

Name: \_\_\_\_\_

This quiz is **open book, open notes**, but there can be no sharing of any material.

1. (1 pt) Write your name in the space provided above.
2. (2 pts) If  $\{(1, 2, 3), (1, 3, 2)\}$  is a valid instance of a relation  $S(A, B, C)$ , list all functional dependencies that cannot possibly hold true. Explain your answer briefly.
3. (2 pts) Consider a relation with schema  $R(A, B, C, D)$  and functional dependencies  $AB \rightarrow D$ ,  $C \rightarrow A$ , and  $D \rightarrow C$ . List all keys of  $R$ .
4. (2 pts) Compute  $\{BC\}^+$  for the schema in Question 3.
5. (2 pts) Consider the relation  $R$  in Question 3. Write a relational algebra query for the  $B$  and  $C$  values of tuples with  $A = 5$ .



9. (2 pts) For the schema in Question 3, list one nontrivial multivalued dependency that is not a functional dependency.
10. (2 pts) Given a SQL database containing a table  $R(A, B, C, D)$  with all attributes of type integer, write a SQL statement that adds a constraint called *ABisKey* stating that  $(AB)$  is a secondary key of  $R$ .
11. (4 pts) Suppose the database suggested by Question 10 has another table,  $S(A, E)$ , with both attributes of integer type. Write a SQL3 trigger that results in the following database behavior. Whenever a tuple  $(a, b, c, d)$  is inserted into  $R$  and  $a$  is a value that does not occur as the first attribute of any tuple in  $S$ , a tuple  $(a, \perp)$  is inserted in  $S$  (where  $\perp$  denotes null).
12. (2 pts) Write down all the constraints guaranteed (maintained) by the trigger in your answer to Question 11.