

Quiz 5

Databases

25 March 2026

Full name:

You have 10 minutes to answer this quiz, directly on this sheet of paper. No electronic devices or material of any kind is allowed. Do not forget to add your name above. Every question amounts to 2 points; the quiz is graded out of 10 points.

Questions

Q1. Circle the only correct answer.

For a relation schema to be in second normal form (2NF), it needs to be in 1NF and it needs to satisfy the following property:

- a. every determinant is a superkey
- b. every non-key attribute depends on the whole of every candidate key
- c. every attribute stores atomic values
- d. non-key attributes do not depend transitively on a key

Q2. Consider the relation

`TeacherInfo(teacher, name, office, building)`

storing information about teacher id, name, their office and their building, with functional dependencies

`teacher → name, office      office → building`

Circle the only correct answer.

- a. The relation is not in 1NF.
- b. The relation is not in 2NF.
- c. The relation is in BCNF.
- d. The relation is not in 3NF.

Q3. In first-order logic, what is a free variable? What is its role in a relational calculus query?

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Q4. Consider the relational-calculus query over a relation `Student(id, name, program)`:

$$Q(n) = \exists i \exists p (\text{Student}(i, n, p) \wedge p = \text{CS})$$

Explain in English what this query returns.

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Q5. Circle all correct answers (there may be more than one).

Which of the following are valid ingredients of first-order logic / relational calculus as presented in the lecture?

- a. quantifiers $\exists, \forall$
- b. a fixpoint operator μ^+
- c. relation atoms such as `Student( $i, n, p$ )`
- d. connectives such as $\wedge, \vee, \neg$