

A.

1. Are foreign keys allowed to have null values?

- a) No, foreign keys should have always a concrete value
- b) No, because the value of a key should be unique for any instance of a relation
- c) Yes, because there are situations in which such kind of information is not available
- d) Yes, foreign keys have always null values.

2. What is logical data independence?

- a) Changes made in physical schema of a database will not affect the conceptual schema
- b) Changes made in user interface will not affect the conceptual schema
- c) Changes made in conceptual schema will not affect the data access module.
- d) Changes made in conceptual schema of a database will not affect the external schemas

3. Which of the following is not a criteria to use databases for your software system?

- a) Preserve data integrity
- b) Huge amount of structured data
- c) Low-level data access
- d) Persistence

4. Which of the following statements about dense-sparse indexes is false?

- a) A dense index must be clustered
- b) A dense index has at least one data entry for every search key which appears in the indexed
- c) A sparse index is typically much smaller than a dense index.
- d) A sparse index contains an entry for each page of records in a data file.

5. Which of the following definitions is not an alternative of data entries in index files?

- a) Search key, record
- b) Search key, address
- c) Search key, record ID
- d) Search key, list of record ID's

6. The correct hierarchy of terms from largest to smallest is:

- a) Field, record, table, database
- b) record, table, database, field
- c) database, table, field, record
- d) database, table, record, field

? HELP P

7. The purpose of a table is to:

- a) Present a document that can be posted on the internet
- b) Present a document in a professional fashion so it can be printed
- c) Store data about an entity type
- d) Answer a question about the database

8. In SQL, if is needed to display records from lowest to highest value, which one of the following commands will be used?

- a) Sort ascending
- b) Remove filter
- c) Sort descending
- d) Referential integrity

Sort ascending

9. Which of the following is not an alternative of mapping inheritance relationship between 2 classes A and B in tables from relational model?

- a) Create table A and de-normalize all attributes of B
- b) Create tables A and B, with their own attributes
- c) Create table B and de-normalize all attributes of A
- d) Create tables A, B and a cross-table between them.

???

10. Which of the following decompositions of the schema {A, B, C, D, E, F} are dependency preserving decompositions under the given functional dependencies?

- a) {A, B, C, D, F} and {B, C, D, E}: given ABC → DEF, BC → EF and EF → B
- b) {A, B, C, D, F} and {B, C, D, E}: given AB → CDE, DE → CF and C → E
- c) {A, B, C, D, F} and {B, C, E}: given ABC → DEF, BC → E and C → B
- d) {A, B, C, D, F} and {B, E, F}: given ABC → DEF, BC → F and EF → B

BC → E

11. Given two relations.

- c) $\{A, B, C, D, F\}$ and $\{B, C, E\}$: given $ABC \rightarrow DEF$, $BC \rightarrow E$ and $C \rightarrow B$
d) $\{A, B, C, D, F\}$ and $\{B, E, F\}$: given $ABC \rightarrow DEF$, $BC \rightarrow F$ and $EF \rightarrow B$

11. Given two relations,

R:	A	B	C
1	2	3	
1	2	4	
3	3	5	

S:	A	D
1	4	
1	7	
3	8	

and the following queries:

- Q₁: SELECT DISTINCT R.B FROM R LEFT OUTER JOIN S ON R.B = S.A
Q₂: SELECT DISTINCT S.A FROM R RIGHT OUTER JOIN S ON R.C = S.D

- a) Q₁ and Q₂ have the same number of tuples
b) Q₁ and Q₂ have different number of tuples
c) Number of tuples in Q₁ cannot be computed
d) Number of tuples in Q₂ cannot be computed

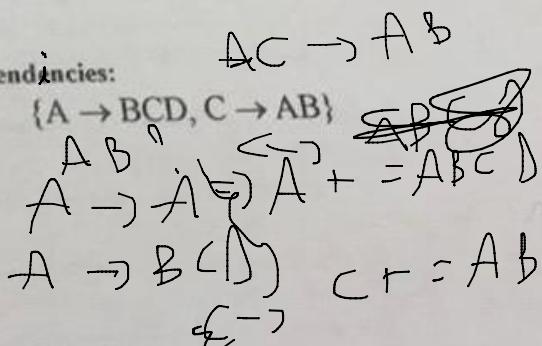
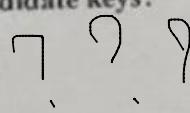
12. Consider the following relation and functional dependencies:

S (A, B, C, D)

$\{A \rightarrow BCD, C \rightarrow AB\}$

Which is the list of all candidate keys?

- a) A
b) A, C
c) AC
d) AB



balanced tree?

- Q₁: SELECT DISTINCT R.B FROM R LEFT OUTER JOIN S ON R.B = S.A
Q₂: SELECT DISTINCT S.A FROM R RIGHT OUTER JOIN S ON R.C = S.D

- a) Q₁ and Q₂ have the same number of tuples
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$\{A \rightarrow BCD, C \rightarrow AB\}$

Which is the list of all candidate keys?

- a) A
b) A, C
c) AC
d) AB

13. Which of the following best characterizes a balanced tree?

- a) All leaves are on the same level
b) Leaves are positioned on at most 2 levels
c) For each node the difference between its sub-trees heights is 1, 0 or -1
d) All paths from root to leaves have the same length

14. Who is responsible for unpinning a page in buffer pool?

- a) The buffer manager
b) The requestor of that page
c) The frame which contains the page
d) The replacement policy

15. The following SQL queries refer to relations R(a; b) and S(b; c):

Q₁: SELECT * FROM R INNER JOIN S ON R.b = S.b;

15. The following SQL queries refer to relations R(a; b) and S(b; c):

Q_1 : SELECT * FROM R INNER JOIN S ON R.b = S.b;

Q_2 : SELECT * FROM R LEFT JOIN S ON R.b = S.b;

a) Q_1 and Q_2 produce the same answer.

b) The answer to Q_1 is always contained in the answer to Q_2 .

c) The answer to Q_2 is always contained in the answer to Q_1 .

d) Q_1 and Q_2 produce different answers.

SPiR i D e N D A G o s

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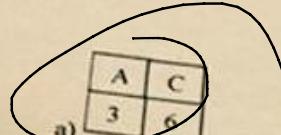
1. Se dau următoarele instanțe a două relații R și S :

R:	A	B	C
1	2	2	
3	4	5	

S:	A	C
1	2	
3	6	
3	5	

Care este rezultatul executiei următoarei interogări:

$$\rho((D \rightarrow A, E \rightarrow C), S) - \pi_{A,C}(R)$$



b)

A	C
1	2
3	5
3	6

D	E
1	2
3	5
3	6

2. Ce este independența fizică a datelor?

- a) Modificările structurii fizice a bazei de date nu vor afecta structura conceptuală
- b) Modificările structurii conceptuale a bazei de date nu vor afecta structura exterñă
- c) Modificările interfeñei cu utilizatorul nu vor afecta structura fizică
- d) Modificările structurii conceptuale nu vor afecta modul de acces al datelor de pe disc.

3. Care din următoarele criterii nu reprezintă un argument valid de utilizare a unei baze de date?

- a) Modalitate unitară de administrare a datelor
- b) Controlul securităñii datelor
- c) Gestionañia unei colecñii de date de dimensiuni reduse
- d) Acces concurrent la date

4. Ce element nou este introdus la nivelul definirii unei clase în bazele de date orientate obiect în comparañie cu limbajele de programare orientate-obiect obiñuite?

- a) Atribute
- b) Metode
- c) Relañiile de asociere
- d) Relañiile de moñtere

5. În cazul relañiei R(A;B;C; D;E) având dependenñele funcñionale AB → C, C → B și D → E, numărul super-cheilor este egal cu:

- a) 2
- b) 4
- c) 6
- d) 8

O tabelă este o colecñie de

- a) Scripturi SQL
- b) Interogări
- c) Înregistrări
- d) Module

ABD

ABC D

ACD

ACD E

ABDE

ABC DE

ACD

ACD E

7. Pentru a afisa mai multe inregistrari intr-o secventa de la cea mai mare la cea mai mica din unui camp particular, se utilizeaza:
- ORDER BY ASC
 - DISTINCT
 - ORDER BY DESC
 - HAVING

8. Ordinea corecta a termenilor, de la cel mai simplu la cel mai complex, este:
- camp, inregistrare, tabel, baza de date
 - inregistrare, tabel, baza de date, camp
 - baza de date, tabel, camp, inregistrare
 - baza de date, tabel, inregistrare, camp

9. Fie urmatoarea relatie Persoane(Cod, Nume, DataNastere, Oras, Profesie). Care din urmatoarele interogari determina programatorii din Cluj-Napoca?

- ~~Oras = Cluj-Napoca AND Profesie = Programator (Persoane)~~
- ~~Oras = Cluj-Napoca AND Profesie = Programator (Persoane)~~
- ~~Oras = Cluj-Napoca AND Profesie = Programator (Persoane)~~
- ~~Oras = Cluj-Napoca AND Profesie = Programator (Persoane)~~

10. Cu care dintre urmatoarele dependente functionale este compatibila relatia:

A	B	C	D	E
a	1	t	x	t
c	1	r	y	t
a	2	e	x	f
b	1	e	y	f

- ~~A → BC~~
- ~~AB → C~~
- ~~AD → AE~~
- BE → AD

$$\begin{aligned}
 & \text{Q1: } f(x_1) = f(x_2) \Rightarrow \\
 & \cancel{f(x_1) \neq f(x_2)} \quad x_1 \neq x_2 \\
 & \text{Q2: } x_1 \neq x_2 \Rightarrow \\
 & \cancel{f(x_1) \neq f(x_2)} \quad \Rightarrow f(x_1) \neq f(x_2)
 \end{aligned}$$

11. Care dintre urmatoarele politici nu este utilizata in inlocuirea de pagini de memorie din memoria interna alocata unui sistem de gestiune a bazelor de date?

- Least Recently Used (LRU)
- Toss-immediate
- ~~Never Used Page (NUP)~~
- Most Recently Used (MRU)

12. Care din urmatoarele afirmatii este falsa?

- O cheie candidat poate fi compusa din mai multe atribute
- O relatie poate avea mai multe super-chei
- ~~O cheie straina este implicit si super-cheie~~
- O multime de atribute poate fi in același timp cheie primara si cheie straina

13. Care dintre urmatoarele interogari este un exemplu corect pentru obtinerea inregistrarilor din tabela T care au valoarea NULL pe campul C?

- SELECT * FROM T WHERE NULL(C);
- SELECT NULL(C) FROM T;
- ~~SELECT * FROM T WHERE C IS NULL;~~
- SELECT * FROM T WHERE C = NULL;

14. Un index clustered este un index în care:

- a) Ordinea de stocare a înregistrărilor din tabela indexată este aceeași cu ordinea memorării intrările din index
- b) Cheia de căutare (indexare) e formată din mai multe atribute
- c) Cheia de căutare este unică
- d) Intrările din index sunt ordonate crescător

15. Rezultatul interogărilor Q_1 și Q_2 va fi dat de colecția de înregistrări returnată de execuția comenziilor

SELECT * FROM R. Vom presupune că structura relației R este R(a; b).

Q_1 : UPDATE R SET b = 10 WHERE a = 20;

SELECT * FROM R;

Q_2 : DELETE FROM R WHERE a = 20;

INSERT INTO R VALUES(20,10);

SELECT * FROM R;

2 0 1 0 1 ✓

a) Q_1 și Q_2 produc același răspuns

b) Răspunsul lui Q_1 este întotdeauna conținut în răspunsul lui Q_2

c) Răspunsul lui Q_2 este întotdeauna conținut în răspunsul lui Q_1

d) Q_1 și Q_2 produc răspunsuri diferite.

5 3

16. Pentru următoarele interogări se poate considera o structură arbitrară a lui R, dar care include un câmp b

Q_1 : SELECT COUNT(DISTINCT b) FROM R;

Q_2 : SELECT COUNT(b) FROM R;

a) Q_1 și Q_2 produc același răspuns

b) Răspunsul lui Q_1 este întotdeauna conținut în răspunsul lui Q_2

c) Răspunsul lui Q_2 este întotdeauna conținut în răspunsul lui Q_1

d) Q_1 și Q_2 produc răspunsuri diferite.

17. Următoarele interogări se execută pe relațiile R(a; b) și S(b; c):

Q_1 : SELECT * FROM R INNER JOIN S ON R.b = S.b;

Q_2 : SELECT * FROM R LEFT JOIN S ON R.b = S.b;

a) Q_1 și Q_2 produc același răspuns

b) Răspunsul lui Q_1 este întotdeauna conținut în răspunsul lui Q_2

c) Răspunsul lui Q_2 este întotdeauna conținut în răspunsul lui Q_1

d) Q_1 și Q_2 produc răspunsuri diferite.

18. Pentru următoarele interogări se poate considera o structură arbitrară a lui R, dar care include câmpurile a și b

Q_1 : SELECT DISTINCT a

FROM R

WHERE b > 0;

Q_2 : SELECT a

FROM R

WHERE b > 0

GROUP BY a;

a) Q_1 și Q_2 produc același răspuns

b) Răspunsul lui Q_1 este întotdeauna conținut în răspunsul lui Q_2

c) Răspunsul lui Q_2 este întotdeauna conținut în răspunsul lui Q_1

d) Q_1 și Q_2 produc răspunsuri diferite.

19. În următoarele interogări vom presupune că relațiile R(a; b) și S(b; c) nu au valori NULL, dar pot conține înregistrări duplicate.

$Q_1: \text{SELECT } R.a \text{ FROM } R, S$

WHERE R.b = S.b;

$Q_2: \text{SELECT } R.a \text{ FROM } R$

WHERE R.b IN (

SELECT S.b FROM S.).

$Q_1: 1, 3$	R	5
$Q_2: 1, 3, 3$	7	1

- a) Q_1 și Q_2 produc același răspuns
- b) Răspunsul lui Q_1 este întotdeauna conținut în răspunsul lui Q_2
- c) \boxed{c} Răspunsul lui Q_2 este întotdeauna conținut în răspunsul lui Q_1
- d) Q_1 și Q_2 produc răspunsuri diferite

20. Pentru următoarele interogări se consideră că cheia relației R(a; b; c) este c.

$Q_1: \text{SELECT } a, \text{MAX}(b) \text{ FROM } R$

GROUP BY a,

DISTINCT

$Q_2: \text{SELECT } a, b \text{ FROM } R r1$

WHERE b >= ALL (SELECT b FROM R r2 WHERE r1.a = r2.a);

- a) Q_1 și Q_2 produc același răspuns

- \boxed{b} Răspunsul lui Q_1 este întotdeauna conținut în răspunsul lui Q_2
- c) Răspunsul lui Q_2 este întotdeauna conținut în răspunsul lui Q_1
- d) Q_1 și Q_2 produc răspunsuri diferite

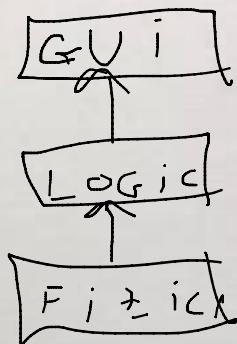
$Q_1: 2, 5$	2	5
	3	5
	3	5
	2	5
$Q_2: 2, 3, 5$	2	5

5

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Grupa: 225



A.

1. Este posibil ca valoarea unei chei străine să fie NULL?

- a) Nu, cheile străine trebuie să aibă întotdeauna o valoare concretă
- b) Nu, deoarece valoarea unei chei trebuie să fie unică pentru orice instanță a unei relații
- c) Da, deoarece există situații când o astfel de informație nu este disponibilă
- d) Da, cheile străine au întotdeauna valoarea NULL

2. Ce este independența logică a datelor?

- a) Modificările structurii fizice a bazei de date nu vor afecta structura conceptuale
- b) Modificările structurii conceptuale a bazei de date nu vor afecta structura extensă
- c) Modificările interfeței cu utilizatorul nu vor afecta structura fizică
- d) Modificările structurii conceptuale nu vor afecta modul de acces al datelor de pe disc

3. Care din următoarele criterii nu reprezintă un argument valid de utilizare a unei baze de date?

- a) Păstrarea integrității datelor
- b) Reprezentare grafică a informațiilor
- c) Gestionația de colecții de date structurate de mari dimensiuni
- d) Persistență

4. Un index clustered este un index în care:

- a) Ordinea de stocare a înregistrărilor din tabela indexată este același cu ordinea membrilor intrările din index
- b) Cheia de căutare (indexare) e formată din mai multe attribute
- c) Cheia de căutare este unică
- d) Intrările din index sunt ordonate crescător

5. Care dintre următoarele exemple nu reprezintă o alternativă de memorare a unei intrări dintr-un spatiu index?

- a) <cheie de căutare, înregistrare>
- b) <cheie de căutare, cheie primară>
- c) <cheie de căutare, identificator înregistrare>
- d) <cheie de căutare, listă de identificatori de înregistrări>

6. Ordinea corectă a termenilor, de la cel mai complex la cel mai simplu, este:

- a) câmp, înregistrare, tabelă, bază de date
- b) înregistrare, tabelă, bază de date, câmp
- c) bază de date, tabelă, câmp, înregistrare
- d) bază de date, tabelă, înregistrare, câmp

7. Scopul unei tabele este de:

- a) Memora un document ce poate fi publicat pe internet
- b) Memorarea unui document într-o formă profesională astfel încât să poate fi listat
- c) Modela o entitate din lumea reală/conceptuală și de a stoca date caracteristice acestei entități
- d) Conține rezultatul unor interrogații execuțiate pe o bază de date

8. Pentru a afișa mai multe înregistrări într-o secvență de la cea mai mare la cea mai mică valoare a unui câmp particular, se utilizează:

- a) ORDER BY ... ASC
- b) DISTINCT
- c) ORDER BY ... DESC
- d) HAVING

16. În următoarele întrebări vom presupune că relația R(a; b; c) nu nu valorei NULL, dar pot conține înregistrări după:

- Q: SELECT R.a FROM R, S
 WHERE R.b = S.b;
 Q: SELECT R.a FROM R
 WHERE R.b IN (SELECT S.b FROM S);

a) Q₁ și Q₂ produc același răspuns
b) Răspunsul lui Q₁ este întotdeauna conținut în răspunsul lui Q₂
 c) Răspunsul lui Q₂ este întotdeauna conținut în răspunsul lui Q₁
d) Q₁ și Q₂ produc răspunsuri diferite.

17. În cele ce urmărește rezultatul întrebărilor Q₁ și Q₂ va fi considerat rezultatul instrucțiunii SELECT * FROM R. De asemenea, structura relației R este R(a; b).

- Q: UPDATE R SET b = 20 WHERE a = 10;
 SELECT * FROM R;
 Q: DELETE FROM R WHERE a = 10;
 INSERT INTO R VALUES(10,20);
 SELECT * FROM R;

a) Q₁ și Q₂ produc același răspuns
b) Răspunsul lui Q₁ este întotdeauna conținut în răspunsul lui Q₂
 c) Răspunsul lui Q₂ este întotdeauna conținut în răspunsul lui Q₁
d) Q₁ și Q₂ produc răspunsuri diferite.

18. Peste următoarele întrebări se stie că R conține un atribut k, restul structurii fiind arbitrar.

- Q: SELECT COUNT(DISTINCT b) FROM R;
 Q: SELECT COUNT(s) FROM R;

- a) Q₁ și Q₂ produc același răspuns
b) Răspunsul lui Q₁ este întotdeauna conținut în răspunsul lui Q₂
c) Răspunsul lui Q₂ este întotdeauna conținut în răspunsul lui Q₁
 d) Q₁ și Q₂ produc răspunsuri diferite.

19. Următoarele întrebări cu operatori algebrici relaționali sunt aplicate relației R având structura R(a; b).

- Q: π_a(R) X π_b(R)
 Q: π_{a,b}(R ⊗_{R,a→b} p(S(a→c, b→d), R))

- a) Q₁ și Q₂ produc același răspuns
b) Răspunsul lui Q₁ este întotdeauna conținut în răspunsul lui Q₂
 c) Răspunsul lui Q₂ este întotdeauna conținut în răspunsul lui Q₁
d) Q₁ și Q₂ produc răspunsuri diferite.

20. Următoarele întrebări SQL se execută pe tabelele R(a; b) și S(c; d).

- Q: SELECT a
 FROM R
 WHERE b >= ALL(SELECT d FROM S WHERE c>5);

- Q: SELECT a
 FROM R
 WHERE b >= ANY(SELECT d FROM S WHERE c>5);

- a) Q₁ și Q₂ produc același răspuns
 b) Răspunsul lui Q₁ este întotdeauna conținut în răspunsul lui Q₂
c) Răspunsul lui Q₂ este întotdeauna conținut în răspunsul lui Q₁
d) Q₁ și Q₂ produc răspunsuri diferite.

$$\pi_a(R) \times \pi_b(R)$$

$$\begin{aligned} &\pi_{a,b}(R \otimes_{R,a \rightarrow b} S) \\ &p(S[a \rightarrow c, b \rightarrow d], R) \\ &= \pi_{a,b}(R \otimes_{R,a \rightarrow b} S) \end{aligned}$$

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Group:

226

Date: 29.01.2022

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A.

1. What is logical data independence?

- a) Changes made in physical schema of a database will not affect the conceptual schema
- b) Changes made in user interface will not affect the conceptual schema
- c) Changes made in conceptual schema will not affect the data access module
- d) Changes made in conceptual schema of a database will not affect the external schemas

2. Which of the following is not a criteria to use databases for your system

- a) Preserve data integrity
- b) Huge amount of structured data
- c) Low-level data access
- d) Persistence

3. Which of the following statements about dense-sparse indexes is false?

- a) A dense index has at least one data entry for every search key which appears in the indexed file
- b) A dense index must be clustered.
- c) A sparse index is typically much smaller than a dense index.
- d) A sparse index contains an entry for each page of records in a data file.

4. Which of the following is a correct example of a query that finds rows in table T which has a NULL in their C column?

- a) SELECT * FROM T WHERE NULL(C);
- b) SELECT DISTINCT * FROM T GROUP BY C;
- c) SELECT * FROM T WHERE C = NULL;
- d) SELECT * FROM T WHERE C IS NULL;

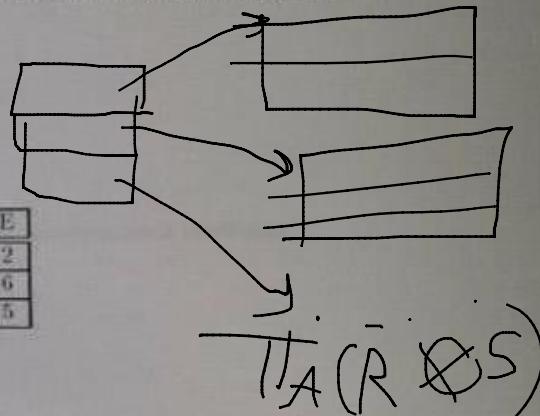
5. Given the instance of two relations:

R:	A	B	C
	1	2	2
	3	4	5

S:

D	E
1	2
3	6
3	5

What is the result of this query:

 $\pi_A(R \otimes S)$ 

a)

A
1

 Invalid query

A
3

A
1

b)

- a) 2
- b) 8
- c) 16
- d) 32

R	S	T
a b	b c	a c
0 0	0 0	0 0
0 1	0 1	0 1
1 0	1 0	1 0
1 1	1 1	1 1

 D+A7. The relation $R(A;B;C;D)$ with dependencies $AB \rightarrow C$, $ABC \rightarrow D$, and $AC \rightarrow\rightarrow B$ is: ~~W~~ $+ \oplus$

- a) Not in 3NF
- b) In 3NF but not in BCNF
- c) In BCNF but not in 4NF
- d) In 4NF

8. Which of the following sets of FDs are defined for a relation with schema $R(A,B,C,D)$ having primary key AB and under which R is in 1NF but not in 2NF?

- a) Not in 3NF
 b) In 3NF but not in BCNF
 c) In BCNF but not in 4NF
 d) In 4NF

8. Which of the following sets of FDs are defined for a relation with schema R(A,B,C,D) having primary key AB and under which R is in 1NF but not in 2NF?

- a) $AB \rightarrow CD$, $B \rightarrow C$
 b) $AB \rightarrow D$, $D \rightarrow C$
 c) $C \rightarrow A$, $BD \rightarrow C$
 d) $A \rightarrow CD$, $B \rightarrow CD$

$F = ST \cap UN \setminus BOU$

9. Why are some functional dependencies called trivial?

- a) they contain superfluous attributes that do not need to be listed
 b) their RHS attributes are included in LHS attributes
 c) they are redundant
 d) they contain redundant attributes

10. Which of the following statements is not true when a page is pinned in the buffer pool?

- a) The pin count of the corresponding frame is incremented
 b) The page is locked and cannot be accessed by another requestor
 c) It is guaranteed that the page will not be removed from the buffer pool by the buffer manager
 d) Another page will not be read into the frame containing the pinned page until it is unpinned by its requestor

11. A relation has relational schema (A, B, C) . The number of elements in $\text{Dom}(A)$ is 3, in $\text{Dom}(B)$ is 4 and in $\text{Dom}(C)$ is 4. The maximum number of tuples that this relation can ever have is:

- a) 4 (i.e. $\max(3, 4, 4)$)
 b) 11 (i.e. $3 + 4 + 4$)
 c) 48 (i.e. $3 * 4 * 4$)
 d) There is no maximum number.

12. Which of the following aggregate functions produces the smallest value in the query "SELECT <aggregate function> FROM NUMBERS;" where NUMBERS is the table shown below?

NUMBERS	NUM
	2
	NULL
	3
	1
	2
	1

$$\begin{aligned} & 6 \cancel{1} \cancel{3} 4 \\ & 6 - 3 = 3 \\ & \frac{9}{5} = 1, 8 \end{aligned}$$

13. With which of the following functional dependencies is this relation compatible?

A	B	C	D	E
a	l	t	x	t
c	l	r	y	t
a	2	e	x	f
b	l	e	y	f

- a) $AB \rightarrow C$
 b) $D \rightarrow B$
 c) $BE \rightarrow AD$
 d) $A \rightarrow BC$

14. Are foreign keys allowed to have null values?

- a) No, foreign keys should have always a concrete value
 b) Yes, because there are situations in which such kind of information is not available
 c) No, because the value of a key should be unique for any instance of a relation
 d) Yes, foreign keys have always null values

15. Which of the following best describes 'seek time' term?

- a) The time taken to move the disk heads to the track on which a desired block is located.
 b) The waiting time for the desired block to rotate under the disk head.

15. Which of the following best describes 'seek time' term?

- a) The time taken to move the disk heads to the track on which a desired block is located.
- b) The waiting time for the desired block to rotate under the disk head
- c) The time to read/write data from/in the block once the head is positioned
- d) The average time taken to find a specific disk page.

16. The following SQL queries refer to relations R(a; b) and S(b; c):

$Q_1: \text{SELECT } * \text{ FROM } R \text{ INNER JOIN } S;$

$Q_2: \text{SELECT } * \text{ FROM } R \text{ LEFT JOIN } S;$

- a) Q_1 and Q_2 produce the same answer.
- b) The answer to Q_1 is always contained in the answer to Q_2 .
- c) The answer to Q_2 is always contained in the answer to Q_1 .
- d) Q_1 and Q_2 produce different answers.

17. In the following, the results of Q_1 and Q_2 should be taken to be the result of the final $\text{SELECT } * \text{ FROM } R$. Assume that the schema of relation R is $R(a; b)$.

$Q_1: \text{UPDATE } R \text{ SET } b = 20 \text{ WHERE } a = 10;$

$\text{SELECT } * \text{ FROM } R;$

$Q_2: \text{DELETE FROM } R \text{ WHERE } a = 10;$

$\text{INSERT INTO } R \text{ VALUES}(10, 20);$

$\text{SELECT } * \text{ FROM } R;$

- a) Q_1 and Q_2 produce the same answer.
- b) The answer to Q_1 is always contained in the answer to Q_2 .
- c) The answer to Q_2 is always contained in the answer to Q_1 .
- d) Q_1 and Q_2 produce different answers.

18. In the following, R has attribute b, but its schema is otherwise not specified, nor is it relevant.

$Q_1: \text{SELECT COUNT(DISTINCT b) FROM R;}$

$Q_2: \text{SELECT COUNT(b) FROM R;}$

- a) Q_1 and Q_2 produce the same answer.
- b) The answer to Q_1 is always contained in the answer to Q_2 .
- c) The answer to Q_2 is always contained in the answer to Q_1 .
- d) Q_1 and Q_2 produce different answers.

$\begin{cases} S(c, d) \\ R(a, b) \end{cases}$

19. In the following expressions of relational algebra, the relation R has schema $R(a; b)$.

$Q_1: \pi_a(R) \times \pi_b(R)$

$Q_2: \pi_{a,d} (R \otimes_{R.b = S.c} \rho(S(a \rightarrow c, b \rightarrow d), R))$

- a) Q_1 and Q_2 produce the same answer.
- b) The answer to Q_1 is always contained in the answer to Q_2 .
- c) The answer to Q_2 is always contained in the answer to Q_1 .
- d) Q_1 and Q_2 produce different answers.

$\overline{\Pi}_a(R) \times \overline{\Pi}_b(R)$

$\overline{\Pi}_{a,d}(R \otimes_{R.b = S.c} \rho(S(a \rightarrow c, b \rightarrow d), R))$

20. In the following, you may assume relations $R(a; b)$ and $S(b; c)$ have no NULL's, but may have duplicates.

$Q_1: \text{SELECT } R.a \text{ FROM } R, S$
 $\text{WHERE } R.b = S.b;$

$Q_2: \text{SELECT } R.a \text{ FROM } R$
 $\text{WHERE } R.b \text{ IN ($
 $\text{SELECT } S.b \text{ FROM } S;);$

- a) Q_1 and Q_2 produce the same answer.
- b) The answer to Q_1 is always contained in the answer to Q_2 .
- c) The answer to Q_2 is always contained in the answer to Q_1 .
- d) Q_1 and Q_2 produce different answers.

a	b	c
3	1	1
4	2	2
5	3	3
6	3	

Name: SPiRIDON DRAGOS
Group: 226

1. Relation C is a projection of relation A. Which of the following statements must be true in all cases where relation C is different from relation A?
 a) The cardinality of C is greater than the cardinality of A
 b) The cardinality of C is less than the cardinality of A
 c) The degree of C is greater than the degree of A
 d) The degree of C is less than the degree of A

2. In a table in 1NF which the only candidate key is a single attribute:
 a) 2NF may not be violated
 b) 3NF may not be violated
 c) BCNF may not be violated
 d) 4NF may not be violated

3. A table is in 2NF if the table is in 1NF and what other condition is met? Please select the best answer.
 a) There are no functional dependencies
 b) There are no null values in primary key fields
 c) There are no repeating groups
 d) There are no attributes that are not functionally dependent on the relation's primary key

4. A table MOVIES in an object-oriented database consists of the attributes title (the primary key), year-produced, and actor-name; actor-name is a repeating group; different movies may have different numbers of actors. The table MOVIES violates the following normal form (choose the lowest one):
 a) 1NF
 b) 2NF
 c) 3NF
 d) 4NF

5. In the relation R(A,B,C; D;E) with functional dependencies AB → C, C → B, and D → E, the number of superkeys is:
 a) 2
 b) 4
 c) 6
 d) 8

6. Which of the following statements about hash-based index files is true?
 a) Support data retrieval based on fields which include the search key
 b) Best suited for equality selections
 c) Very effective for range selections
 d) Recommended when the value of the search key is changed frequently

7. The relation R(A,B,C,D) with functional dependencies A → B, B → C, and BC → D is:
 a) Not in 3NF
 b) In 3NF but not in BCNF
 c) In BCNF but not in 4NF
 d) In 4NF

**A → B BC
BC → A A
B → C**

8. You are making your own table so you can organize information about your Top 100 movies. You want to include information like Title, Actor(s), Director, Year, Genre, etc. Each record in your database will represent:
 a) an actor
 b) a year
 c) a movie
 d) a director

9. In which data model would I export to see details of the structure and locations of the files used to keep the contents of a database on disk?
 a) The logical model
 b) The physical model
 c) The conceptual model
 d) The structural model

10. Which of the following statements about disk components is false?
 a) Block size is a multiple of sector size
 b) All the tracks that could be read from one position of the arm is called a cylinder
 c) Two or more heads can read/write data from disk platters in the same hole
 d) Each track is made up of fixed size sectors

11. Which of the following decompositions of the schema {A, B, C, D, E} are dependency preserving decompositions under the given functional dependencies?
 a) {A, B, C, D, F} and {B, C, D, E}; given ABC → DEF, BC → EF and EF → B
 b) {A, B, C, D, F} and {B, C, D, E}; given AB → CDE, DE → CF and C → E
 c) {A, B, C, D, F} and {B, C, D, E}; given ABC → DEF, BC → E and C → B
 d) {A, B, C, D, F} and {B, C, D, E}; given ABC → DEF, BC → EF and EF → B

12. Consider the relational schema R(A,B,C,D,E) with non-key functional dependencies C,D → E, and B → E.
 a) Consider the strongest statement that can be made about the schema R.
 b) R is in first normal form
 c) R is in second normal form
 d) R is in third normal form
 e) R is in BCNF normal form

**C → E
B → E**

13. Given two relations:
 R:

A	B	C
1	2	3
1	3	4
3	3	5

 S:

A	B
1	2
1	3
3	5

what is the answer of the following query:
 SELECT R.A, SUM(S.B) FROM R WHERE R.A=1 GROUP BY R.A
R.A

**a) (1, 2) (3, 9)
b) (1, 4)
c) (1, 4) (3, 3)
d) (1, 2)**

14. What is a primary index?
 a) An index on a set of fields that are included in the primary key
 b) An index on a set of fields that compose a candidate key
 c) The first index defined for a relation
 d) An index on a set of fields that includes the primary key

15.

A. (40%)

1	6	6	11	C	16	0
2	9	7	12	d	17	0
3	d	8	13	f	18	0
4	a	9	14	d	19	0
5	0	10	15	l	20	0

B. (15%) Give an example of an Extendible Hashing index file for which it is necessary to increase the global depth from 2 to 3 when the value '20' is inserted. Show your structure before and after the insertion.

C. (30%) Consider the following relation and the set of functional dependencies: R(A,C,B,D), {A → B, BC → D, A → C}

a) Identify the key(s) for the relation.
 b) State the strongest normal form that the relation is in.
 c) If R is not in BCNF, decompose it into a set of BCNF relations that preserve the dependencies

D. (15%) The following report is how an inexperienced database developer might create a table. Your mission is to get into 3rd Normal Form. The primary key is Customer_ID, Movie_ID, and Check_Out_Date.

Normalize ME							
Customer_ID	Customer_Name	Movie_ID	Title	Vendor	Type	Check Out Date	Return Date
1001	John Doe	101	Title of Movie 1	ACM	ACTION	1/1/2014	1/2/2015
1001	John Doe	102	Title of Movie 2	ACM	COMEDY	1/1/2014	1/2/2015
1001	John Doe	103	Title of Movie 3	ACM	DRAMA	1/1/2014	1/5/2015
1001	John Doe	104	Title of Movie 4	ACM	DRAMA	1/1/2014	1/6/2015
1001	John Doe	105	Title of Movie 5	ACM	DRAMA	1/1/2014	
1001	John Doe	106	Title of Movie 6	BB	DRAMA	1/1/2014	
1001	John Doe	107	Title of Movie 7	BB	COMEDY	1/1/2014	
1001	John Doe	108	Title of Movie 8	ACM	COMEDY	1/1/2014	
1001	John Doe	109	Title of Movie 9	ACM	COMEDY		

16. Which of the following is not an alternative of mapping inheritance relationship between 2 classes A and B in tables from the next part?
 a) Create table A and de-normalize all attributes of B
 b) Create table A, B and a cross-table between them
 c) Create table A and B, with their own attributes
 d) Create table B and de-normalize all attributes of A

17. In the following queries, the schema of relation R can be arbitrary.
 Q₁: (SELECT * FROM R)
 UNION
 (SELECT * FROM R);
 Q₂: SELECT * FROM R;
 a) Q₁ and Q₂ produce the same answer.
 b) The answer to Q₁ is always contained in the answer to Q₂.
 c) The answer to Q₂ is always contained in the answer to Q₁.
 d) Q₁ and Q₂ produce different answers

18. The following SQL queries refer to a relation R(a; b; c).
 Q₁: SELECT * FROM R r1
 WHERE EXISTS (SELECT * FROM R r2
 WHERE b = ANY (SELECT a FROM R));
 a) Q₁ and Q₂ produce the same answer.
 b) The answer to Q₁ is always contained in the answer to Q₂.
 c) The answer to Q₂ is always contained in the answer to Q₁.
 d) Q₁ and Q₂ produce different answers

19. The following SQL queries refer to a relation R(a; b; c).
 Q₁: SELECT DISTINCT a, b FROM R;
 Q₂: SELECT a, b FROM R GROUP BY a, b;
 a) Q₁ and Q₂ produce the same answer.
 b) The answer to Q₁ is always contained in the answer to Q₂.
 c) The answer to Q₂ is always contained in the answer to Q₁.
 d) Q₁ and Q₂ produce different answers

20. In the following queries, the schema of R is arbitrary, although it must include a.
 Q₁: SELECT * FROM R;
 Q₂: SELECT * FROM R
 ORDER BY a;
 a) Q₁ and Q₂ produce the same answer.
 b) The answer to Q₁ is always contained in the answer to Q₂.
 c) The answer to Q₂ is always contained in the answer to Q₁.
 d) Q₁ and Q₂ produce different answers

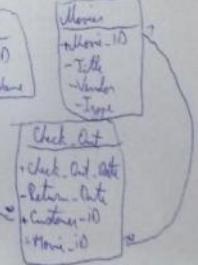
21. In the following relational algebra expressions, R and S have the same schema, which includes attributes a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z, which are otherwise arbitrary.
 a) $\exists a \exists b \exists c \exists d \exists e \exists f \exists g \exists h \exists i \exists j \exists k \exists l \exists m \exists n \exists o \exists p \exists q \exists r \exists s \exists t \exists u \exists v \exists w \exists x \exists y \exists z$

- a) Q_1 and Q_2 produce the same answer.
 b) The answer to Q_1 is always contained in the answer to Q_2 .
 c) The answer to Q_2 is always contained in the answer to Q_1 .
 d) Q_1 and Q_2 produce different answers.
- 20. In the following relational algebra expressions, R and S have the same schema, which includes attribute s, but the schemas are otherwise arbitrary.**
- $Q_1: \pi_s(R) \times_s (S)$
 $Q_2: \pi_s(R \times S)$
- a) Q_1 and Q_2 produce the same answer.
 b) The answer to Q_1 is always contained in the answer to Q_2 .
 c) The answer to Q_2 is always contained in the answer to Q_1 .
 d) Q_1 and Q_2 produce different answers.

1001	John Doe	108	Title of Movie a	
1001	John Doe	109	Title of Movie b	ACM COMEDY

c.
 $\exists A^* - ABCD \rightarrow A$ is a candidate key
 t_{12} is not contained in $\text{key}(t)$

l.) 2NF



2

SPRIJON DRAGOS **226/2-CEILALTI**

Nume: S. C. I. A. L. T. I. Grupa: 226/2-CEILALTI

1. Pentru ca o relație afăță în 1NF să nu fie în a doua formă normală trebuie să împărtășească condiție să fie adevarată:

- Trebuie să existe dependențe multi-valoare netriviale
- Trebuie să existe dependențe transitive
- O parte a cheii determină un atribut neprim
- Toate de mai sus

2. Despre o relație afăță în 1NF și pentru care singura cheie candidat este formată dintr-un singur atribut putem spune că mai mult că:

- A doua formă normală este respectată
- A treia formă normală este respectată
- Forma normală Boyce-Codd este respectată
- A patra formă normală este respectată

3. Folosim operatorul algebraic relațional Θ (join natural) pentru:

- Proiecțarea unui anumit set de attribute dintr-o relație
- Filtrarea tupelor dintr-o relație
- Combinarea a două relații pe baza attributelor cu același nume
- Determinarea producătorului cartezian a două relații

4. Care dintre următoarele afirmații NU reprezintă o proprietate a unei arbori B de grad m?

- Focare nod conține cel mult m-1 valori ale cheii de clătură
- Focare nod are cel puțin $\lceil m/2 \rceil$ valori ale cheii de clătură (excepție fiind rădăcina)
- Focare nod are cel puțin m subarbori
- Toate frunzele sunt poziționate la același nivel

5. În relația R(A,B,C; D,E) cu dependențele funktionale AB \rightarrow C, C \rightarrow B, și D \rightarrow E, numărul supercheilor este:

- 2
- 4
- 6

6. Ce element nou este introdus la nivelul definirii unei clase în bazile de date orientate obiect în comparație cu limbajele de programare orientate-obiect obisnuite?

- Attribute
- Metode
- Relațiile de asociere
- Relațiile de moștenire

7. Despre relația R(A,B;C,D) cu dependențele funktionale A \rightarrow B, B \rightarrow C, și BC \rightarrow A putem spune că:

- Nu este în 3NF
- E este în 3NF dar nu în BCNF
- E este în BCNF dar nu în 4NF
- E este în 4NF

8. Un index cheiește este un index la care:

- Cheia de clătură (indexare) e formată din mai multe attribute
- Cheia de clătură este unică
- Întrările din index sunt ordonate crescător

9. Arborii binari echilibrați au proprietatea că:

- Toate nodurile frunză sunt ca și la același nivel
- Toate nodurile frunză sunt pe cel mai deosebit nivel
- Diferența dintre înălțimile subarborilor orizontal este între 1, 0 sau -1

10. Ce este un ciliindru al unui hard disk?

- Mediazorul discului hard-diskului dispozitiv de citire scriere
- Mediazorul discului hard-diskului dispozitiv de scriere
- Mediazorul discului hard-diskului dispozitiv de citire
- Mediazorul discului hard-diskului dispozitiv de scriere

11. Care dintre următoarele descompuneri ale relației [A, B, C, D, E, F] păstrează dependențele (reprezentate prin linii de dependență funcționale date)?

R:

A	B	C
1	2	3
1	2	4
3	3	5

 S:

A	D
1	4
1	7
3	6

și următoarele interogări:

- SELECT R.A FROM R INNER JOIN S ON R.A = S.A EXCEPT SELECT R.A FROM R
- SELECT R.A FROM R INNER JOIN S ON R.A = S.A INTERSECT SELECT R.A FROM R

a) Q₁ și Q₂ au același număr de tuple
b) Q₁ și Q₂ au număruri diferențiale de tuple
c) Numărul tupelor din Q₁ nu poate fi determinat
d) Numărul tupelor din Q₂ nu poate fi determinat

12. Fie două instanțe de relații:

13. Given the same two relations from previous question, what is the answer of the following query:
SELECT R.A, SUM(R.B) FROM R WHERE R.A>1 GROUP BY R.A

- (1, 2) (3, 9)
- (1, 4)
- (3, 4) (3, 3)
- (1, 2)

14. Ce este un index primar (primary index)?

- Un index definit pe cămpuri care sunt incluse în cheia primară
- Un index definit pe primele n cămpuri ale unei tabele
- Este primul index definit pentru o tabelă
- Un index definit pe un set de cămpuri ce includ cheia primară

Subject 3

29 January 2022
22:41

Name: S. D.

Group: 226

Date: 31.01.2022

A.

1. What is logical data independence?

- a) Changes made in physical schema of a database will not affect the conceptual schema
- b) Changes made in user interface will not affect the conceptual schema
- c) Changes made in conceptual schema will not affect the data access module.
- d) Changes made in conceptual schema of a database will not affect the external schemas

2. Which of the following is not a criteria to use databases for your system

- a) Preserve data integrity
- b) Huge amount of structured data
- c) Low-level data access
- d) Persistence

3. Which of the following statements about dense-sparse indexes is false?

- a) A dense index has at least one data entry for every search key which appears in the indexed file
- b) A dense index must be clustered.
- c) A sparse index is typically much smaller than a dense index.
- d) A sparse index contains an entry for each page of records in a data file.

4. Which of the following is a correct example of a query that finds rows in table T which has a NULL in their C column?

- a) SELECT * FROM T WHERE NULL(C);
- b) SELECT DISTINCT * FROM T GROUP BY C;
- c) SELECT * FROM T WHERE C = NULL;
- d) SELECT * FROM T WHERE C IS NULL;

5. Given the instance of two relations:

R:	A	B	C
	1	2	2
	3	4	5

S:

D	E
1	2
3	6
3	5

What is the result of this query:

$\pi_A(R \odot S)$

a)

A

b) Invalid query

c)

A
1
3

d)

A
1

6. Consider three relations R(a,b), S(b,c), and T(a,c) that have the following records:

R		S		T	
a	b	b	c	a	c
0	0	0	0	0	0
0	1	0	1	0	1
1	0	1	0	1	0
1	1	1	1	1	1

- a) 2
- b) 8
- c) 16
- d) 32

?)

OK

7. The relation R(A;B;C;D) with dependencies AB → C, ABC → D, and AC →→ B is:

Name: S P RIDON
 Group: 22G
 A.

Date: 29.01.2021

SP RIDON DRAGOŠĆEVA
29.01.2021

1. Which of the following sets of FDs are defined for a relation with schema R(A,B,C,D) having primary key AB and under which R is in 2NF but not in 3NF?

- a) $AB \rightarrow CD, B \rightarrow C$
- b) $AB \rightarrow CD, C \rightarrow D$
- c) $AB \rightarrow C, AB \rightarrow D$
- d) $A \rightarrow B, B \rightarrow C, C \rightarrow D$

2. In a table in 1NF in which the only candidate key is a single attribute:

- a) 2NF may not be violated
- b) 3NF may not be violated
- c) BCNF may not be violated
- d) 4NF may not be violated

3. A violation of BCNF is typical of the following condition(s) on a table:

- a) The table has a unique candidate key consisting of one attribute
- b) The table has two candidate keys each consisting of one attribute
- c) The table has two non-overlapping candidate keys
- d) The table has two candidate keys that share a common attribute

4. A relation R has schema:

```
CREATE TABLE R (
    a INT PRIMARY KEY,
    b INT DEFAULT 0,
    c INT NOT NULL);
```

R is currently empty. Which of the following INSERT statements is allowable?

- a) INSERT INTO R(c) VALUES(0);
- b) INSERT INTO R VALUES(1, 2, NULL);
- c) INSERT INTO R(a,c) VALUES(1,1);
- d) INSERT INTO R VALUES(7,8,NOT NULL)

YES

5. In the relation R(A;B;C; D;E) with functional dependencies $AB \rightarrow C$, $C \rightarrow B$, and $D \rightarrow E$, the number of superkeys is:

- a) 2
- b) 4
- c) 6
- d) 8

6. Which of the following statements about hash-based index files is true?

- a) Support data retrieval based on fields which include the search key
- b) Best suited for equality selections
- c) Very effective for range selections
- d) Recommended when the value of the search key is changed frequently

7. The relation R(A;B;C;D) with functional dependencies $A \rightarrow B$, $B \rightarrow C$, and $BC \rightarrow A$ is:

- a) Not in 3NF.
- b) In 3NF but not in BCNF.
- c) In BCNF but not in 4NF.
- d) In 4NF.

8. Let R(a) be a relation, and let R currently consist of the four tuples (3), (9), (11), and (12). Then the result of the query:

```
SELECT a
FROM R
WHERE a > ALL(SELECT a FROM R WHERE a <= 10);
```

consists of which set of tuples?

- a) $\{(19), (11), (12)\}$
- b) $\{(11), (12)\}$
- c) The empty set
- d) $\{(12)\}$

9. In which data model would I expect to see details of the structure and locations of the files used to keep the contents of a database on disk.

- a) The logical model
- b) The physical model
- c) The conceptual model
- d) The structural model.

10. Which of the following statements about disk components is false?

- a) Block size is a multiple of sector size
- b) All the tracks that could be read from one position of the arm is called a cylinder
- c) Two or more heads can read/write data from/on disk platters in the same time
- d) Each track is made up of fixed size sectors.

11. Which of the following decompositions of the schema $\{A, B, C, D, E, F\}$ are dependency preserving decompositions under the given functional dependencies?

- a) $\{A, B, C, D, F\}$ and $\{B, C, D, E\}$: given $ABC \rightarrow DEF$, $BC \rightarrow EF$ and $EF \rightarrow B$
- b) $\{A, B, C, D, F\}$ and $\{B, C, D, E\}$: given $AB \rightarrow CDE$, $DE \rightarrow CF$ and $C \rightarrow E$
- c) $\{A, B, C, D, F\}$ and $\{B, C, E\}$: given $ABC \rightarrow DEF$, $BC \rightarrow E$ and $C \rightarrow B$
- d) $\{A, B, C, D, F\}$ and $\{B, C, D, E\}$: given $ABC \rightarrow DEF$, $BC \rightarrow EF$ and $EF \rightarrow B$

12. Given two relations,

	A	B	C		A	D
R:	1	2	3	S:	1	4
	1	2	4		1	7
	3	3	5		3	8

and the following queries:

Q_1 : SELECT R.A FROM R INNER JOIN S EXCEPT SELECT R.A FROM R

Q_2 : SELECT R.A FROM R INNER JOIN S INTERSECT SELECT R.A FROM R

- a) Q_1 and Q_2 have the same number of tuples
- b) Q_1 and Q_2 have different number of tuples
- c) Number of tuples in Q_1 cannot be computed
- d) Number of tuples in Q_2 cannot be computed

13. Given the same two relations from previous question, what is the answer of the following query:

SELECT R.A, SUM(R.B) FROM R WHERE R.A=1 GROUP BY R.A

- a) $(1, 2) (3, 9)$
- b) $(1, 4)$
- c) $(1, 4) (3, 3)$
- d) $(1, 2)$

14. What is a primary index?

- a) An index on a set of fields that are included in the primary key
- b) An index on a set of fields that compose a candidate key
- c) The first index defined for a relation
- d) An index on a set of fields that includes the primary key

15. Which of the following is not an alternative of mapping inheritance relationship between 2 classes A and B in tables from relational model?

- a) Create table A and de-normalize all attributes of B
- b) Create tables A, B and a cross-table between them
- c) Create tables A and B, with their own attributes
- d) Create table B and de-normalize all attributes of A

16. The following SQL queries refer to a relation R(a; b; c).

$Q_1: \text{SELECT DISTINCT } a, b \text{ FROM } R;$
 $Q_2: \text{SELECT } a, b \text{ FROM } R \text{ GROUP BY } a, b;$

- a) Q_1 and Q_2 produce the same answer.
- b) The answer to Q_1 is always contained in the answer to Q_2 .
- c) The answer to Q_2 is always contained in the answer to Q_1 .
- d) Q_1 and Q_2 produce different answers.

17. In the following queries, the schema of R is arbitrary, although it must include a.

$Q_1: \text{SELECT * FROM } R;$
 $Q_2: \text{SELECT * FROM } R$
 $\text{ORDER BY } a;$

- a) Q_1 and Q_2 produce the same answer.
- b) The answer to Q_1 is always contained in the answer to Q_2 .
- c) The answer to Q_2 is always contained in the answer to Q_1 .
- d) Q_1 and Q_2 produce different answers.

18. In the following relational algebra expressions, R and S have the same schema, which includes attribute a, but the schemas are otherwise arbitrary.

$Q_1: \pi_a(R) \cap \pi_a(S)$
 $Q_2: \pi_a(R \cap S)$

- X a) Q_1 and Q_2 produce the same answer.
b) The answer to Q_1 is always contained in the answer to Q_2 .
c) The answer to Q_2 is always contained in the answer to Q_1 .
d) Q_1 and Q_2 produce different answers.

a	b
1	3
1	3

a	b
1	3
2	2

19. In the following queries, the schema of relation R can be arbitrary.

$Q_1: (\text{SELECT * FROM } R)$
 UNION
 $(\text{SELECT * FROM } R);$

$Q_2: \text{SELECT * FROM } R;$

1 1
2 2

- X a) Q_1 and Q_2 produce the same answer.
b) The answer to Q_1 is always contained in the answer to Q_2 .
c) The answer to Q_2 is always contained in the answer to Q_1 .
d) Q_1 and Q_2 produce different answers.

20. The following SQL queries refer to a relation R(a; b).

$Q_1: \text{SELECT } a \text{ FROM } R \text{ r1}$
 $\text{WHERE EXISTS}(\text{SELECT * FROM } R \text{ WHERE } a = \text{r1.b});$
 $Q_2: \text{SELECT } a \text{ FROM } R$
 $\text{WHERE } b = \text{ANY}(\text{SELECT } a \text{ FROM } R);$

- a) Q_1 and Q_2 produce the same answer.
b) The answer to Q_1 is always contained in the answer to Q_2 .
c) The answer to Q_2 is always contained in the answer to Q_1 .
d) Q_1 and Q_2 produce different answers.