CSE 414 - Database
Assignment 2

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In this assignment you have to use the techniques mentioned in our lecture and slides. Any other technique will not be graded. You have to write down the answers to a paper and upload the photo of the paper to moodle.

1- Given R (A1, A2, A3, A4, A5, A6, A7, A8) and
F = {A1 A3 → A7, A4 → A5 A7, A2 A3 → A4, A3 A7 → A2 A4, A1 A3 A4 → A7, A3 A5 → A1 A7}
After finding extraneous attributes and eliminating them and redundant functional dependencies, find the canonical cover of F. You have to define all the steps to get the canonical cover. Just writing the canonical cover without the steps will not be graded.

- split the functional dependencies such that contain the single attribute

- A1, A3 → A7 · A4 → A5 · A4 → A7 · A2 → A3 · A3, A7 → A2 · A3 A7 → A4
- A1, A3, A4 → A2 · A3, A5 → A1 · A3, A5 → A7

No redundant functional dependencies.

Find the redundant attributes on left hand side

- (A1, A3)+ → A1, A3, A7, A2
  A1, A3, A4 → A2 can be reduced as A1 A3 → A2

And then canonical form is

A1 A3 → A7, A4 → A5, A4 → A7, A2 A3 → A4, A3 A7 → A2, A3 A7 → A4
A1 A3 → A2, A3 A5 → A1, A3 A5 → A7

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2- Given R(A1, A2, A3, A4, A5, A6) and
- A1 A2 → A3 - A1 A4 → A5 - A2 → A4 - A1A6 → A2

Find the {A1, A2}+ and {A1, A6}+
Why do we need closure? Explain giving examples if necessary

- {A1, A2}+ = {A1 A2 A3 A4 A5} (A1A2
(A1 A2 → A3, A2 → A4, A1 A4 → A5)

{A1, A6}+ = {A1 A6 A2 A3 A4 A5}
(A1 A6 → A2, A2 → A4, A1 A4 → A5, A1 A2 → A3)

- The main purpose of the closure is like to find the all possible attributes are derived from a given set the functional dependency of a given set can find using closure. It has also importance to determine the key of the dataset is the candidate key or not and using closure find all attributes that functionally dependent on the other attributes.

R(A, B, C, D) {A → B, B → C, C → D

{A}+ = {ABCD}

A derived all functionality that direct or indirect depend on A

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3 - Given R(A1, A2, A3, A4)
F = {A1 → A2, A2 → A3}
A1 and A2 are superkeys.
Is R in BCNF? Give the proof.
Suppose that we decomposed R into R1(A1A2) R2(A1A3) R3(A1A4)
Are each of the relations in BCNF? Give the proof.
Is the decomposion dependency preserving? Give the proof.

- Let R be relational schema X → Y be any non-trivial functional dependency over R is BCNF if X is candidate key or superkey.
If A1 and A2 are superkey the relation R will be in BCNF.
The relation is in BCNF when the functional dependency is of the form superkey → attribute set.
All functional dependencies satisfying condition
A1 → A2, A2 → A3
In the both above case, A1 and A2 are superkeys of R
So the relation of R in BCNF

- A relation is in BCNF if X is a superkey for every functional dependency X → Y. A1 and A2 are superkey means they can derive all the attributes ie A1 A2 A3 A4.
R1 has A1A2 and both are superkeys, R1 is BCNF
R2 has A1A3 and A1 is superkey it can derive A3, R2 in BCNF
R3 has no FD, but A1 is superkey it can derive A4, R3 in BCNF

- Decomposing the table into three tables R1 R2 R3
since there is no FD. FD's of decomposed relations
FD1 A1→A2 FD2 A2→A3 and there is no FD derived from R3
Finding the closures of the FD
closure(A1) = {A1, A2} closure(A2) = {A2, A3}
Finding union of closures
{A1 A2} U {A2 A3} = {A1 A2 A3} = F
It is dependency preserving decomposition