1. Considerăm relația cu patru atribute ABCD și următoarele dependențe funcționale: BC → D, BC → A, D → B, A → C.
   a) Identificați cheia/cheile relației: **BC (deoarece cunoscând valorile B și C putem afla toate celelalte atribute ale relației)**
   b) Explicați de ce relația nu se află în BCNF, dar se află în 3NF: **Nu este în BCNF pentru că există dependența A → C, iar A nu reprezintă cheie pentru relație. Se află în 3NF pentru că orice atribut neprim (A și D) este dependent functional de întreaga cheie (BC).**
   c) Descompuneți relația într-un set de relații BCNF:

      Alegem dep. A → C => relațiile (B, A, D) și (A, C), care încă nu sunt în BCNF

      Alegem dep. D → B => relațiile (A, D) și (D, B), care sunt în BCNF.

      Deci setul de relații BCNF este {R_1(A, D), R_2(D, B)}.

2. **Are foreign keys allowed to have null values?**
   a) No, foreign keys should always have 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 always have null values.

3. **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.

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

      Q1: SELECT * FROM R INNER JOIN S;

      Q2: SELECT * FROM R LEFT JOIN S;

   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.

5. **In the following, the results of Q1 and Q1 should be taken to be the result of the final SELECT * FROM R. Assume that the schema of relation R is R(a; b).**

      Q1: UPDATE R SET b = 20 WHERE a = 10;

SELECT * FROM R;

Q2: DELETE FROM R WHERE a = 10;

INSERT INTO R VALUES(10, 20);

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.

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

Q1: SELECT COUNT(DISTINCT b) FROM R;

Q2: SELECT COUNT(b) 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.

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

Q1: SELECT R.a FROM R, S

WHERE R.b = S.b;

Q2: SELECT R.a FROM R

WHERE R.b IN (SELECT S.b FROM S;);

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.

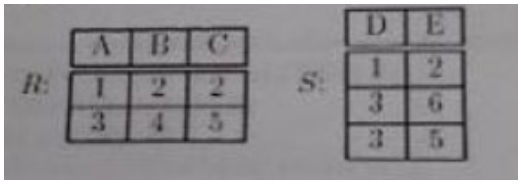
8. **What is logical data independence?**
a) Changes made in physical schema of a database will not affect the conceptual schema.
b) Changes made in user interface will not affect the conceptual schema.
c) Changes made in conceptual schema will not affect the data access mode.
d) Changes made in conceptual schema of a database will not affect the external schemas.

9. **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

10. **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.

11. **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.

12. **Given the instance of two relations:**



What is the result of this query?

$\pi_A(R \otimes S)$

   a) A
   b) Invalid query
   c) A 1 3
   d) A 1

13. **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 → CD, B → C
   b) AB → CD, C → D
   c) AB → C, AB → D
   d) A → B, B → C, C → D

14. **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

15. **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

16. **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);

17. **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

$ABCDE^+$ = {A, B, C, D, E} – supercheie

$ABDE^+$ = {A, B, C, D, E} – supercheie

$ABCD^+$ …

ABD: AB, AD, BD, A, B, D – CK

PA: {A, B, D}

NPA -> NPA

AB^+ = {A, B, C} – nu e supercheie

ABD^+ = {A, B, D, C, E} – supercheie

$ABCD^+$ = {A, B, C, D, E} – supercheie

$ABCDE^+$ = {A, B, C, D, E} – supercheie

$ABDE^+$ = {A, B, D, E, C} - supercheie

18. **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.

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

20. **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) {(9), (11), (12)}

b) {(11), (12)}
c) The empty set
d) {(12)}

21. 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

22. 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 at the same time.
d) Each track is made up of fixed size sectors.

23. 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, C, D, E}: given ABC → DEF, BC → EF and EF → B

24. 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 R.A FROM R INNER JOIN S EXCEPT SELECT R.A FROM R

Q2: SELECT R.A FROM R INNER JOIN S INTERSECT SELECT R.A FROM R

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

25. 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)

26. 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.

27. Which of the following is *not* an alternative of mapping inheritance relationships 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

28. 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

29. 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

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

Q1: π_a(R) ∩ π_a(S)

Q2: : π_a (R ∩ S)

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

31. In the following queries, the schema of a 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

32. The following SQL queries refer to a relation R(a,b).

Q1: SELECT a FROM R r1

WHERE EXISTS(SELECT * FROM R WHERE a = r1.b);

Q2: SELECT a FROM R

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