School: Computer Science
Institution: University of Windsor
Term: Fall 2019
Course: Comp-3150 (03-60-315-1) : Database Management Systems
Instructor: Dr. C. I. Ezeife
Assignment #2: Total: 50 marks
Handed Out:Thurs. Sep. 26, 2019; Due Thurs Oct. 24, 2019

Objective of Assignment: To test on knowledge and design of relational model constraints, relational database schemas, functional dependencies and normalization of relational databases.

Scope: Assignment covers materials from Chapters 5 and 14 of book discussed in class.

Electronic Assignment Submission: Done through http://blackboard.uwindsor.ca

Marking Sheme : The mark for each of the questions is indicated beside each question.

Academic Integrity Statement: Remember to submit only work that is yours and include the following confidentiality agreement and statement at the beginning of your assignment.

CONFIDENTIALITY AGREEMENT & STATEMENT OF HONESTY

I confirm that I will keep the content of this assignment/examination confidential.
I confirm that I have not received any unauthorized assistance in preparing for or doing this assignment/examination. I confirm knowing that a mark of 0 may be assigned for copied work.

Andrea Bonato _____ Andrea Bonato

Student Signature Student Name (please print)

104760390 2019-09-21

Student I.D. Number Date

Marking Scheme : The mark for each question and sub question is shown with the question below. Place your solutions in tables where possible.

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Question	Mark
1	/20
2	/10
3	/10
4	/10
Total	/50

CHAPTER 5: THE RELATIONAL DATA MODEL AND RELATIONAL DATABASE CONSTRAINTS

1. (total marks 20) Given the same simple Employee-Workson-Project database schema you worked on in assignment 1, which contains three files described as follows:

   Emp (eid : integer, ename : string, age : integer, salary: real)
   Workson (eid : integer, pid : integer, hours : integer)
   Project (pid : integer, pname : string, budget : real, managerid : integer)

   Note : eid, ename, age and salary are the employee id, name, age and salary respectively. Also, hours is the number of hours worked by employee on a project. The rest of the attributes pid, pname, budget and managerid are the project id, name, budget and managerid respectively. A manager is an employee.

   Assume that an update is to be made to this database to enter information about a new project manager who is now the new manager of an existing project (replacing the old manager) and although he is new, he has worked some hours in another existing project. Answer the following questions on what specific relations, attributes and operations (eg. insert, modify, delete) that need to be done for this update to be implemented in the entire database.

Provide your answers both in descriptive sentences and using the formal database operations of INSERT, MODIFY, DELETE as used in Chapter 5 of book with specific attributes and relations when possible. An example formal insert of an employee record into the Emp table is:
INSERT < eid, ename, age, salary> into Emp; // for new Employee record
And an example descriptive sentence is:
i). do an insert operation for a new employee record into the Emp table.

(a) Give the set of needed insert, modify or delete operations for this update. 5 marks

(b) What types of integrity constraints (explain using attributes, eg, eid of relevant files)) would you expect to check for this update to be done? 5 marks

(c) Which of these integrity constraints are key, entity integrity, and referential (foreign key) integrity constraints and which are not? 5 marks

(d) Specify all the referential integrity (foreign key) constraints on this database in the format Referring_Relation.Attribute --> Referred_Relation.Attribute. 5 marks

(Total for que 1 is 20 marks)

Solution:

Question	Answers

a. Give the operations for this update.
 	
5 marks
	//Since the manager is already an existing employee, and has worked hours on other projects, we do not need to insert into Emp
	
	//Ensure that the temporarily deleted PID will not affect an other parts of the table. It can be associated with a brand new pid number for the new manager.
	
	//Just in case we do need to insert the new employee, even if they should exist go to i) if not, skip the step II)
	i) Do an INSERT operation for a new employee into the EMP table
	
	INSERT<eid, ename, age, salary> into EMP
	
	ii) Do an MODIFY operation for the existing manager with a specific managerid into Project
	
	MODIFY the eid in Project for the new managers project
	
	iii) Do an INSERT operation for a new relationship into the Workson table. Add the managers eid to work on the specific pid
	
	INSERT<eid,pid,hours> into Workson
	
	//If the old manager is going to be fired, then there would also need a delete operation on that manager's eid in association to Emp

b. What types of constraints would you expect to check? 5 marks	We would need to check the various different constraints that both the INSERT and DELETE operations can affect. We would need to check to see if the value of the pid in the new tuple already exists in another tuple. We would also need to check to see if pid or eid is null in the new tuple. Similarly, we would need to check to see if the values of the primary key pid is being referenced from other tuples in the database.

c. Which of these constraints are key, entity integrity, and referential integrity constraints and which are not? 5 marks	The values that have to be weary of entity integrity are the primary keys pid and eid. In this case, when managing and deleting the tuples from Project, we have to be weary that the value of the pid can not be null. This is because when we insert it, when being referenced to it, it will cause errors and constraints in the database. The referential constraint is how the pid is referenced in both the Workson and the Project table. Without the pid existing, the referenced value will remain null and cause more constraints.
d. Specify all the referential integrity constraints on this database. 5 marks	A referential integrity relation is when a foreign key value in the new tuple references a primary key value that does not exist in the reference relation. This means that once one of the tuples are deleted, we must make sure that the primary key is not referenced in any other relationships. In this case, we must make sure that when we are temporarily deleting the specific project from the Project table, we must make sure that it's PID is not being referenced in any other instances. This can be changed by using the RESTRICT option, CASCADE option and SET NULL options. Another referential integrity constraints are the when inserting, we must make sure that the PID that we are inserting exists

2. (total marks 10) Using your own Employee-Workson-Project database instance from assignment 1, login to the SQL query processor on our cs server, called Oracle Sqlplus to create the three database tables and insert the tuples in your database state with the following sequence of instructions. Note that this exercise is to get you beginning to connect to SQLplus while preparing to learn full SQL language syntax in Chapters 6 and 7. You will be given the instructions to use now. Show the result of this exercise through a Unix script file you will attach.

(Total for que 2 is 10 marks)

i. First connect to our cs.uwindsor.ca through either Bitvise SSH client or NoMachine
ii. Then create a script file to capture your Unix session and connect to Sqlplus with:

>script username_assn2que2
>sqlplus <username>
>password

SQL>
CREATE TABLE Emp
(
eid number(10) NOT NULL,
ename varchar2(20),
age number(10),
salary number(20,2),
primary key (eid)
);

```
SQL> create table Project
(
pid number(10) not null,
pname varchar2(20),
budget number(10,2),
managerid number(10),
primary key(pid),
foreign key (managerid) references Emp(eid)
);

SQL> create table Workson
(
eid number(10) not null,
pid number(10) not null,
hours number(10),
primary key (eid,pid),
foreign key (eid) references Emp(eid),
foreign key (pid) references Project(pid)
);

SQL> insert into Emp values(10,'Jobe Bata', 25, 50000.00);

SQL> COMMIT;
// Repeat similar INSERT instructions for all the data in all your tables
// starting with the entity tables first, eg, Emp, Project, before
WORKSON.

SQL> select * from cat;   // to show all the objects in your catalogue

SQL> select * from Emp;  // to show the contents of this table
```

SQL> exit //to exit sqlplus

>exit // to exit and create Unix script file to hand in

Solution: (10 marks)

An attached Unix script file showing execution of CREATE TABLE instructions and INSERT INTO tablnamee VALUES instructions with the few SELECT instructions to show contents of the catalogue and tables (your database instance).

CHAPTER 14: Database Design Theory: Introduction to Normalization Using Functional and Multivalued Dependencies

3. (total marks 10) Consider the following relation:

Takes(Studid, Crsid, CTitle, Score, Lettergrade)

Assume that a student (Studid) may be enrolled in multiple courses (Crsid) and hence {Studid, Crsid} is the primary key.
Thus, the following functional dependency exists:

{Studid, Crsid } -> {CTitle, Score, Lettergrade}

Additional dependencies are:

Crsid -> CTitle

Score -> Lettergrade

Based on the given primary key,

i. is this relation in 1NF, 2NF, or 3NF? Why or why not?
ii. If not in 2NF at least, normalize it completely into 2NF and 3NF? Provide your answers using functional dependencies (FDs).

(Total for que 3 is 10 marks)

Solution (i): (5 marks)

Answer: Since there is no composite attributes, multivalued attributes and the domain includes only atomic values, it is in 1NF. Since the primary key is a composite key, it is not 2NF. Since it is not 2NF, then it is not 3NF.

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Solution (ii) (5 marks)

Answer:

2NF:
EnrolledA(Studid, Crsid, Score, LetterGrade)
EnrolledB(Crsid, CTittle)
3NF:
EnrolledA(Studid, Crsid, Score)
EnrolledAA(Score, LetterGrade)
Enrolled2(Crsid, CTittle)

4. (total marks 10) What (i) update, (ii) delete and (iii) insertion anomalies occur in the DEPARTMENT_PROJECT relation obtained by doing a natural join of the two relations DEPARTMENT and PROJECT of Fig 14.2 on page 463 of book? Explain with examples using this database and the DEPARTMENT_PROJECT relation schema with state given below as Figures 4.1 and 4.2 below.

(Total for que 4 is 10 marks)

Note: 3 marks for correct discussion of each anomaly and 1 mark for attempt.

Figure 14.2 (book): Sample database state for a simplified COMPANY relation DB

EMPLOYEE

Ename	Ssn	Bdate	Address	Dnumber
Smith, John B.	123456789	1965-01-09	731 Fondren, Houston, TX	5
Wong, Franklin T.	333445555	1955-12-08	638 Voss, Houston, TX	5
Zelaya, Alicia J.	999887777	1968-07-19	3321 Castle, Spring, TX	4
Wallace, Jennifer S.	987654321	1941-06-20	291Berry, Bellaire, TX	4
Narayan, Ramesh K.	666884444	1962-09-15	975 Fire Oak, Humble, TX	5
English, Joyce A.	453453453	1972-07-31	5631 Rice, Houston, TX	5
Jabbar, Ahmad V.	987987987	1969-03-29	980 Dallas, Houston, TX	4
Borg, James E.	888665555	1937-11-10	450 Stone, Houston, TX	1

DEPARTMENT

Dname	Dnumber	Dmgr_ssn
Research	5	333445555
Administration	4	987654321
Headquarters	1	888665555

DEPT_LOCATIONS

Dnumber	Dlocation
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

WORKS_ON

Ssn	Pnumber	Hours
123456789	1	32.5
123456789	2	7.5
666884444	3	40.0
453453453	1	20.0
453453453	2	20.0
333445555	2	10.0
333445555	3	10.0
333445555	10	10.0
333445555	20	10.0
999887777	30	30.0
999887777	10	10.0
987987987	10	35.0
987987987	30	5.0
987654321	30	20.0
987654321	20	15.0
888665555	20	Null

PROJECT

Pname	Pnumber	Plocation	Dnum
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

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Fig 4.1: DEPARTMENT_PROJECT DB schema suffering from update anomalies

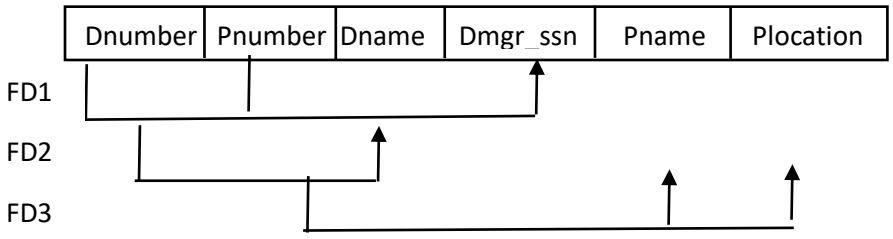

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Fig 4.2: A database state of the DEPARTMENT_PROJECT DATABASE derived from Fig 14.2

DNUMBER	PNUMBER	DNAME	DMGR_SSN	PNAME	PLOCATION
5	3	Research	333445555	ProductZ	Houston
5	10	Research	333445555	Computerize	Stafford
5	20	Research	333445555	Reorganize	Houston
5	30	Research	333445555	Nbenefits	Stafford
5	1	Research	333445555	ProductX	Bellair
5	2	Research	333445555	ProductY	Sugarland
4	3	Administration	987654321	ProductZ	Houston
4	10	Administration	987654321	Computerize	Stafford
4	20	Administration	987654321	Reorganize	Houston
4	30	Administration	987654321	Nbenefits	Stafford
4	1	Administration	987654321	ProductX	Bellair
4	2	Administration	987654321	ProductY	Sugarland
1	3	Headquarters	888665555	ProductZ	Houston
1	10	Headquarters	888665555	Computerize	Stafford
1	20	Headquarters	888665555	Reorganize	Houston
1	30	Headquarters	888665555	Nbenefits	Stafford
1	1	Headquarters	888665555	ProductX	Bellair
1	2	Headquarters	888665555	ProductY	Sugarland

18 rows selected.

Solution: (3 + 3 + 3 + 1 marks)

i) Update: If someone changes Plocation, it must change for every single person and project that will be a that location. If someone changed plocation based on dname for one of the tuples, the other will change as well.

ii) Delete: If people delete the values that are associated with the pname and dname, every other value with those corresponding with those attributes. For example, if you delete by the Pname ProductZ, all off them will be removed

iii) Insertion: To insert into this relationship, the new tuple must contain both a dnumber and a pnumber. That means, that in order for a tuple to be eligible to be added, it must have an existing and corresponding department AND project or else it can not be immediately inserted