

# SOLUTIONS:

## Databases

### 1994 Comprehensive Exam in Databases Sample Solution

1. (a)  $\Pi_{name, address}((\sigma_{dept="CS"}(student \bowtie enrolled)))$
- (b) `SELECT name, address  
FROM student, enrolled  
WHERE student.ID = enrolled.ID  
AND dept = "CS"`
- (c) Parts (a) and (b) will not return exactly the same result. SQL returns duplicate values in results while relational algebra does not. If a student is taking more than one CS course, then the student's name and address will appear multiple times in the answer to (b) but only once in the answer to (a). Note that if the query for (b) uses `SELECT DISTINCT` then the results will be the same.
- (d) `SELECT sum(units)  
FROM enrolled, course  
WHERE enrolled.dept = course.dept  
AND enrolled.code = course.code`
- (e) No. Relational algebra does not include aggregate operators such as `sum`.
2.  $B$  is the only key. Since  $B$  does not appear on the right of any functional dependency, it must be in any key. However, we can use  $B \rightarrow E \rightarrow A$  to show  $B \rightarrow A$ , and then use  $AB \rightarrow C$  to show  $B \rightarrow C$ . Thus  $B$  by itself is a key and hence is the only key.

3. (a) Lock Compatibility Matrix:

		Lock Held By Another Transaction:		
		read	write	update
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Lock	read	Y	N	Y
Requested:	write	N	N	N
	update	Y	N	N

- (b) Example:

Transaction T1 requests update lock for item A -> request granted  
 Transaction T2 requests update lock for item A -> T2 must wait  
 Transaction T1 requests write lock for A -> request granted  
 Transaction T1 completes and releases all of its locks  
 Transaction T2 gets update lock on A and continues processing  
 Transaction T2 requests write lock for A -> request granted  
 Transaction T2 completes and releases all of its locks