

Course Name: Database
MidSem Paper
Duration: 2 Hours

Course Code: CS354
Autumn 2019
Full Marks: 50

Answer all the questions. You may answer the questions in any order. However, all parts of the same question must be answered together. Clearly state any reasonable assumptions you make.

1. Describe what the following ER representations capture.

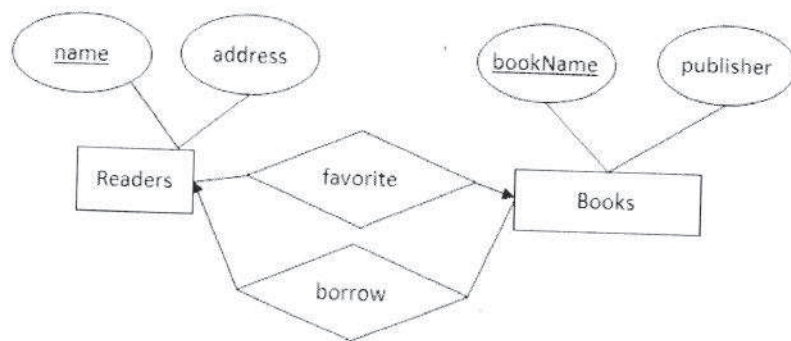


Figure 1: Book Reader relations

2. Describe whether the following ER representations capture anything unusual. If yes then identify that and give a correct representation. Give necessary justifications.

5 Marks



Figure 2: president relation

3. Information about a collection of students is given using the relation **studInfo**(*studId*, *name*, *sex*, *height*). The relation **enroll**(*studId*, *courseId*) gives which student has enrolled for what course(s). Assume underlined attributes are key attributes and every course is taken by atleast one male and one female student. Now write a relational algebra expression (without using extended relational algebra operators) corresponding to each of the followings-

5 Marks

- (a) Lists the Id(s) of the girl student(s) with highest height.
(b) List the courses taken by all male students.

2 × 5 = 10 Marks

4. Consider the functional dependency set $F: AC \rightarrow BD, A \rightarrow B$. Is there any extra attribute in this functional dependency set F . Show necessary steps. 5 Marks

5. Use *Armstrong's axioms* to prove the *decomposition rule* i.e. if $\alpha \rightarrow \beta\gamma$ holds then $\alpha \rightarrow \beta$ and $\alpha \rightarrow \gamma$. 5 Marks

6. Let $R = (A, B)$ and $S = (A, C)$, and let $r(R)$ and $s(S)$ be relations. Write expressions in Tuple Relational Calculus and Domain Relational Calculus for each of the following queries:

(a) $\pi_A(\sigma_{B=17}(r))$

(b) $r \bowtie s$

2 × 5 = 10 Marks

7. List the functional dependencies satisfied by the following instance of relation r . What would be a possible candidate key for this relation r ? Is this relation in 2NF? If not then decompose into two non-loss components such that they satisfy 2NF condition. Are these components dependency preserving? Justify your answer.

A	B	C
a_1	b_1	c_1
a_1	b_1	c_2
a_1	b_2	c_1
a_2	b_3	c_3

5 Marks

8. Consider the relation $r < A, B, C, D >$ with the following functional dependencies

$AC \rightarrow D$

$BC \rightarrow D$

$A \rightarrow B$

$B \rightarrow A$

Check whether the relation r is in BCNF. If not then perform the necessary non-loss decompositions so that the decomposed components are in BCNF. Are the decomposed components dependency preserving? Justify.

5 Marks