Purdue University
Computer Science
Department CS44800
Homework 4
Fall 2024

Reference:

- **Fundamentals of Database Systems by Elmasri & Navathe, 7th Edition**

Total Points: **3 points**
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Provide concise but to the point explanation to support your answers. If possible, use bullets to organize the ideas in your answer.

Question 1. (0.75 points)

Consider the universal relation R = {A, B, C, D, E, F, G, H, I, J} and the set of functional dependencies F.

F =

{{A, B}→{C, D},
{D}→{E, F, G},
{F, G}→{H},
{A}→{I},
{A, B}→{E, G},
{A, I} → {I, J}}

(a) What is the closure of the set {A, D}?
(b) What is the key for R?
(c) What is the minimum cover for the set of functional dependencies F?

(d) Decompose R into 2NF.
(e) Decompose R into 3NF.

Question 2. (0.75 points)

(a) What are the possible sources of the information that defines the functional dependencies that hold among the attributes of a relation schema? Discuss two possible sources. Explain your answer.

(b) What is meant by the closure of a set of functional dependencies? Illustrate with an example.

(c) What is the lossless (or nonadditive) join property of a decomposition? Why is it important?

Question 3. (0.75 points)

Consider the following four schedules for transactions T1, T2 and T3:

a. r1(X); r3(X); w1(X); r2(X); w3(X); w2(X)
b. r1(Y); r3(Y); w3(X); w1(X); r2(X); w2(Y)
c. w2(X); r1(Y); w2(Y); r2(X); w2(Y); r3(Y)
d. r3(X); r2(X); w3(X); r1(Y); w1(X); r2(Y)
e. r3(X); r2(X); r1(X); w3(X); w1(X); w2(X)

(a) For each schedule, specify whether or not the schedule is conflict serializable and why. To determine if a schedule is conflict serializable you can either use the precedence graph or swap conflicting operations.

(b) Then, for each serializable schedule, give the equivalent serial schedule.

Question 4. (0.75 points)

Consider the following actions taken by transaction T1 on a database with objects X and Y:

R1(X), W1(X), R1(Y), W1(Y)

Without altering the order of operations of T1, give example schedules with an additional Transactions T2 (with 4 operations accessing both database objects X and Y) that fulfill the following conditions:

(a) Give an example schedule using two transactions (T1 and T2) which is conflict serializable.

(b) Give an example schedule using two transactions (T1 and T2) which is not conflict serializable. Explain why the schedule is not conflict serializable.