

Database Management System: Assignment 1

Total Marks : 20

June 7, 2022

Question 1

Consider the following table:

student				
student_roll	name	dept_code	dept_name	project_group
CS121	Rohit	D01	CSE	Image Processing
CS432	Sidra	D03	IT	Computer Architecture
CS432	Sidra	D03	IT	Ethical Hacking
CS133	Reeta	D02	ECE	Signal Processing
CS133	Reeta	D02	ECE	Image Processing
EE134	Rina	D04	EE	Image Processing

Identify the correct statement(s).

Mark:2 MCQ

- a) The above table is an example of an instance of relation **student**.
- b) The above table is an example of a logical schema of relation **student**.
- c) The above table is an example of a physical schema of relation **student**.
- d) The above table is an example of an abstraction of relation **student**.

Answer: a)

Explanation: The above table is an example of instances of relation **student**. Hence, option a) is correct.

Question 2

A relation R has 2 candidate keys with 1 and 2 attributes respectively. There are 40 super keys of R. What is the total number of attributes in R? *Marks: 2 MCQ*

- a) 3
- b) 4
- c) 5
- d) 6

Answer: d)

Explanation: A relation R with n attributes and 2 candidate keys having 1 and 2 attributes respectively, has $K = 2^{(n-1)} + 2^{(n-2)} - 2^{(n-3)}$ superkeys. Here, $K = 40$ So, $n = 6$. Hence, option (d) is correct.

Question 3

Consider the following instances:

QB1		QB2	
Q	Ans	Q	Ans
1	x	1	x
2	y	1	y
3	y	2	y

Which of the following relational operations will produce the following tuple only?

3	y	1	y
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Marks: 2 MCQ

- a) $(QB1 \cup QB2) \times (QB2 \cup QB1)$
- b) $(QB1 - QB2) \cap (QB2 - QB1)$
- c) $(QB1 - QB2) \times (QB2 - QB1)$
- d) $(QB1 \cap QB2) - (QB2 \cap QB1)$

Answer: c)

Explanation: $(QB1 - QB2)$ produces $\langle 3, y \rangle$. $(QB2 - QB1)$ produces $\langle 1, y \rangle$. Only a Cartesian product between the two will produce

3	y	1	y
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. Hence, option (c) is correct.

Question 4

Consider the following instance of `CelestialReport(CelestialObject, ReportBy, ReportScore, GroupLead)`.

<u>CelestialObject</u>	ReportBy	ReportScore	GroupLead
Pluto	Team 5	90	L. Kurtz
Jupiter	Team 5	88	L. Kurtz
Sirius A	Team 1	96	Samuel
Rigel	Team 8	96	Louie

Which of the following is a Secondary Key in `CelestialReport`?

Marks: 2 MSQ

- a) {ReportBy, ReportScore}.
- b) {ReportBy, GroupLead}.
- c) {GroupLead, CelestialObject}.
- d) {ReportScore, GroupLead}.

Answer: a), d)

Explanation: A secondary key is formed when a superkey is minimal, but has not been chosen as a primary key. {ReportBy, ReportScore} can uniquely identify all tuples, but is not a primary key (CelestialObject). Also, no proper subset of {ReportBy, ReportScore} can be a key. The same logic applies for {ReportScore, GroupLead}. Hence, options (a) and (d) are correct.

Question 5

Consider the following relational schema for a university:

- student(roll_no, name, dob)
- dept(deptNo, dName, location)
- project(proj_no, deptNo, roll_no, pName)

What is the type of the key(s) that will be used to uniquely identify an entity of the project relation?

Mark: 2 MCQ

- a) Simple key
- b) Alternate Key
- c) Composite Key
- d) Compound key

Answer: d)

Explanation: As per the definition of compound key. Refer to the slide 4.13.

Question 6

Consider the following relational schema for a university:

- student(roll_no, name, dob)
- dept(deptNo, dName, location)
- project(proj_no, deptNo, roll_no, pName)

Identify the correct relational algebraic expression for the following query: *Mark: 2 MCQ*

Find the names of students who have selected any project offered by the department "CSE".

- a) $\Pi_{\text{name}}((\text{student} \bowtie \text{project}) \bowtie \Pi_{\text{deptNo}}(\sigma_{\text{dName}='CSE'}(\text{dept})))$
- b) $\Pi_{\text{name}}(\sigma_{\text{dName}='CSE'}(\text{dept} \bowtie \text{project}))$
- c) $\Pi_{\text{name}}(\sigma_{\text{dName}='CSE'}(\text{student} \bowtie \text{dept}) \bowtie (\text{project}))$
- d) $\Pi_{\text{name}}(\text{student} \bowtie (\sigma_{\text{dName}='CSE'}(\text{project})))$

Answer: a)

Explanation: $(\text{student} \bowtie \text{project})$ creates a table with all tuples where roll_no attribute matches.

When this table is joined with a table containing the dept_no of "CSE", tuples with the names of students working in projects offered by "CSE" department are only preserved.

Finally, the projection operation takes out the names of those students.

Hence, option (a) is correct.

Question 7

Consider the following tables:

R_1		
BOOK_TITLE	AUTHOR_NAME	TOTAL_SOLD_COPIES
COMPUTER NETWORKS	FOROUZAN	15000
DATA STRUCTURES	CORMEN	20000
DATA STRUCTURES	ULLMAN	20000
DBMS	KORTH	15000
MACHINE LEARNING	MITCHELL	18000

R_2		
BOOK_TITLE	AUTHOR_NAME	TOTAL_SOLD_COPIES
COMPILER	ULLMAN	12000
DATA STRUCTURES	CORMEN	20000
DATA STRUCTURES	ULLMAN	20000
NLP	MANNING	12000
OPERATING SYSTEM	GALVIN	25000

Identify the correct operation(s) which will produce the following output from the above two relations.

Marks: 2 MCQ

BOOK_TITLE	AUTHOR_NAME	TOTAL_SOLD_COPIES
COMPUTER NETWORKS	FOROUZAN	15000
COMPILER	ULLMAN	12000
DBMS	KORTH	15000
MACHINE LEARNING	MITCHELL	18000
NLP	MANNING	12000
OPERATING SYSTEM	GALVIN	25000

- a) $R_1 - R_2$
- b) $R_2 - R_1$
- c) $(R_1 \cup R_2) \cap (R_1 \cap R_2)$
- d) $(R_1 - R_2) \cup (R_2 - R_1)$

Answer: d)

Explanation: The relation $R_1 - R_2$ is as follows:

R_1		
BOOK_TITLE	AUTHOR_NAME	TOTAL_SOLD_COPIES
COMPUTER NETWORKS	FOROUZAN	15000
DBMS	KORTH	15000
MACHINE LEARNING	MITCHELL	18000

The relation $R_2 - R_1$ is as follows:

R_2		
BOOK_TITLE	AUTHOR_NAME	TOTAL_SOLD_COPIES
COMPILER	ULLMAN	12000
NLP	MANNING	12000
OPERATING SYSTEM	GALVIN	25000

By union of two above relations, the output is produced.
Hence, option d) is correct.

Question 8

Consider the following instance:

BookDetails				
BOOK_ID	YEAR_PUB	BOOK_TITLE	AUTHOR_NAME	TOTAL_SOLD_COPIES
1001	2010	DBMS	KORTH	15000
1002	2010	OPERATING SYSTEM	GALVIN	25000
1003	2020	COMPILER	ULLMAN	12000
1004	1995	DATA STRUCTURES	CORMEN	20000
1005	1995	DATA STRUCTURES	ULLMAN	20000
1006	1990	COMPUTER NETWORKS	FOROUZAN	15000
1007	2010	MACHINE LEARNING	MITCHELL	18000

Identify the correct operation(s) which produces the following output from the above relation.

Marks: 2 MCQ

BookDetails				
BOOK_ID	YEAR_PUB	BOOK_TITLE	AUTHOR_NAME	TOTAL_SOLD_COPIES
1002	2010	OPERATING SYSTEM	GALVIN	25000
1007	2010	MACHINE LEARNING	MITCHELL	18000

- a) $\Pi_{(YEAR_PUB=2010) \vee (TOTAL_SOLD_COPIES > 15000)}(BookDetails)$
- b) $\Pi_{(YEAR_PUB=2010) \wedge (TOTAL_SOLD_COPIES > 15000)}(BookDetails)$
- c) $\sigma_{(YEAR_PUB=2010) \vee (TOTAL_SOLD_COPIES > 15000)}(BookDetails)$
- d) $\sigma_{(YEAR_PUB=2010) \wedge (TOTAL_SOLD_COPIES > 15000)}(BookDetails)$

Answer: d)

Explanation: In projection operation, a condition cannot be given. So, options (a) and (b) are not correct.

If $(YEAR_PUB=2010)$ condition is used, we get three tuples as given below.

BookDetails				
BOOK_ID	YEAR_PUB	BOOK_TITLE	AUTHOR_NAME	TOTAL_SOLD_COPIES
1001	2010	DBMS	KORTH	15000
1002	2010	OPERATING SYSTEM	GALVIN	25000
1007	2010	MACHINE LEARNING	MITCHELL	18000

If you use another condition $(TOTAL_SOLD_COPIES > 15000)$, the output becomes the same as the given output.

Hence, option (d) is correct.

Question 9

Consider the following instance:

BookDetails				
BOOK_ID	YEAR_PUB	BOOK_TITLE	AUTHOR_NAME	TOTAL_SOLD_COPIES
1001	2010	DBMS	KORTH	15000
1002	2010	OPERATING SYSTEM	GALVIN	25000
1003	2020	COMPILER	ULLMAN	12000
1004	1995	DATA STRUCTURES	CORMEN	20000
1005	1995	DATA STRUCTURES	ULLMAN	20000
1006	1990	COMPUTER NETWORKS	FOROUZAN	15000
1007	2010	MACHINE LEARNING	MITCHELL	18000

Identify the correct output(s) which will be produced by the following relational expression.

Marks: 2 MCQ

$\Pi_{\text{BOOK_TITLE}}(\sigma_{\text{TOTAL_SOLD_COPIES} > 18000}(\text{BookDetails}))$

a)

BOOK_TITLE
OPERATING SYSTEM
DATA STRUCTURES
DATA STRUCTURES

b)

BOOK_TITLE
OPERATING SYSTEM
DATA STRUCTURES

c)

BOOK_ID	YEAR_PUB	BOOK_TITLE	AUTHOR_NAME	TOTAL_SOLD_COPIES
1002	2010	OPERATING SYSTEM	GALVIN	25000
1004	1995	DATA STRUCTURES	CORMEN	20000
1005	1995	DATA STRUCTURES	ULLMAN	20000

d)

BOOK_ID	YEAR_PUB	BOOK_TITLE	AUTHOR_NAME	TOTAL_SOLD_COPIES
1002	2010	OPERATING SYSTEM	GALVIN	25000
1004	1995	DATA STRUCTURES	CORMEN	20000

Answer: b)

Explanation: The condition $\text{TOTAL_SOLD_COPIES} > 18000$ selects the following tuples.

BookDetails				
BOOK_ID	YEAR_PUB	BOOK_TITLE	AUTHOR_NAME	TOTAL_SOLD_COPIES
1002	2010	OPERATING SYSTEM	GALVIN	25000
1004	1995	DATA STRUCTURES	CORMEN	20000
1005	1995	DATA STRUCTURES	ULLMAN	20000

The projection operation selects only one column and removes duplicate tuples from the output.

Hence, option (b) is correct.

Question 10

Which of the following can be a candidate key for the following instance?

Marks: 2 MSQ

BookDetails				
BOOK_ID	YEAR_PUB	BOOK_TITLE	AUTHOR_NAME	TOTAL_SOLD_COPIES
1001	2010	DBMS	KORTH	15000
1002	2010	OPERATING SYSTEM	GALVIN	25000
1003	2020	COMPILER	ULLMAN	12000
1004	1995	DATA STRUCTURES	CORMEN	20000
1005	1995	DATA STRUCTURES	ULLMAN	20000
1006	1990	COMPUTER NETWORKS	FOROUZAN	15000
1007	2010	MACHINE LEARNING	MITCHELL	18000

- a) {BOOK_ID, YEAR_PUB}
- b) {BOOK_ID, BOOK_TITLE}
- c) {BOOK_TITLE, AUTHOR_NAME}
- d) {BOOK_ID}

Answer: c), d)

Explanation: Option a) is incorrect because {BOOK_ID, YEAR_PUB} forms a superkey.

Similarly, option b) is incorrect because {BOOK_ID, BOOK_TITLE} forms a superkey.

In the above instance, each row can be uniquely identified by either {BOOK_TITLE, AUTHOR_NAME} or {BOOK_ID} from the given options.

Hence, options c) and d) are correct.