

CS 33007 Introduction to Database System Design, Summer 2018

Midterm Solution

1. Consider the following database schema where primary keys are underlined.

Table1 (A, B, C, D, E),

Table2(D, X, L, R)

Table3(X, P, Q)

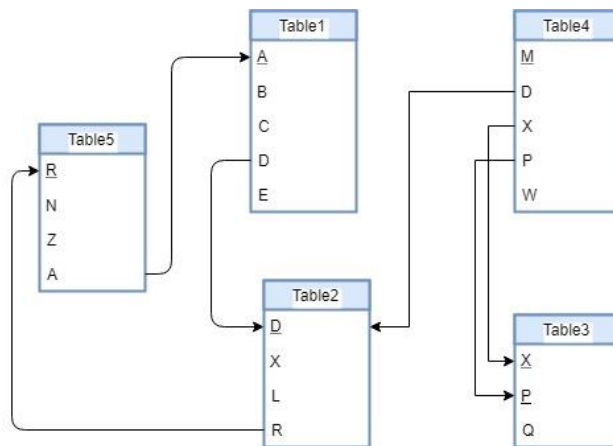
Table4(M, D, X, P, W)

Table5(R, N, Z, A)

- a) Draw the schema diagram showing foreign key constraints.

[15 points]

Answer:



- b) Write query for creating relation Table4 specifying integrity constraints.

[10 points]

Answer: considering datatype of all fields varchar(20)

```
create table Table4(  
    M varchar(20),  
    D varchar(20),  
    X varchar(20),  
    P varchar(20),  
    W varchar(20),  
    primary key(M),  
    foreign key(D) references Table2(D)  
    foreign key(X,P) references Table3(X,P)  
);
```

2.

(i) Write the following queries in relational algebra, using the university schema. **[15 points]**

a. Find the titles of courses in the Comp. Sci. department that have 3 credits.

Answer: $\Pi_{title} (\sigma_{dept_name = 'Comp. Sci.' \wedge credit=3} (course))$

b. Find the courses that have prerequisite CS12401.

Answer: $\Pi_{course_id} (\sigma_{prereq_id = 'CS12401'} (prereq))$

(ii) Write an equivalent SQL query for the following expression of relational algebra **[10 points]**

$\Pi_{A, r.B, C, r.D, E} (\sigma_{r.B > s.B \wedge r.D < s.D} (r \times s))$

Answer:

select A, r.B, C, r.D, E ***from*** r, s ***where*** r.B>s.B and r.D < s.D

3. Write SQL queries for the following sentences considering the given relational schema of university database. [30 points]

- (i) Suppose full name of the instructors are stored as atomic value where parts of names are separated by blank space. Find all instructors who has last name "Hossain".

Answer: *select* name *from* instructor *where* name like '%Hossain';

- (ii) Find the name of those departments whose total salary of the instructors is greater than 600000.

Answer: *select* dept_name, SUM(salary) *as* Total_salary *from* instructor **GROUP BY** dept_name **having** Total_salary>600000;

- (iii) Delete courses having ID beginning with "CS";

Answer: Delete from course where course_id like "CS%";

- (iv) Update the salary of each instructor to 10000 times the number of course sections they have taught.

Answer: *update* instructor *set* salary = 10000*(*SELECT COUNT*(*) *FROM* teaches **WHERE** instructor.ID = teaches.ID)

4. Using university database relational schema,

- (i) Write a SQL function that takes department name as input and increase the salary 10% only for the instructors whose salary is less than the average salary of the instructors of the department.
[20 points]

Answer:

```
1 create function increment_on_salary(dept_name varchar(20))
2 returns int
3 begin
4
5     declare avg_salary float;
6     select AVG(salary) into avg_salary from instructor where instructor.dept_name = dept_name;
7
8     update instructor
9     set salary = salary*1.1 where salary < avg_salary and instructor.dept_name = dept_name;
10    RETURN null;
11 end
```

SELECT * SELECT INSERT UPDATE DELETE Clear Format

- (ii) What is the difference between views and functions. **[5 points]**

Answer:

Functions are called parameterized views. The functions can generate different outputs based on the given parameters but the underlying query for view always generates same output.