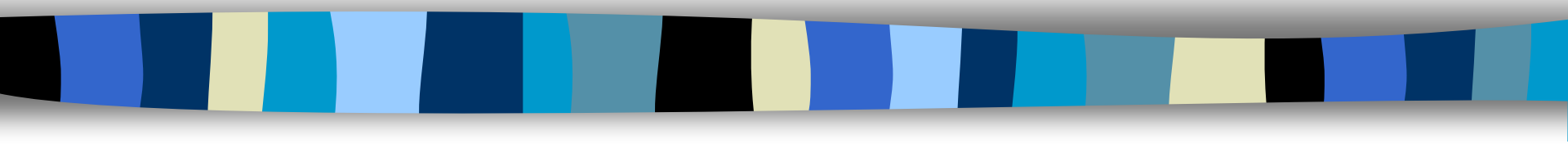
Lecture 4



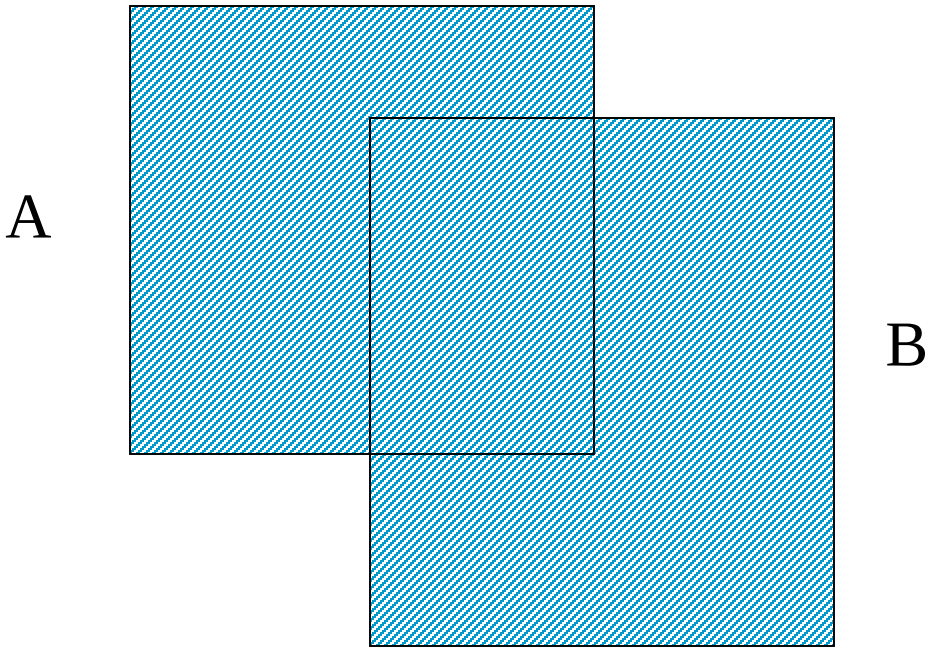
Introduction to Relational Algebra - 1

What is Relational Algebra?

- Operators
  - Relational Algebra consists of eight operators:
    - Four traditional set operators: **UNION**, **INTERSECTION**, **DIFFERENCE**, **CARTESIAN PRODUCT**
    - Four special relational operators: **RESTRICTION**, **PROJECTION**, **JOIN**, **DIVISION**
- Operands
  - Relations are the operands used in Relational Algebra
- Closure property of Relations
  - output from some relational operator is always a relation.

Traditional Set Operators

- UNION
  - the union of two type-compatible relations A and B (A UNION B) is a relation with the same heading as each of A and B and with a body consisting of the set of all tuples belonging to A and B.
  - relations must have same heading
  - same tuples are included once



Traditional Set Operators

- UNION
  - Returns a relation consisting of all tuples appearing in either or both relations

A

ID	Name	Age	Department	NIC
S1	Ahmad	23	Sales	245-77-245367
S2	Salman	34	Marketing	234-66-245368
S4	Tariq	29	Admin	245-71-325370

B

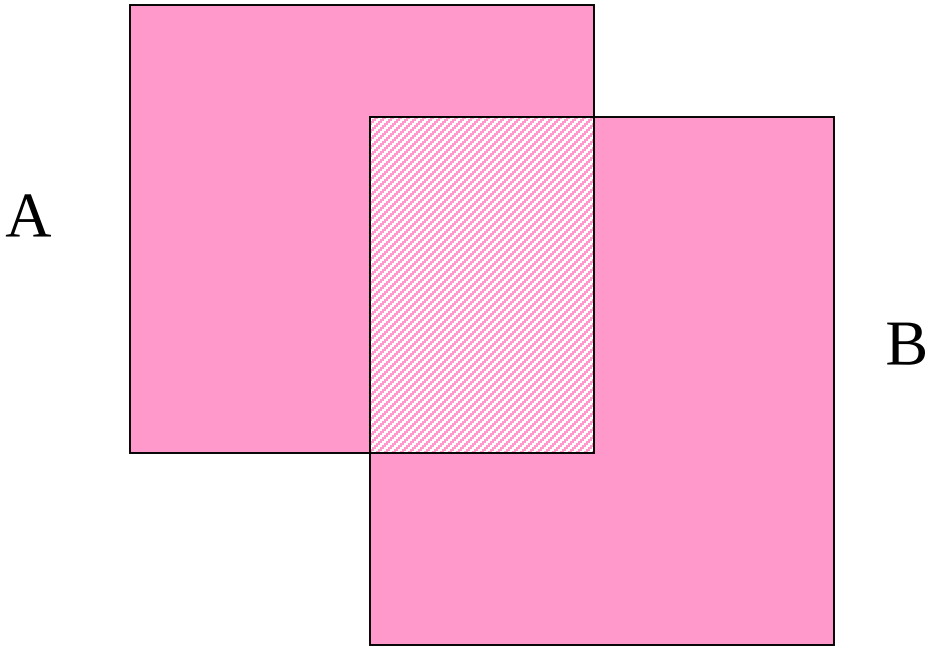
ID	Name	Age	Department	NIC
S3	Karim	21	Sales	255-79-256369
S4	Tariq	29	Admin	245-71-325370
S5	Sadiq	32	Sales	245-68-345371

A UNION B

ID	Name	Age	Department	NIC
S1	Ahmad	23	Sales	245-77-245367
S2	Salman	34	Marketing	234-66-245368
S3	Karim	21	Sales	255-79-256369
S4	Tariq	29	Admin	245-71-325370
S5	Sadiq	32	Sales	245-68-345371

Traditional Set Operators

- INTERSECTION
  - the intersection of two type-compatible relations A and B (A INTERSECT B) is a relation with the same heading as each of A and B and with a body consisting of the set of all tuples belonging to both A and B.
  - relations must have same heading



Traditional Set Operators

- INTERSECTION
  - Returns a relation consisting of all tuples appearing in both of two specified relations

A

ID	Name	Age	Department	NIC
S1	Ahmad	23	Sales	245-77-245367
S2	Salman	34	Marketing	234-66-245368
S4	Tariq	29	Admin	245-71-325370

B

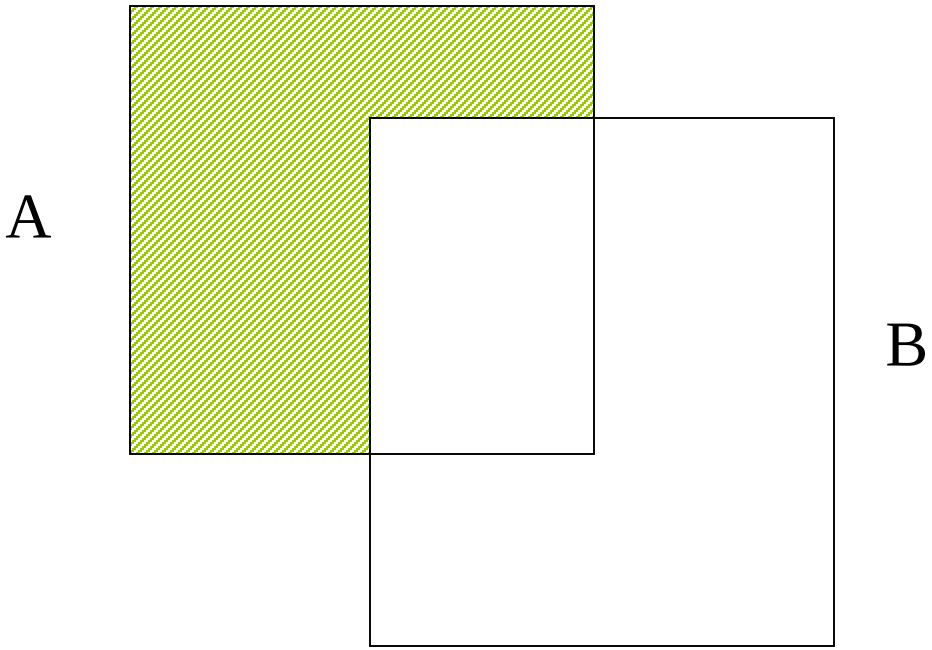
ID	Name	Age	Department	NIC
S3	Karim	21	Sales	255-79-256369
S4	Tariq	29	Admin	245-71-325370
S5	Sadiq	32	Sales	245-68-345371

A INTERSECT B

ID	Name	Age	Department	NIC
S4	Tariq	29	Admin	245-71-325370

Traditional Set Operators

- DIFFERENCE
  - the difference between two type-compatible relations A and B, in that order (A MINUS B) is a relation with the same heading as each of A and B and with a body consisting of the set of all tuples belonging to A and not to B.
  - relations must have same heading
  - direction of operation does matter



Traditional Set Operators

- DIFFERENCE
  - Returns a relation consisting of all tuples appearing in the first and not in the second of two specified relations

A

ID	Name	Age	Department	NIC
S1	Ahmad	23	Sales	245-77-245367
S2	Salman	34	Marketing	234-66-245368
S4	Tariq	29	Admin	245-71-325370

B

ID	Name	Age	Department	NIC
S3	Karim	21	Sales	255-79-256369
S4	Tariq	29	Admin	245-71-325370
S5	Sadiq	32	Sales	245-68-345371

A MINUS B

ID	Name	Age	Department	NIC
S1	Ahmad	23	Sales	245-77-245367
S2	Salman	34	Marketing	234-66-245368

B MINUS A

ID	Name	Age	Department	NIC
S3	Karim	21	Sales	255-79-256369
S5	Sadiq	32	Sales	245-68-345371

Traditional Set Operators

- PRODUCT (CARTESIAN PRODUCT)
  - the product of two relations A and B with no common attribute, (A TIMES B) is a relation with a same heading as set of all attributes in each of A and B and with a body consisting of the set of all tuples such that each resulting tuple is combination of a tuple from A and a tuple from B.
  - Cardinality of resulting relation is equal to the product of the cardinalities of A and B.
  - Degree of resulting relation is equal to the sum of the degrees of A and B.
- **Returns a relation consisting of all possible tuples that are a combination of two tuples, one from each of two specified relations.**

Traditional Set Operators

- PRODUCT (CARTESIAN PRODUCT)

A

ID	Name	Age
S1	Ahmad	23
S2	Salman	34
S4	Tariq	29

B

Department	NIC
Sales	255-79-256369
Admin	245-71-325370
Sales	245-68-345371

A TIMES B

ID	Name	Age	Department	NIC
S1	Ahmad	23	Sales	255-79-256369
S1	Ahmad	23	Admin	245-71-325370
S1	Ahmad	23	Sales	245-68-345371
S2	Salman	34	Sales	255-79-256369
S2	Salman	34	Admin	245-71-325370
S2	Salman	34	Sales	245-68-345371
S4	Tariq	29	Sales	255-79-256369
S4	Tariq	29	Admin	245-71-325370
S4	Tariq	29	Sales	245-68-345371

Quiz # 1

ID	LAST_NAME	FIRST_NAME	USERID	SALARY
1	Patel	Ralph	rpatel	795
2	Dancs	Betty	bdancs	860
3	Biri	Ben	bbiri	1100
4	Newman	Chad	cnewman	750
5	Ropeburn	Audry	aropebur	1550

- Q1: Identify the possible candidate keys in the given relation?
- Q2: There are 4 candidate keys identified in a relation each having 12 elements. What would be the cardinality of the relation. Also write the lowest possible value of degree for that relation.
- Q3: Explain meaning of RESTRICTED and CASCADE in case of update for a foreign key.
- Q4: Give an example of repeating group from keeping in view the relation given above.