Chapter-3 (Relational Algebra and SQL) The relational algebra: The relational objection The nelational algobra fundamental operation in nelational algebra \bigoplus Unary relational operator : select Project Hiera Migdl 20 union, set intensection, set difference, contesia (\mathcal{X}) product, Assignment, Division operatorial moject (71) -> Umagy chenaling Natural join Union (U) -> Binny Aggnegation Ber gilleneus K- Boundary +55 Θ sel companison Carterian product (x) -> Binoup · Rename (P) -> unocy coeriodon. Cherif eperchan which eperche co one relation. Bineary openation - which openede on points

The additional openation.

Sert intersection (a) > circosy operators

Necland join (Lay) > circosy operators

Nichand join (Lay) > circosy

Division operators (...) > circosy

Division operators (...)

The nelational algebra: The nelational algebra
is a procedural query language. The consists of a
Set of operations that takes one on two
nelations as input and produce a new nelation
as their nesult.

Fundamental relation operation in relational algebra:

day who day

3 Set companison

Soleet (6), it unary operator desired to marginely desired to marginely desired to marginely desired to marginely desired to the marginely desired to the de

Set differences Binary

Cartersian product $(x) \rightarrow Binovy$ Rename $(P) \rightarrow unavy operator.$

Binary operator - which operate on one relation.

Binary operator - which operate on points.

The additional openation:

Set intersection $(n) \rightarrow Binary$ operator Assignment operator $(=) \rightarrow Binary$ operator Natural join $(Ma) \rightarrow Binary$ Division operator $(\div) \rightarrow Binary$

```
outen join fleft outen join (IX)
          Fright outen join (DI)
  Him with Full briden join ( 12) har both with 12
unary relational operation: Its SELECT (symbol: 6 (sigma))
                        田 PROJECT (Symbol: 不 (Pi))
The select operation: The select operation selects tuples that
 Satisfy a given predicate. Donated by sigma (6)
       syntan: 6p(10) p= priedicate leondition
              : 6 condition (Meleation) OR Selection_chitenia (Input)
                                                    nelation
   Comparison openaton ( = ( + > >)
                                                      instance
   connections And In) or (U), NOT 17
En: 1) To solect those tuples of the instructure melation where
  the instructor is in the physics department,
       6 dept-name = 'physics' (instructor)
```

(3 show the instrinction raine) solvey travilles) (2) To find all instauctors with salary greater than \$90,000

SALARY

I raine saley It saley in the control as tou (instituction) 6 salony > 90000 (instructor)

3 solvet the instructors in physics with instruction lid, name, dept-name, a salary greater than \$90,000 (and (A), or (V) and not (-1))

6 dept_name = "physics" A Salary > 90000 (instruction)

Table

Sorlary) department (dept_name, building, budge Section (counse_id, sec_id, servesten year, building, noom number, time_slot_id) Heacher IJD, course_id, Sec_id, semester, year)

The project operation: The project operation is a unary operation that neturns its argument nelation, with centain attributes, left out as materials landings promu

Projection is denoted by uppercase brucek letter pila)

To the mesult, the duplicate mous are eliminated

Symtan: Tattributes, otheributes 2, ____ (Relation)

En: O show the ID, name, salary

TID, name, salony (instructory)

@ show the all instructor mame who are take the liphysics iphysics
transmitsuph surely gate of information gal

Trame (6 dept-pame = rphysics" (instructor))

(3) show the instructor name, salony, tarliox)

regard treaten towns Trame, salony, 11 salony * 104 100) as tan (instructor)

O To list each employee's first and last name consider and notice to the and salary, TINAME, FNAME, SALARY

ontrounce "physics" y supply sooca (institutes)

Rename operators the metal at the first books algebra enprossions a name. Denoted by sneek openation who (P), feet, a unico apenatan nua to be valid me maquine Pr (E) = Prin, A2, --- An) (E) had additional algebra.

Relational algebra.

Relational algebra.

Relational algebra.

Princession

Relation name

enpricession

additional algebra. Enample: > SlastName, socsocNo (Employee) output schema: Answer (LastName, SocsocNo) consister, the spring and series eter. [changes the schema not he oteon of cours of the part is course the fall across to cost of 1) 60001 25 19 (Semos) 61 - 11 CM " V Jews - 2003 (SC CHOW)) 0105 Buruder au in publing example ma de top 39, put au 4 I competed (securestan = "stainth whe out = non (seather))

ment 14 (Crosson = Fall Nyeon 2-13 (section)) V Mount of (comment

- The union operator: It is a set of all objects that are member of A on B on both
- -> Duplicated row are eliminated, It is a binary operation.
- => denoted by my U
- => Syntan: Teodlumn (Relation-1) U Teolumn (Relation-2)
- For, a union openation RUS to be valid, we require that two conditions hold:
- 1) The melations mand s must be of the name ority.

 That is they must have the same number of attributes.
- 3) The domains of the ith attribute of 11 and the ith attribute of 5 must be the same.
- [Fn:] () Consider a guery to find the not of all courses taight in the Fall 2009 semester, the oping 2010 semester.
 - Teourise id (Gemesten = "Fall" 1 year 2009 (Seetion))
 - > To find the set of our counses tought in the spring 2010 semeston,

Tourse_id (Semester = "spring" 1 year = 2010 (section))

output;

Theourse_id (Germester = "Fall" Nyeron = 2009 (Section)) U Teourse id (Seemester = "spring" nyeron = 2010 (Section))

- 504-Intensection openation: It is a set of all objects that are a member of both A and B.

 The denoted by Minimum (Relation-1) 1) A column (Relation-2)
- [Fn] To find the set of bull courses taught in both the Fall 2009 and the spring 2010 semesters.
- Teourse-id (Geneston = "Fall" Nyear = 2009 (section)) nT course-id (Geneston Spring' Nyear 2016 (Section))
- En Find all the counses taught in the tall 2009 semesters but not in spring 2010 semesters.
- Output Tourse-id (Gemester = "FALL" Nyear = 2009 (section) Theourse-id (Semester = "SPRING" Nyear = 2010)

 (Section)

 (Section)

ing -> ha potousa 4

Contosia - Product opro operatori

> Denoted by a cross (x)

=> allows us to combine information from any

as RIXRED US pringe of bord end 194

Ex: Find the teachen name and course-id who taken course in CSE department.

Thame, course-id (Sinstitucton.id = teach es.id (Gdopt-name)

- 105E1 (instructon x teacher))

Assignment operation: A nelational operation algebra
enpression by assigning parts of it to temponary
relation variables.

The assignment openation works like assignment (moiting) in a programming language

> Denoted by + on =

To illustrate this operator, consider the definition of natural join operation.

We could write MMS as

temp 1
RXS

temp 2
GA, = S.A. AN p.A. = S.A. A. A. -- A p. A. = S. A. (temp 1)

result = Trus (temp 2)

there is at least common admission that exists

Division operator: The division operatoritis used for queries which involved the socialis and level exhibition

> Denoted by : sign

Represented by R1/Roman R1 in R2 where R1 and R2 are melations.

En: Retrieve the name of the subject that is taught in all eoursess.

Name	counse
System	Betch
Database	Mtoch
Database	Blech
Algebra	Btech

11/1

	Counse	
	Betch	
` [Htech	

dipartin .

outpid: RJ + Re

Name dotabase

Can write R h + 3 as of nothing in the reilion. temp 1 + TR-s (h) bus could family the HM 3 at temp 2 (TR-s (Hemps x5) - TR-s, 6-(10)) of a - of mosult = temp1 - temp3 he - no -> 2 gmil

(equal) Evax Elvery Natural join (M): Natural join can be performed if there is at least one common attribute that exists between it two molation of milital and instance milital

> The attributes must have the same name and domain angie : gd bollmod to

denoted by the join symbol with botomany

> Natural join is the inner join.

Syntan: Reminer Rem Hosique out to some out systems in

natural join = enoss product + condition

(1. gmg/-)

En:
$$\rho = \Lambda$$
 B

 $\times \gamma$
 $\times \gamma$

[Em] Instructor table

JD	Name	Dept-name	salary (k)	1110 -110
1010101	white x	CSE SINAL M	56	
10102	Υ	FEE	60	
10103	2	CSFS	67	

Teaches table

Jo	Course nam _id	sec_id	semester
10101	CSE-2423	A	4
10102	EFE - 1221	В	1

instructor x teaches is (2 Mg) into their

bassel .	id	name	dept_name	Salay (K)	Course	Sec	Semesten.
latt.	10101	×	ese.	56	CSE_2423	A	4
	10102	Υ	EE	60	EEE_1221	В	

En: Find the names of all Instructions together with the counse-id of all courses they taught".

Trame, course id (instructor & teaches)

Left Outer Join(R → S):

Instructor > Teaches

ld	Name	Dept_na me	Salary(k)	course_i d	sec_id	semeste r	year
10101	Salam	CSE	56	CSE-24 23	Α	4	2022
10102	Rafiq	EEE	65	EEE-12 21	В	1	2022
10103	Jabbor	CSE	67				

Right Outer Join(R X S):

Instructor M Teaches

ld	Name	Dept_ name	Salary (k)	cours e_id	ld	cours e_id	sec_id	seme ster	year
10101	Salam	CSE	56	CSE- 2423	10101	CSE- 2423	Α	4	2022
10102	Rafiq	EEE	65	EEE-1 221	10102	EEE-1 221	В	1	2022

Full Outer Join: (R M S)

Instructor M Teaches

ld	Name	Dept_ name	Salary (k)	cours e_id	ld	cours e_id	sec_id	seme ster	year
10101	Salam	CSE	56	CSE- 2423	10101	CSE- 2423	Α	4	2022
10102	Rafiq	EEE	65	EEE-1 221	10102	EEE-1 221	В	1	2022
10103	Jabbo r	CSE	67	4					



Theta join: => A join involves a priedicate

=> RI IXIDR2 = OB (RIXR2) [B can be any Condition]

(a) Pa patour y 1 by uniported pt (a)

Eq-join: Equijoin is a special care of conditional join where only equality condition holds between a pain of attributes

> A thota join where o is an equality

PRIIXIA=BR2 = GA=B (RIXR2) minimum

=> En: Employ ee IXI SSN=SSN Dependents

Semijoin: RIXIS = TAI, --. An (RIXIS)

where AI, --. An are the attributes in R

En: Employee IX Dependents

=> Can neurite Semijoin using projection and join:

-RDFS = TAIR MFS)

Aggregation: Aggregate function take or collection of values and motumn a single value as a nesult

Hygregate operation & I denoted by G)

which permits the use of aggregate functions

such as min on average, on sets of Values.

some aggregate function are sum, arg, man, min, count, months to some horage A a niving and

angio avoringe value blad willham philosop place

min: minimum Value a gradu de mont of a

max: maximum Value

Sum: Sum of Values

Semijoin: RIXIS TO TOUR COTE THE COTE THE CONTRIBUTED AT THE COTE THE COTE

Syntan: (grouping-attributes) G, (function_list) (R)

Ex: Find the number of the salary from instruction table.

& G sum(salary) (instructory)

cepdate:

回

G1, G2 -- Gn G F1(A1); F2 (A2 -- Fn (An) (E) 31 gmm)

Eis any relational algebra expression

(can be empty)

=> Each F, is an organizate function

=> Each Ai is an attribute name

Insent: Enample- Add an instruction, Bonkhot is an instruction table realowy in 54k and he also take course where course where course idde: - COTE-1224, sec-id-2, somethon. 2, year = 2020

Traches + } [Instruction U ? ("Bonkhot", 54)) 100 His
Teaches + } [Instruction_id, " CSE-12241, 2, 2, 2023)

* Aname, course, id (cinstructor, id = leacher, id (court nesser)

(((Madayat Kurdru atam)

Deloto: (9) (10) andon 12 () a dad in the - proposition Example: Delete all the course which are teach on 2019

=> Teaches - Teaches - Gyeon = 2019 (Teachen)

update:

Example: salony of out instruction over 55K increase 7% wheneas all other neceive 5%

Instruction (Mid, pame, dept-name, salary 1.07 (Salary) = 55 (Instructor))

U Tid, name, dept-name, salary * 1.07 (salary <55 (Instructor))

View: Create à View name as Equety enpression) Example: Find the teacher name and course id

who are taken counse in CSE department. Create view

ell est dept - instruction. I intomit in bli- line sunt vit

=> Thame, course-id (Sinstructorid = teacher.id (Stept_name = "CSE" (instructor x teachery))

Insent into view:

Tid, name, dept_name (Instructor)

Insert into dept_short details view:

dept_short details \ dept_ short_details U? (1941, 2)

set comparison: set comparison sql

 \rightarrow \some, \= some, \some, \= some, = some and \> some \rightarrow \lambda all, \= all, \= all and \> all

Frample: Find the name of out branches that have assets greated than those of at located one branch of located at chittogong'

Select

branch_name

-from branch

where

assets) some (select assets

-from branch

whene branch-city = 1 chittagong