Lab 3

TDDD37 - Database technology

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1 Task 1

a)
FD2: $\{C\} \to \{A, D\}$
Transitivity with FD1
FD4: $\{C\} \to \{B, C, D\}$
Decomposition from FD4
Final FD: $\{C\} \to \{B\}$

b)
FD1: $\{A\} \to \{B, C\}$
Transitivity with FD2
FD4: $\{A\} \to \{B, A, D\}$
Decomposition from FD4
FD5: $\{A\} \to \{D\}$
Augumentation with E
FD6: $\{A, E\} \to \{D, E\}$
Transitivity with FD3
Final FD $\{A, E\} \to \{F\}$

2 Task 2

a)
Intital: $X = \{A\}$
With FD1: $X = \{A, B, C\}$
With FD2: $X = \{A, B, C, D\}$
With FD3: $X = \{A, B, C, D\}$

b)
Intital: $X = \{C, E\}$
With FD2: $X = \{A, C, D, E\}$
With FD1: $X = \{A, B, C, D, E\}$
With FD3: $X = \{A, B, C, D, E, F\}$

3 Task 3

a)
We can quickly see that, A and B are a candidate key, E and F (and all their combinations) are redundant and that no single letter can be a candidate key. We also see that D implies B, and thus A and D are also a canditate key: $\{A, B\}+ = \{A, B, C, D, E, F\}$
$\{A, D\}+ = \{A, B, C, D, E, F\}$
$\{A, B\}$ and $\{A, D\}$ are candidate keys

b)
FD2 and FD3 are not super keys and thus is not in BCNF.

c)

From FD2 we create R1 and R2 as following:

R1(E,F), with FD2, Candidate key = E is in BCNF

R2(A,B,C,D,E) with FD1 (without F), FD3. Canditade keys are A,B and A,D. Not in BCNF (FD3).

We decompose R2 with FD3 and get

R3(D,B) With FD3, candidate key = D, is in BNCF

R4(A,C,D,E) with FD1 (without F and B), candidate key = $\{A, D\}$, is in BNCF
By deriving our FD's we get FD4: $\{A, D\} \rightarrow \{C, D, E\}$ Byt using the transitivity rule on FD1 with FD2 and FD3, and removing repetitions. R4 thus have the candidate key $\{A, D\}$, which is the new FD4, and it's in BCNF.
Hence the normalisation of R consists of R1, R3 and R4.

4 Task 4

a)
We have the FD:s
FD1: $\{A, B, C\} \rightarrow \{D, E\}$
FD2: $\{B, C, D\} \rightarrow \{A, E\}$
FD3: $\{C\} \rightarrow \{D\}$
We can see that the candidate key is $\{B, C\}$
FD3 is not candidate key, and thus R is not in BCNF.

b)
We need to decompose R with FD3 and get:
R1(C,D) with FD3. Candidate key is $\{C\}$ and it's BCNF.

R2(A,B,C,E) with two new FD:s
By decompositoin from FD1 we get
FD4: $\{A, B, C\} \rightarrow \{E\}$
By augumenting FD3 with B,C we get FD5: $\{B, C\} \rightarrow \{B, C, D\}$
And with transitivity on FD5 and FD2 we get
FD6: $\{B, C\} \rightarrow \{A, E\}$
Candidate key is $\{B, C\}$ and it's in BCNF.

Hence the normalisation of R consists of R1 and R2.