MONASH University

Information Technology

FIT2094 Databases

Week 2 – Relational Model

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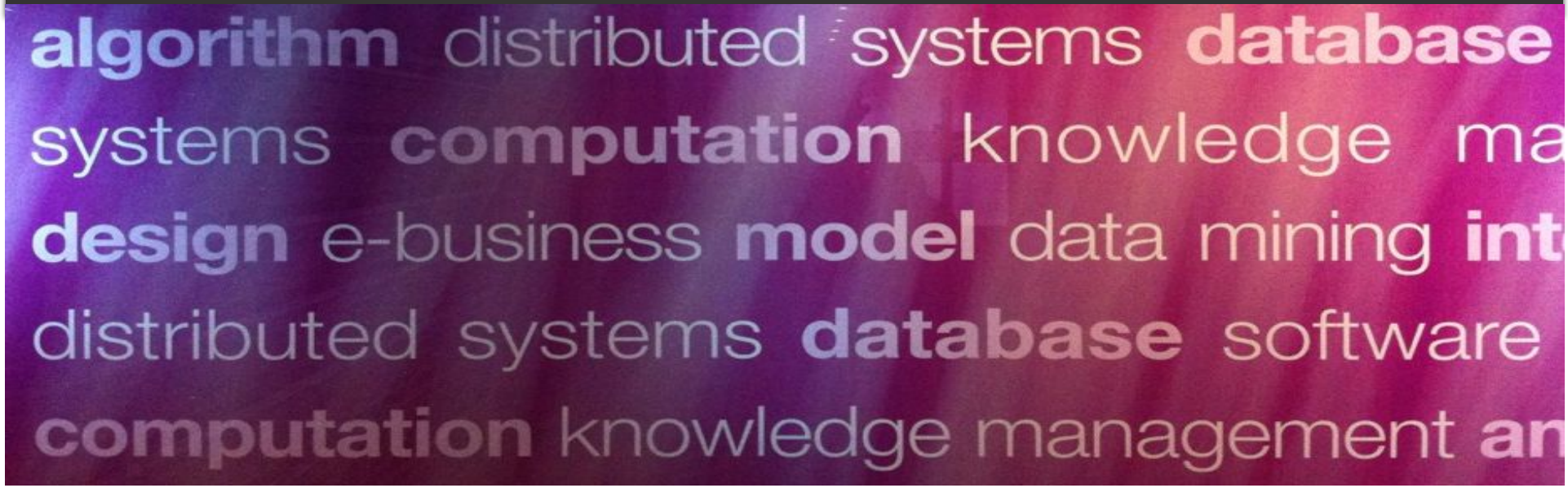

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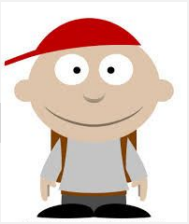

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3. Touch the + symbol
4. Enter the code for your unit: F5CQAT
5. Answer questions when they pop up.

Agenda

- Data Redundancy
  - The motivation behind introducing the relational model
- Relational Model
- Relational Algebra

Data Anomalies

Update, Delete, Insert

PROJECT_CODE	PROJECT_MANAGER	MANAGER_PHONE	MANAGER_ADDRESS	PROJECT_BID_PRICE
21-5Z	Holly B. Parker	904-338-3416	3334 Lee Rd., Gainesville, FL 37123	$16,833,460.00
25-2D	Jane D. Grant	615-898-9909	218 Clark Blvd., Nashville, TN 36362	$12,500,000.00
25-5A	George F. Dorts	615-227-1245	124 River Dr., Franklin, TN 29185	$32,512,420.00
25-9T	Holly B. Parker	904-338-3416	3334 Lee Rd., Gainesville, FL 37123	$21,563,234.00
27-4Q	George F. Dorts	615-227-1245	124 River Dr., Franklin, TN 29185	$10,314,545.00
29-2D	Holly B. Parker	904-338-3416	3334 Lee Rd., Gainesville, FL 37123	$25,559,999.00
31-7P	William K. Moor	904-445-2719	216 Morton Rd., Stetson, FL 30155	$56,850,000.00

Q1. Assume a database contains a single table as depicted above. The table is used to record data regarding on-going projects and the project manager. Each row is uniquely identified by project_code. A project_code is assigned to a project when the project commences. A new project manager has been hired in an anticipation of a big project commencing in 2 months. What would be a problem associated with using the above table if we try to add the details of the new manager to the database?

a. There will not be enough columns to enter the data into the database.

b. The new manager cannot be added to the data as they have not been assigned a project as yet

c. There will not be enough rows to enter the data in the database.

d. None of the above

PROJECT_CODE	PROJECT_MANAGER	MANAGER_PHONE	MANAGER_ADDRESS	PROJECT_BID_PRICE
21-5Z	Holly B. Parker	904-338-3416	3334 Lee Rd., Gainesville, FL 37123	$16,833,460.00
25-2D	Jane D. Grant	615-898-9909	218 Clark Blvd., Nashville, TN 36362	$12,500,000.00
25-5A	George F. Dorts	615-227-1245	124 River Dr., Franklin, TN 29185	$32,512,420.00
25-9T	Holly B. Parker	904-338-3416	3334 Lee Rd., Gainesville, FL 37123	$21,563,234.00
27-4Q	George F. Dorts	615-227-1245	124 River Dr., Franklin, TN 29185	$10,314,545.00
29-2D	Holly B. Parker	904-338-3416	3334 Lee Rd., Gainesville, FL 37123	$25,559,999.00
31-7P	William K. Moor	904-445-2719	216 Morton Rd., Stetson, FL 30155	$56,850,000.00

Q2. Ms. Holly B. Parker needs to change her phone number. Which of the following is correct?

a. Her phone number cannot be changed unless the related project_code is also changed.

b. The project details of Holy B Parker will be deleted.

c. Records in more than one row need to be updated which may lead to data inconsistencies.

d. All rows related to her need to be deleted and reinserted with the correct phone number.

	PROJECT_CODE	PROJECT_MANAGER	MANAGER_PHONE	MANAGER_ADDRESS	PROJECT_BID_PRICE
▶	21-5Z	Holly B. Parker	904-338-3416	3334 Lee Rd., Gainesville, FL 37123	$16,833,460.00
	25-2D	Jane D. Grant	615-898-9909	218 Clark Blvd., Nashville, TN 36362	$12,500,000.00
	25-5A	George F. Dorts	615-227-1245	124 River Dr., Franklin, TN 29185	$32,512,420.00
	25-9T	Holly B. Parker	904-338-3416	3334 Lee Rd., Gainesville, FL 37123	$21,563,234.00
	27-4Q	George F. Dorts	615-227-1245	124 River Dr., Franklin, TN 29185	$10,314,545.00
	29-2D	Holly B. Parker	904-338-3416	3334 Lee Rd., Gainesville, FL 37123	$25,559,999.00
	31-7P	William K. Moor	904-445-2719	216 Morton Rd., Stetson, FL 30155	$56,850,000.00

Q3. Mr. George F. Dorts leaves the company, hence his records in the table need to be deleted. What would be the potential issue related to this deletion?

Note: a deletion involves removal of a row in the table.

a. No issue at all
b. The details of all the projects managed by Dorts will be lost.
c. The database becomes smaller.
d. All the details of Dorts will be lost.
e. None of the above.

Relational Model

The Relational Model

- Introduced by CODD in 1970 - the fundamental basis for relational DBMS's
- Basic structure is the mathematical concept of a RELATION mapped to the 'concept' of a table (tabular representation of relation)
  - Relation - abstract object
  - Table - pictorial representation
  - Storage structure - "real thing" - eg. isam file
- Relational Model Terminology
  - DOMAIN - set of atomic (indivisible) values
    - specify
      - name
      - data type
      - data format
- Examples:
  - customer_number domain - 5 character string of the form xxxdd
  - name domain - 20 character string
  - address domain - 30 character string containing street, town & postcode
  - credit_limit domain - money in the range $1,000 to $99,999

A Relation

- A relation consists of two parts
  - heading
  - body
- Relation Heading
  - Also called Relational **Schema** consists of a fixed set of attributes
    - R (A1,A2,.....An)
      - R = relation name, Ai = attribute i
  - Each attribute corresponds to one underlying domain:
    - Customer relation heading:
      - CUSTOMER (custno, custname, custadd, credlimit)
        - dom(custno) = customer_number
        - dom(custname) = name
        - dom(custadd) = address
        - dom(credlimit) = credit_limit

custno	custname	custadd	credlimit

Relation Body

- Relation Body
  - Also called Relation Instance (state)
    - r(R) = {t1, t2, t3, ..., tm}
    - consists of a time-varying set of n-tuples
      - Relation R consists of tuples t1, t2, t3 .. tm
      - m = number of tuples = relation cardinality
    - each n-tuple is an ordered list of n values
    - t = < v1, v2, ..., vn>
      - n = number of values in tuple = relation degree
  - In the tabular representation:
    - Relation heading ⇨ column headings
    - Relation body ⇨ set of data rows

custno	custname	custadd	credlimit
SMI13	SMITH	Wide Rd, Clayton, 3168	2000
JON44	JONES	Narrow St, Clayton, 3168	10000
BRO23	BROWN	Here Rd, Clayton, 3168	10000

Relation Properties

- *No duplicate tuples*
  - ➢ by definition sets do not contain duplicate elements
    - hence tuples are unique
- *Tuples are unordered within a relation*
  - ➢ by definition sets are not ordered
    - hence tuples can only be accessed by content
- *No ordering of attributes within a tuple*
  - ➢ by definition sets are not ordered

Relation Properties cont'd

- *Tuple values are atomic - cannot be divided*
  - EMPLOYEE(eid, ename, departno, dependants)
    - not allowed – dependants (depname, depage) *multivalued*

➢ hence no multivalued (repeating) attributes allowed, called the first normal form rule

- COMPARE with tabular representation
  - normally nothing to prevent duplicate rows
  - rows are ordered
  - columns are ordered

➢ tables and relations are not the same 'things'

Q4. Which of the following statements is TRUE according the characteristics of relational table?

A. All values in a column need to be from the same domain.
B. Each column needs to have a distinct name.
C. The order of attribute(column) and tuple(row) matters.
D. Each intersection of a column and a row represent a single value.
E. More than one statement is TRUE

surname	firstname	degree	DOB
Black	Sam	BBIS	02-02-1996
Brown	Jane	BITS	01-01-1995
Chen	Chan	BITS	09-02-1996
Grey	Maria	BCS	15-12-1995
Indigo	Jose	BITS	28-10-1995
Black	Jet	BCS	13-05-1996
Chen	Maria	BITS	31-08-1995

- Functional Dependency:
  - A set of attributes X functionally determines an attribute Y if, and only if, for each X value, there is exactly one Y value in the relation. It is denoted as X → Y.
- For example:
  - firstname, surname → degree
    - *but*
  - firstname → degree does not hold
  - What about: degree → firstname, surname?

surname	firstname	degree	DOB
Black	Sam	BBIS	02-02-1996
Brown	Jane	BITS	01-01-1995
Chen	Chan	BITS	09-02-1996
Grey	Maria	BCS	15-12-1995
Indigo	Jose	BITS	28-10-1995
Black	Jet	BCS	13-05-1996
Chen	Maria	BITS	31-08-1995

Q5. Which of the following statement is TRUE when the concept of **functional dependency** is applied to **the above data**?

a. surname → firstname.
b. surname, firstname → degree
c. DOB → surname
d. degree → surname
e. firstname, degree → DOB
f. surname, degree →DOB
g. options b, c and e are correct
h. options b, c, e, and f are correct

surname	firstname	degree	DOB
Black	Sam	BBIS	02-02-1996
Brown	Jane	BITS	01-01-1995
Chen	Chan	BITS	09-02-1996
Grey	Maria	BCS	15-12-1995
Indigo	Jose	BITS	28-10-1995
Black	Jet	BCS	13-05-1996
Chen	Maria	BITS	31-08-1995

- **Superkey:** A set of attributes X that uniquely identifies each row in a relation R. i.e. X → {R} where {R} represents all attributes in a relation R
  - For example: {DOB, firstname} is a superkey, DOB is also a super key
- **Candidate Key:** A **minimal** set of attributes X that uniquely identifies each row in a relation R. i.e. X → {R} **AND** for every subset Y of X, Y must not be a superkey, i.e., Y→ {R} **must not** hold
  - For example: {DOB} is a candidate key but {DOB, firstname} is not a candidate key
- **Primary Key:** There may be more than one candidate key in a table. A primary key is one of the candidate keys chosen by the designer as the primary key. There is exactly, and only, one primary key for each table.

surname	firstname	degree	DOB
Black	Sam	BBIS	02-02-1996
Brown	Jane	BITS	01-01-1995
Chen	Chan	BITS	09-02-1996
Grey	Maria	BCS	15-12-1995
Indigo	Jose	BITS	28-10-1995
Black	Jet	BCS	13-05-1996
Chen	Maria	BITS	31-08-1995

Q6. Superkey: A set of attributes X that uniquely identifies each row in a relation R. Which of the following is **not** a superkey based on the **the above data**?

a. DOB
b. DOB, degree
c. Surname, firstname
d. surname, firstname, DOB
e. surname, degree
f. All of the above are super keys
g. None of the above is a super key

surname	firstname	degree	DOB
Black	Sam	BBIS	02-02-1996
Brown	Jane	BITS	01-01-1995
Chen	Chan	BITS	09-02-1996
Grey	Maria	BCS	15-12-1995
Indigo	Jose	BITS	28-10-1995
Black	Jet	BCS	13-05-1996
Chen	Maria	BITS	31-08-1995

Q7. Candidate Key: A **minimal** set of attributes X that uniquely identifies each row in a relation R. i.e. X → {R} **AND** for any subset Y of X, Y→ {R} does not hold.

Which of the following is a candidate key based on the **the above data**?

a. DOB
b. DOB, degree
c. Surname, firstname
d. surname, firstname, DOB
e. Options a and c are candidate keys
f. Options a, b, and c are candidate keys
g. All of the above are candidate keys

surname	firstname	degree	DOB
Black	Sam	BBIS	02-02-1996
Brown	Jane	BITS	01-01-1995
Chen	Chan	BITS	09-02-1996
Grey	Maria	BCS	15-12-1995
Indigo	Jose	BITS	28-10-1995
Black	Jet	BCS	13-05-1996
Chen	Maria	BITS	31-08-1995

Q8. Candidate Key: A **minimal** set of attributes X that uniquely identifies each row in a relation R. i.e. X → {R} **AND** for any subset Y of X, Y→ {R} does not hold.

How many candidate keys are there in the table based on the **the above data**?

a. 0
b. 1
c. 2
d. 3
e. 4

surname	firstname	degree	DOB
Black	Sam	BBIS	02-02-1996
Brown	Jane	BITS	01-01-1995
Chen	Chan	BITS	09-02-1996
Grey	Maria	BCS	15-12-1995
Indigo	Jose	BITS	28-10-1995
Black	Jet	BCS	13-05-1996
Chen	Maria	BITS	31-08-1995

Q9. How many primary keys are there in the table based on the **the above data**?

a. 0
b. 1
c. 2
d. 3
e. 4

Selection of a Primary key

- **A primary key must be chosen considering the data that *may be added to the table in the future***
  - Names, dates of birth etc are rarely unique and as such are not a good option
  - PK should be free of 'extra' semantic meaning, preferably single attribute, preferably numeric (see Table 5.3 Coronel & Morris)
  - Natural vs Surrogate

stu_no	surname	firstname	degree	DOB
1111	Black	Sam	BBIS	02-02-1996
1112	Brown	Jane	BITS	01-01-1995
1113	Chen	Chan	BITS	09-02-1996
1114	Grey	Maria	BCS	15-12-1995
1115	Indigo	Jose	BITS	28-10-1995
1116	Black	Jet	BCS	13-05-1996
1117	Chen	Maria	BBIS	31-08-1995

Foreign Key (FK)

- An attribute/s in a table that exists in the same, or another table as a Primary Key.
- Referential Integrity
  - A Foreign Key value must **either** match the primary key in another table **or** be NULL.
- The pairing of PK and FK creates relationships (logical connections) between tables. Hence the abstraction away from the underlying storage model.

MANAGER

PROJECT_MANAGER	MANAGER_PHONE	MANAGER_ADDRESS
Holly B. Parker	904-338-3416	3334 Lee Rd., Gainesville, FL 37123
Jane D. Grant	615-898-9909	218 Clark Blvd., Nashville, TN 36362
George F. Dorts	615-227-1245	124 River Dr., Franklin, TN 29185
William K. Moor	904-445-2719	216 Morton Rd., Stetson, FL 30155

PROJECT

PROJECT_CODE	PROJECT_BID_PRICE
21-5Z	$16,833,460.00
25-2D	$12,500,000.00
25-5A	$32,512,420.00
25-9T	$21,563,234.00
27-4Q	$10,314,545.00
29-2D	$25,559,999.00
31-7P	$56,850,000.00

Q10. If the above two tables are to be created in a relational database, in which table would you assign the FK (and using which attribute) to create the logical link? Remember for our supplied scenario (see slide 7) a manager may manage many projects.

a. MANAGER table using project_manager attribute.
b. PROJECT table using project_code attribute.
c. MANAGER table using manager_phone attribute.
d. PROJECT table using project_manager attribute
e. None of the above, a relationship is not needed.

Data Integrity

- Entity integrity
  - Primary key values must be unique
  - Primary key value must not be NULL.
- Referential integrity
  - The values of FK must **either** match a value of the PK in the related relation **or** be NULL.
- Column/Domain integrity
  - All values in a given column must come from the same domain (the same data type and range).

MANAGER

PROJECT_MANAGER	MANAGER_PHONE	MANAGER_ADDRESS
Holly B. Parker	904-338-3416	3334 Lee Rd., Gainesville, FL 37123
Jane D. Grant	615-898-9909	218 Clark Blvd., Nashville, TN 36362
George F. Dorts	615-227-1245	124 River Dr., Franklin, TN 29185
William K. Moor	904-445-2719	216 Morton Rd., Stetson, FL 30155

PROJECT

PROJECT_CODE	PROJECT_MANAGER	PROJECT_BID_PRICE
21-5Z	Holly B. Parker	$16,833,460.00
25-2D	Jane D. Grant	$12,500,000.00
25-5A	George F. Dorts	$32,512,420.00
25-9T	Holly B. Parker	$21,563,234.00
27-4Q	George F. Dorts	$10,314,545.00
29-2D	Holly B. Parker	$25,559,999.00
31-7P	William K. Moor	$56,850,000.00

Q11. Suppose that the manager William K. Moor leaves the company and we delete his record from the manager table. Which of the following actions will satisfy the data integrity constraints?

a. The last row in PROJECT table must be deleted
b. The PROJECT_MANAGER value in the last row of PROJECT table must be set to NULL (empty)
c. The PROJECT_MANAGER value in the last row of PROJECT table must be set to any string (e.g., “XYZ”)
d. The options a and b
e. All of the above

RELATIONAL ALGEBRA

Manipulation of relational data

Relational Operation PROJECT

PROJECT_CODE	PROJECT_MANAGER	PROJECT_BID_PRICE
21-5Z	Holly B. Parker	$16,833,460.00
25-2D	Jane D. Grant	$12,500,000.00
25-5A	George F. Dorts	$32,512,420.00
25-9T	Holly B. Parker	$21,563,234.00
27-4Q	George F. Dorts	$10,314,545.00
29-2D	Holly B. Parker	$25,559,999.00
31-7P	William K. Moor	$56,850,000.00

Relational Operation SELECT

PROJECT_CODE	PROJECT_MANAGER	PROJECT_BID_PRICE
21-5Z	Holly B. Parker	$16,833,460.00
25-2D	Jane D. Grant	$12,500,000.00
25-5A	George F. Dorts	$32,512,420.00
25-9T	Holly B. Parker	$21,563,234.00
27-4Q	George F. Dorts	$10,314,545.00
29-2D	Holly B. Parker	$25,559,999.00
31-7P	William K. Moor	$56,850,000.00

Relational Operation Multiple Actions

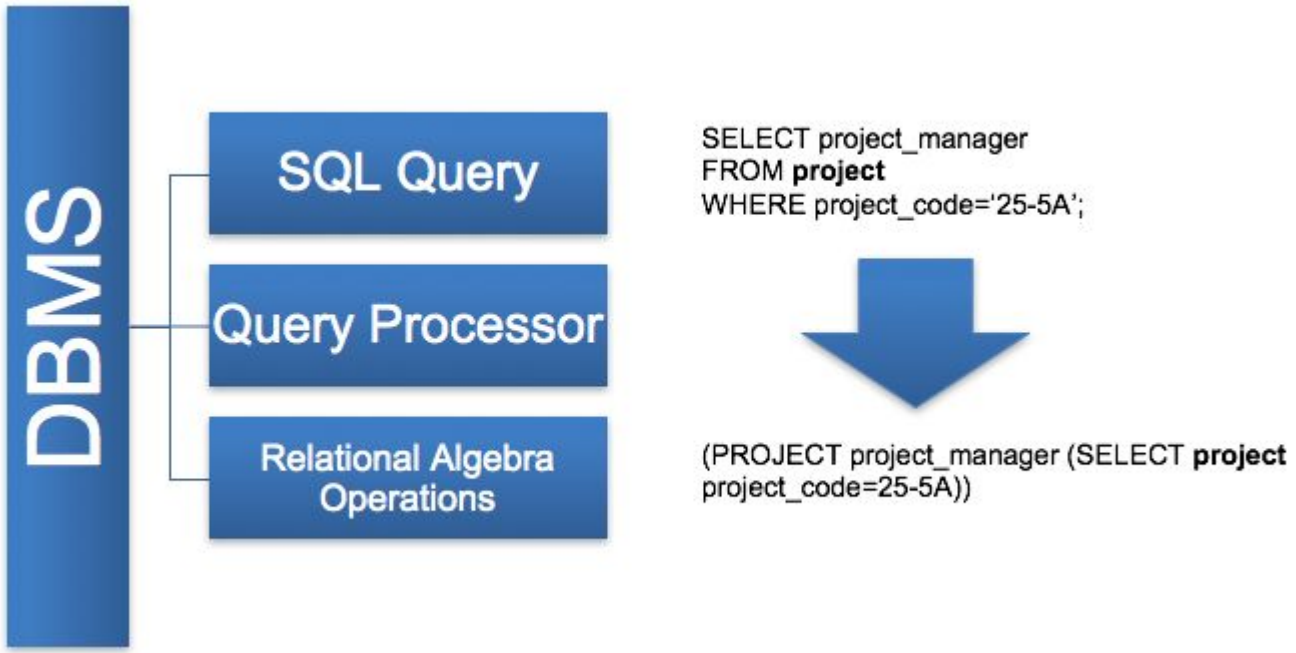
2

1

PROJECT_CODE	PROJECT_MANAGER	PROJECT_BID_PRICE
21-5Z	Holly B. Parker	$16,833,460.00
25-2D	Jane D. Grant	$12,500,000.00
25-5A	George F. Dorts	$32,512,420.00
25-9T	Holly B. Parker	$21,563,234.00
27-4Q	George F. Dorts	$10,314,545.00
29-2D	Holly B. Parker	$25,559,999.00
31-7P	William K. Moor	$56,850,000.00

Result = (PROJECT project_manager(SELECT project project_code=25-5A))

Relational Calculus (SQL) vs Relational Algebra in the Database



Notations

- Standard notations use Greek symbols

Operation	Standard Notation	Our Notation
Selection	$\sigma_{expr}(Rel)$	$Sel[expr](Rel)$
Projection	$\pi_{A,B,C}(Rel)$	$Proj[A,B,C](Rel)$
Join	$Rel_1 \bowtie_{expr} Rel_2$	$Rel_1 \ Join[expr] \ Rel_2$

STUDENT

course	name	sid
BE	Anne	21333
BE	Dave	21876
BSc	John	21531
BSc	Tim	21623

MARK

stude	subj	mark
21333	1011	74
21333	1021	70
21333	2011	68
21531	1011	94
21531	1021	90
21623	1011	50

Q12. Which of the following statements returns the student ids of the students who got more than 70 marks in the subject 1011.

a. Sel [mark > 70] (Proj [stude] (MARK))
b. Sel [mark > 70] (MARK)
c. Sel [mark > 70 AND subj = 1011] (Proj [stude] (MARK))
d. Sel [mark > 70 AND subj = 1011] (MARK)
e. Proj [stude] (Sel [mark > 70 AND subj = 1011] (MARK))

STUDENT

course	name	sid
BE	Anne	21333
BE	Dave	21876
BSc	John	21531
BSc	Tim	21623

MARK

stude	subj	mark
21333	1011	74
21333	1021	70
21333	2011	68
21531	1011	94
21531	1021	90
21623	1011	50

Q13. How many rows are generated when the product (Cartesian Product) of the STUDENT and MARK relations is taken? i.e. the number of rows in STUDENT X MARK.

a. 24
b. 6
c. 18
d. 7
e. none of the above

STUDENT

course	name	sid
BE	Anne	21333
BE	Dave	21876
BSc	John	21531
BSc	Tim	21623

MARK

stude	subj	mark
21333	1011	74
21333	1021	70
21333	2011	68
21531	1011	94
21531	1021	90
21623	1011	50

Q14. How many columns are generated when the product (Cartesian Product) of the STUDENT and MARK relations is taken? i.e. the number of columns in STUDENT X MARK.

a. 9
b. 6
c. 5
d. 7
e. none of the above

NATURAL JOIN

STUDENT

ID	Name
1	Alice
2	Bob

MARK

ID	Subj	Marks
1	1004	95
2	1045	55
1	1045	90

Step 1: STUDENT X MARK
Step 2: delete rows where IDs do not match (select =)

ID	Name	ID	Subj	Marks
1	Alice	1	1004	95
~~1~~	~~Alice~~	~~2~~	~~1045~~	~~55~~
1	Alice	1	1045	90
~~2~~	~~Bob~~	~~1~~	~~1004~~	~~95~~
2	Bob	2	1045	55
~~2~~	~~Bob~~	~~1~~	~~1045~~	~~90~~

NATURAL JOIN

STUDENT

ID	Name
1	Alice
2	Bob

MARK

ID	Subj	Marks
1	1004	95
2	1045	55
1	1045	90

Step 1: STUDENT X MARK
Step 2: delete rows where IDs do not match (select =)
Step 3: delete duplicate columns (project away)

ID	Name	ID	Subj	Marks
1	Alice	1	1004	95
1	Alice	1	1045	90
2	Bob	2	1045	55

NATURAL JOIN

STUDENT

ID	Name
1	Alice
2	Bob

MARK

ID	Subj	Marks
1	1004	95
2	1045	55
1	1045	90

Step 1: STUDENT X MARK
Step 2: delete rows where IDs do not match (select =)
Step 3: delete duplicate columns (project away)

ID	Name	Subj	Marks
1	Alice	1004	95
1	Alice	1045	90
2	Bob	1045	55

A natural join of STUDENT and MARK

STUDENT

course	name	sid
BE	Anne	21333
BE	Dave	21876
BSc	John	21531
BSc	Tim	21623

MARK

stude	subj	mark
21333	1011	74
21333	1021	70
21333	2011	68
21531	1011	94
21531	1021	90
21623	1011	50

Q15. Which of the following statements returns a natural join of the two relations on the student ids (sid and stude)?

a. Sel [sid = stude] (STUDENT X MARK)
b. Proj [course, name, sid, subj, mark] (Sel [sid = stude] (STUDENT X MARK)
c. Sel [sid = stude] (Proj [course, name, sid, subj, mark](STUDENT X MARK))
d. All of the above
e. None of the above

STUDENT

ID	Name
1	Alice
2	Bob
3	Chris

MARK

ID	Subj	Marks
1	1004	95
2	1045	55
1	1045	90
4	1004	100

Q16. Assume "R join S" denotes a natural join of relations R and S. Which of the following statements returns names and subject codes for which the students got more than 70 marks in the subject.

a. Sel [Marks > 70] (STUDENT join MARK)
b. Proj [Name, subj] (Sel [Marks > 70] (STUDENT join MARK))
c. Proj [Name, subj] (STUDENT join MARK)
d. None of the above

OUTER JOIN

STUDENT

ID	Name
1	Alice
2	Bob
3	Chris

MARK

ID	Subj	Marks
1	1004	95
2	1045	55
1	1045	90
4	1004	100

No information for Chris and the student with ID 4

ID	Name	Subj	Marks
1	Alice	1004	95
1	Alice	1045	90
2	Bob	1045	55

A natural join of STUDENT and MARK

FULL OUTER JOIN

STUDENT

ID	Name
1	Alice
2	Bob
3	Chris

MARK

ID	Subj	Marks
1	1004	95
2	1045	55
1	1045	90
4	1004	100

Get (incomplete) information of both Chris and student with ID 4

ID	Name	Subj	Marks
1	Alice	1004	95
1	Alice	1045	90
2	Bob	1045	55
3	Chris	Null	Null
4	Null	1004	100

A full outer join of STUDENT and MARK

LEFT OUTER JOIN

STUDENT

ID	Name
1	Alice
2	Bob
3	Chris

MARK

ID	Subj	Marks
1	1004	95
2	1045	55
1	1045	90
4	1004	100

Get (incomplete) information of only Chris

ID	Name	Subj	Marks
1	Alice	1004	95
1	Alice	1045	90
2	Bob	1045	55
3	Chris	Null	Null

A left outer join of STUDENT and MARK

RIGHT OUTER JOIN

STUDENT

ID	Name
1	Alice
2	Bob
3	Chris

MARK

ID	Subj	Marks
1	1004	95
2	1045	55
1	1045	90
4	1004	100

Get (incomplete) information of the student with ID 4

ID	Name	Subj	Marks
1	Alice	1004	95
1	Alice	1045	90
2	Bob	1045	55
4	Null	1004	100

A right outer join of STUDENT and MARK

STUDENT

course	name	sid
BE	Anne	21333
BE	Dave	21876
BSc	John	21531
BSc	Tim	21623

MARK

stude	subj	mark
21333	1011	74
21333	1021	70
21333	2011	68
21531	1011	94
21531	1021	90
21623	1011	50

Q17. Consider the above relations and assume that we want to join the them to obtain the information of all students (Anne, Dave, John and Tim). Which of the following is **not** a correct approach?

a. Left outer join on STUDENT and MARK
b. Right outer join on MARK and STUDENT
c. Right outer join on STUDENT and MARK
d. Full outer join on STUDENT and MARK
e. B and C are incorrect
f. B, C and D are incorrect