$

b. List product description and category name of products that are not part of any invoice

i. Find all Product\_id in ITEM:

1.  $\pi_{\text{Product\_id}}(\text{ITEM})$

ii. Find products not in invoices:

1.  $\text{PRODUCT} - \pi_{\text{Product\_id}}(\text{ITEM})$

iii. Join with CATEGORY to get Category\_name:

1.  $(\text{PRODUCT} - \pi_{\text{Product\_id}}(\text{ITEM})) \bowtie \text{CATEGORY}$

iv. Projection to get Description and Category:

1.  $\pi_{\text{Description}, \text{Category}}((\text{PRODUCT} - \pi_{\text{Product\_id}}(\text{ITEM})) \bowtie \text{CATEGORY})$

c. Total amount (quantity \* price) of all electronics listed in an invoice

i. Find Category\_id for Electronic:

1.  $\sigma_{\text{Category}='Electronic'}(\text{CATEGORY})$

ii. Extract Category\_id (1):

1.  $\pi_{\text{Category\_id}}(\sigma_{\text{Category}='Electronic'}(\text{CATEGORY}))$

iii. Find Product\_id for Electronics:

1.  $\sigma_{\text{Category}=1}(\text{PRODUCT})$

iv. Join with ITEM to get quantities:

1.  $\text{ITEM} \bowtie \sigma_{\text{Category}=1}(\text{PRODUCT})$

v. Compute Quantity \* Price:

1.  $\sum(\text{Quantity} \times \text{Price})(\pi_{\text{Quantity}, \text{Price}}(\text{ITEM} \bowtie \sigma_{\text{Category}=1}(\text{PRODUCT})))$

d. Display the content of the RESULT relation for query “c” above

i. Total\_amount =  $(3 * 250) + (10 * 900) + (10 * 250) = 750 + 9000 + 2500 =$

ii. 12250

**INVOICE**

Invoice number	Client id	Payment
1001	1	0
1002	2	800
1003	3	9000
1004	2	2500

**PRODUCT**

Product id	Description	Category	Price
10	Watch	1	250
20	Computer	1	900
30	Bike	3	1200
40	Tire	4	200
50	Database	5	88

**CATEGORY**

Category id	Category
1	Electronic
3	Sports
4	Automotive
5	Books

**ITEM**

Invoice number	Product id	Quantity
1001	10	3
1001	30	1
1002	40	4
1003	20	10
1004	10	10

**CLIENT**

Client id	Name	Address	City	State
1	S-MART	2389 Smart ln	Denver	CO
2	Have it all	123 Warehouse st	Pueblo	CO
3	Everything++	555 Storage ave	Topeka	KS