Introduction to Databases
Constraints and Entailment

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Problem 1. Consider the following set of FDs:

$$D \to AC\,, \qquad AB \to DE\,, \qquad FD \to E\,, \qquad C \to F$$

(a) Indicate which of the above FDs hold in the following relation:

A	B	C	D	E	F
1	1	2	3	0	4
2	1	2	3	1	4
1	1	3	3	0	5

Moreover, for each FD that does not hold provide two tuples (from the above relation) constituting a violation.

(b) Determine whether each of the following FDs is implied by the FDs above:

$AC \to E$	$BD \to EF$	$EF \to BC$	$BC \to BF$
$AD \to CF$	$ABC \to DF$	$DEF \to AB$	$DF \to AE$
$CD \to DE$	$BE \to AC$	$CD \to ED$	$DE \to AF$

(c) For each FD in point (b) that is implied, write a derivation using Armstrong's axioms (including union and decomposition).

Problem 2. Let R, S and T be relations on attributes A, B, C. Given the following set of INDs:

$$R[A, B] \subseteq S[B, C] \qquad\qquad S[C, B] \subseteq T[C, A]$$

determine which of the following INDs are implied:

$R[A] \subseteq T[A]$	$R[B] \subseteq T[B]$	$R[C] \subseteq T[C]$
$R[A] \subseteq T[B]$	$R[B] \subseteq T[A]$	$R[B] \subseteq T[C]$
$R[C] \subseteq T[B]$	$R[A] \subseteq T[C]$	$R[C] \subseteq T[A]$