Assignment 3

COMP 353

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**Question 1:**

1. **If AB → C and A → C, then B → C.**

No, given F={AB-> C and A-C}, in order to prove the statement we must have C inside B+, which it does not give us C, therefore B alone does NOT control C.

1. ) **If AB → C, then A → C or B → C**

No, given F={AB-> C}, we conclude that A and B alone do not control C, given their closures.

**Question 2:**

**Complete closure of all subsets of S, except empty set and ABC, using the given closures of R**

1. **AB → DE, C → E, D → C, and E → A**

A+ = A

B+ = B

C+ = C

AB+ = ABDEC (AB->DE, D->C) -> **AB->C**

AC+ = ACE (C->E, E->A) **C->A**

BC+ = BCEADC (C->E, E->A, AB->DE, D->C) **C->A**

1. **A → D, BD → E, AC → E, and DE → B**

A+ = A

B+ = B

C+ = C

AB+ = ABDE (A->D, BD->E, DE->B)

AC+ = ACEDB (AC->E, A->D, DE->B) **AC->B**

BC+ = BC

1. **AB → D, AC → E, BC → D, D → A, and E → B**

A+ = A

B+ = B

C+ = C

AB+ = ABD (AB->D, D -> A)

AC+ = ACEBD (AC->E, E->B) **AC->B**

BC+ = BCDAE (BC->D, D->A) **BC->A**

**Question 3:**

R = (A,B,C,D,E,G,H,I)

F = {CD→A, EC→H, GHB→AB, C→D, EG→A, H→B, BE→CD, EC→B}

1. **Candidate Keys:**

**EGIB, EGIC, EGIH** are candidate keys because their closures give the whole set R. Basically the candidate keys appear on the left side of FDs.

1. **R is not in 3NF because of the violating properties:**

* BE→CD
* C→D
* CD→A
* EG→A
* GHB→AB

Basically the RHS’s are not part of the candidate keys and the LHS’s are not candidate keys by themselves

1. **Canonical Basis:**

**Step 1: FDs in simple forms**

G = {CD->A, EC->H, GHB->A, C->D, EG->A, H->B, BE->C, BE->D, EC->B}

**Step 2: Minimize the left hand side of each FD**

G = {**C->A**, EC->H, **GH->A**, C->D, EG->A, H->B, BE->C, BE->D, EC->B}

**Step 3: Delete redundant FD’s**

G = {C->A, EC->H, GH->A, C->D, EG->A, H->B, BE->C}

1. **Give a 3NF decomposition of R which is loss-less and dependency-preserving**
2. **Projection of F on schema S(A,B,C,D)**

A+= A

B+= B

C+= C

AB+= AB

AC+= ACD (C->D)

BC+= BCDA (C->D, CD->A)

**Question 4:**

1. **Minimal Basis:**

F = {Ship→Capacity, Ship,Date→Cargo, Cargo,Capacity→Value}

Itself is minimized already and there are no redundant FDs.

1. **Loss-less and dependency-preserving?**

The decomposition of relation Shipping into R1 and R2 **IS loss-less, but NOT dependency-preserving** because missing Cargo,Capacity→Value

1. **Loss-less and dependency-preserving?**

Yes, the decomposition of relations R1, R2 and R3 **IS loss-less AND dependency-preserving**