University at Buffalo

CSE 4/560
Fall 2024
Databases and Query Languages Homework -2
Total Marks 100

Instructions:

1. Write the answers to each problem in a MS Word file, and save it as a single PDF file. Upload the PFD file in BrightSpace
2. Write your name and your UBIT number top of the HomeWork
3. No handwritten or drawn Homework will be accepted.
5. Only a single attempt for the submission, before submission carefully check the file.
6. **Submission Deadline: October 15th October**

Problem 1 [10]

Consider a database that includes the entity sets student, course, and section from the university schema and that additionally records the marks that students receive in different exams of different sections.

a. Construct an E-R diagram that models exams as entities and uses a ternary relationship as part of the design.

Problem 2 [10X2=20]

Consider the schema $R = (A, B, C, D, E, G, H)$ and the set F of functional dependencies:

$AB \rightarrow CD, D \rightarrow C, DE \rightarrow B, DEH \rightarrow AB, AC \rightarrow DC$

Compute

a. A list of all candidate keys

b. A canonical cover or minimal basis for *F, Fc*

Problem 3 [20]

For each of the following relation schemas and sets of FD's:

a) $R(A, B, C, D)$ with FD's $AB \rightarrow C$, $C \rightarrow D$ and $D \rightarrow A$.

b) $R(A, B, C, D)$ with FD's $A\,B \rightarrow C$, $B\,C \rightarrow D$, $CD \rightarrow A$, and $AD \rightarrow B$.

do the following:

i) Indicate all the BCNF violations. Do not forget to consider FD's that are not in the given set, but follow from them. However, it is not necessary

to give violations that have more than one attribute on the right side.
ii) Decompose the relations, as necessary, into collections of relations that are in BCNF.

Problem 4:[10]

For the given relation schemas and sets of FD's
R (A ,B ,C ,D) with FD's $AB \rightarrow C$, $C \rightarrow D$ and $D \rightarrow A$.

i) Indicate all the 3NF violations.
ii) Decompose the relations, as necessary, into collections of relations that are in 3NF.

Problem 5 [20]

Suppose we have relation *R (A ,B ,C ,D ,E) ,* with some set of FD's, and we wish to project those FD's onto relation *S(A, B, C).* Give the FD's that hold in *S* if the FD's for *R* are:

a) $AB \rightarrow DE$, $C \rightarrow E$, $D \rightarrow C$, and $E \rightarrow A$.
b) $A \rightarrow$ D , $BD \rightarrow E$, $A\ C \rightarrow E$ and $DE \rightarrow B$.

Problem 6 [10]

Let *R(A, B, C, D, E)* be decomposed into relations with the following three sets of attributes: *{A, B, C}, {B, C, D},* and {A, *C, E).* For each of the following sets of FD's, use the chase test to tell whether the decomposition of *R* is lossless. $A \rightarrow D$, $D \rightarrow E$, and $B \rightarrow D$.

Problem 7 [10]

For each of the following relation schemas and dependencies
b) *R(A, B, C, D)* with MVD's $A \rightarrow\rightarrow B$ and $A \rightarrow\rightarrow C$
c) *R(A, B, C, D*) with MVD $A \rightarrow\rightarrow B$ and FD $B \rightarrow\rightarrow C\ D$.
do the following:
i) Find all the 4NF violations.
ii) Decompose the relations into a collection of relation schemas in 4NF.