

**Directions:** Examine the following relations.

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1. Using Table 1, determine if  $A \rightarrow B$ ,  $B \rightarrow C$ , and  $AB \rightarrow D$ . In words, is  $B$  dependent on  $A$ ? is  $C$  dependent on  $B$ ? and is  $D$  dependent on  $AB$ ?

Table 1: Relation in Problem 1.

R =	A	B	C	D
	$a_1$	$b_1$	$c_1$	$d_1$
	$a_1$	$b_1$	$c_3$	$d_1$
	$a_2$	$b_1$	$c_3$	$d_4$
	$a_2$	$b_1$	$c_3$	$d_4$
	$a_3$	$b_6$	$c_3$	$d_1$

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2. Determine if there are any transitive dependencies in Table 2. If so, specify.

Table 2: Relation in Problem 2.

R =	A	B	C	D
	$a_1$	$b_1$	$c_1$	$d_1$
	$a_1$	$b_1$	$c_3$	$d_1$
	$a_2$	$b_2$	$c_3$	$d_4$
	$a_2$	$b_2$	$c_3$	$d_4$
	$a_3$	$b_6$	$c_3$	$d_2$

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3. Determine all (nontrivial) dependencies in Table 3. Identify symmetric and transitive dependencies. Note: A functional dependency  $A \rightarrow B$  is **trivial** if  $B \subseteq A$ . *Hint:* there are five.
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4. Use functional dependencies in the relation  $R$  (see Table 3) to determine a primary key for the relation. Note: functional dependencies are used to identify candidate keys (any of which can

Table 3: Relation in Problem 3.

R =

A	B	C	D	E
$a_1$	$b_2$	$c_7$	$d_9$	$e_4$
$a_5$	$b_2$	$c_8$	$d_9$	$e_5$
$a_1$	$b_4$	$c_7$	$d_9$	$e_6$
$a_5$	$b_4$	$c_8$	$d_9$	$e_4$
$a_1$	$b_6$	$c_7$	$d_2$	$e_6$
$a_5$	$b_6$	$c_8$	$d_2$	$e_6$

be used for the primary key). Candidate keys are determined by finding set(s) of attributes for which all other attributes are functionally dependent.

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5. List three anomalies and give an example of one of them.
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