

Quiz 7

Databases

22 April 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.

In the iterator model, each physical operator exposes an `open()` / `next()` / `close()` interface. The main benefit of this design is:

- a. it guarantees that the output of every operator is sorted
- b. it lets operators *pipeline* tuples one at a time, avoiding the materialization of full intermediate results
- c. it removes the need for a query optimizer
- d. it makes every operator automatically parallel

Q2. Circle all correct answers (there may be more than one).

Which of the following are valid equivalence rules for relational algebra, used by optimizers to rewrite logical plans?

- a. $\sigma_{p_1 \vee p_2}(R) \equiv \sigma_{p_1}(R) \cap \sigma_{p_2}(R)$
- b. $(R \bowtie S) \bowtie T \equiv R \bowtie (S \bowtie T)$
- c. $\sigma_p(R \bowtie S) \equiv \sigma_p(R) \bowtie S$, when p only mentions attributes of R
- d. $\pi_A(R \bowtie S) \equiv \pi_A(R) \bowtie \pi_A(S)$

Q3. Explain briefly why “pushing selections below joins” is almost always beneficial for query performance.

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- Q4.** Consider a block nested loop join between two relations R and S , with $B_R = 100$ pages, $B_S = 500$ pages, and $M = 12$ buffer pages. Recall that the I/O cost is

$$B_R + \left\lceil \frac{B_R}{M-2} \right\rceil \cdot B_S.$$

Which of the following is the correct cost? Circle the only correct answer.

- a. 600 I/Os
- b. 1 500 I/Os
- c. 5 100 I/Os
- d. 50 100 I/Os

- Q5.** Running **EXPLAIN** on a three-way join query in MySQL produces the following output:

table	type	key	Extra	rows
S	ALL	NULL	Using where	1000
E	ref	PRIMARY		21
C	eq_ref	PRIMARY		1

What does the value **ALL** in the **type** column for table **S** tell us? Circle the only correct answer.

- a. the optimizer will use all available indexes on **S**
- b. the query returns all rows of **S**
- c. **S** will be accessed via a *full table scan* (no index is used)
- d. all columns of **S** will be projected in the output