Tutorial 8

CSN-351/AID-523 Database Management Systems

1. **Pubs Database Schema**

Author (author id, f irst name, last name) *author pub* (author id, pub id, author position) *Book* (book id, book title, month, year, editor) *Pub* (pub id, title, book id)

- author id in author pub is a foreign key referencing author
- pub id in author pub is a foreign key referencing pub
- book id in pub is a foreign key referencing book
- editor in book is a foreign key referencing author(author id)
- Primary keys are underlined

r(author)

author_id	first_name	last_name
1	John	McCarthy
2	Dennis	Ritchie
3	Ken	Thompson
4	Claude	Shannon
5	Alan	Turing
6	Alonzo	Church
7	Perry	White
8	Moshe	Vardi
9	Roy	Batty

r(author_pub)

author_id	pub_id	author_position
1	1	1
2	2	1
3	2	2
4	3	1
5	4	1
5	5	1
6	6	1

r(book)

book_id	book_title	month	year	editor
1	CACM	April	1960	8
2	CACM	July	1974	8
3	BST	July	1948	2
4	LMS	November	1936	7
5	Mind	October	1950	NULL
6	AMS	Month	1941	NULL
7	AAAI	July	2012	9
8	NIPS	July	2012	9

r(pub)

pub_id	title	book_id
1	LISP	1
2	Unix	2
3	Info Theory	3
4	Turing Machines	4
5	Turing Test	5
6	Lambda Calculus	6

How many tuples will be returned by the following relational algebra query?

$$\pi_{book\_title}(book)$$

What question does the following expression answer?

$$|\pi_{author\_id}(author) - \pi_{editor}(book)|$$

Write a relational algebra expression that returns the names of all authors who are book editors.

Write a relational algebra expression that returns the names of all authors who are not book editors.

Write a relational algebra expression that returns the names of all authors who have at least one publication in the database.

How many tuples are returned by the following relational algebra expression?

$$author \bowtie_{author\_id=editor} book$$

What question does the following relational algebra expression answer?

$$author * (author\_pub * (\sigma_{month='July'}(book) * pub))$$

2.Consider the following relations P(X,Y,Z) ; Q(X,Y,T) and R(V,Y)

P

X	Y	Z
X1	Y1	Z1
X1	Y1	Z2
X2	Y2	Z2
X2	Y4	Z4

Q

X	Y	T
X2	Y1	2
X1	Y2	5
X1	Y1	6
X3	Y3	1

R

Y	V
Y1	V1
Y3	V2
Y2	V3
Y2	V2

How many tuples will be returned by the following relational algebra query?

$$\prod_X(\sigma_{(P.Y=R.Y \wedge R.V=V2)}(P \times R)) - \prod_X(\sigma_{(Q.Y=R.Y \wedge Q.T>2)}(Q \times R))$$

3. Consider two relations R1(A, B) with the tuples (1, 5), (3, 7) and R2(A, C) = (1, 7), (4, 9). Assume that R(A,B,C) is the full naturalouter join of R1 and R2. Consider the following tuples of the form (A,B,C)
a = (1, 5, null); b = (1, null, 7) ; c = (3, null, 9) ; d = (4, 7,null); e = (1, 5, 7) ; f = (3, 7, null) ; g = (4, null, 9).
Which one of the following statements is correct?
(A) R contains a, b, e, f, g but not c, d
(B) R contains a, b, c, d, e, f, g

(C) R contains e, f, g but not a, b
(D) R contains e but not f, g

4. Consider the relational schema given below, where eId of the relation Dependent is a foreign key referring to empId of the relation Employee. Assume that every employee has at least one associated dependent in the Dependent relation.
Employee (empId, empName, empAge)
Dependent (depId, eId, depName, depAge)
Write a relational algebra query which returns the set of $empId_s$ of employees whose age is greater than that of all of his/her dependents.

5. Consider the following relational database schema consisting of the four relation schemas:
passenger (pid, pname, pgender, pcity)
agency (aid, aname, acity)
flight (fid, fdate, time, src, dest)
booking (pid, aid, fid, fdate)
Answer the following questions using relational algebra queries;
a. Get the details of flights that are scheduled on either of the dates 01/12/2020 or 02/12/2020 or both at 16:00 hours.
b. Find the agency names for agencies who do not have any bookings for passenger with id 123.
c. Find the passenger names for those who do not have any bookings in any flights.

6. What is the optimized version of the relation algebra expression $\pi A1(\pi A2\ (\sigma F1\ (\sigma F2(r))))$, where A1, A2 are sets of attributes in r with $A1 \subset A2$ and F1, F2 are Boolean expressions based on the attributes in r?
a. $\pi A1(\ \sigma(F1 \wedge F2)(r))$
b. $\pi A1(\ \sigma(F1 \vee F2)(r))$
c. $\pi A2(\ \sigma(F1 \wedge F2)(r))$
d. $\pi A2(\ \sigma(F1 \vee F2)(r))$