NORTH SOUTH UNIVERSITY
CSE 311 Database Management Systems
Department of ECE
Instructor: Dr. Kamruddin Nur
Midterm Exam (25%), Time: 12 Hours, Summer 2020, SET: A

Student ID: [redacted] Name: [redacted] Section: [redacted]

Instructions:

• Answer all questions.

1. Write your understanding of the following terms: [2.5×2=5]

Answer:

(a) Data Manipulation Language (DML):

Ans: - A Data Manipulation Language (DML) is a type of language through which we can insert, retrieve, delete, and modify data in a database. A DML can be both Navigational and Declarative. A Navigational DML is procedural (containing loops and branching conditions). It selects one record at a time. Here, Programmer must define how and what in Navigational DML. On the other hand, Declarative DML is nonprocedural. It is set oriented. Here in Declarative DML, Programmer only needs to define what.

(b) Relational Database:

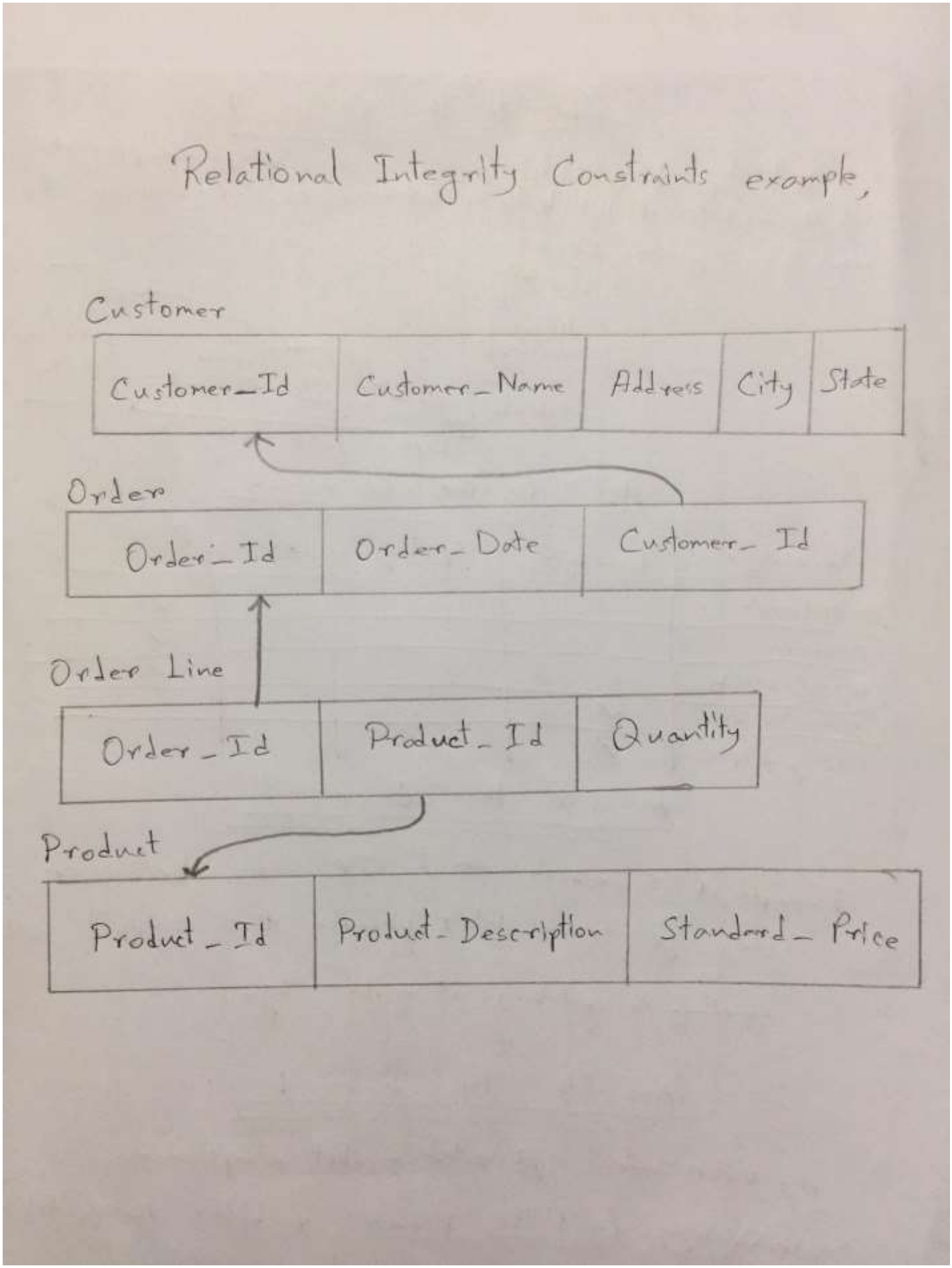
Ans: - A collection of data organized in a table structure is known as Relational Database. It is a digital Database based on the relational model of data. Relational database provides a logical human-level view of the data and associations among groups of data. There are both advantages and disadvantages in a Relational Database. Some of the advantages and disadvantages are given below:

Advantages are: It has structural independence. It is easy to use, implement, management and database design. Ad hoc query capability with SQL. Disadvantages are: It is a complex system. Poor design and implementation are made easy. etc.

2. (a) Define Relational Data Model and explain the Relational Integrity Constraints with an example. [2.5]

Answer: A primary data model which is used for data storage and processing is known as Relational Data Model. The Relational Data Model represents the database as a collection of relations. In 1970 E.F Codd introduced it. The conditions which must be present for a valid relation are known as Relational Integrity Constraints. We have to consider two important integrity rules. They are: Entity integrity and Referential integrity. In Entity Integrity Constraint no attribute of a primary key can be null. But in Referential Integrity Constraint, if a foreign key exists in a relation, either the foreign key value must match a candidate key value of some tuple in its home relation or the foreign key value must be wholly null. An example of Relational

Integrity Constraints is given below:



(b) Define Relational Algebra, List the operations of Relational Algebra. [1+1.5=2.5]

Answer:

Relational Algebra:

A theoretical language with operations that work on one or more relations to define another relation without changing the original relations is known as Relational Algebra.

Operations of Relational Algebra:

There are three types of Operations in Relational Algebra. They are:

1) Relational Database Operations: Select, Project, and Join.

2) Set Theoretic Operations: Union, Intersect, Set Difference, and Cartesian Product.

3) Additional Relational Operations: Aggregate, Grouping, and Outer Join.

3. (a) Define the following terms as they apply to the relational model of data: [1×2=2]

Answer:

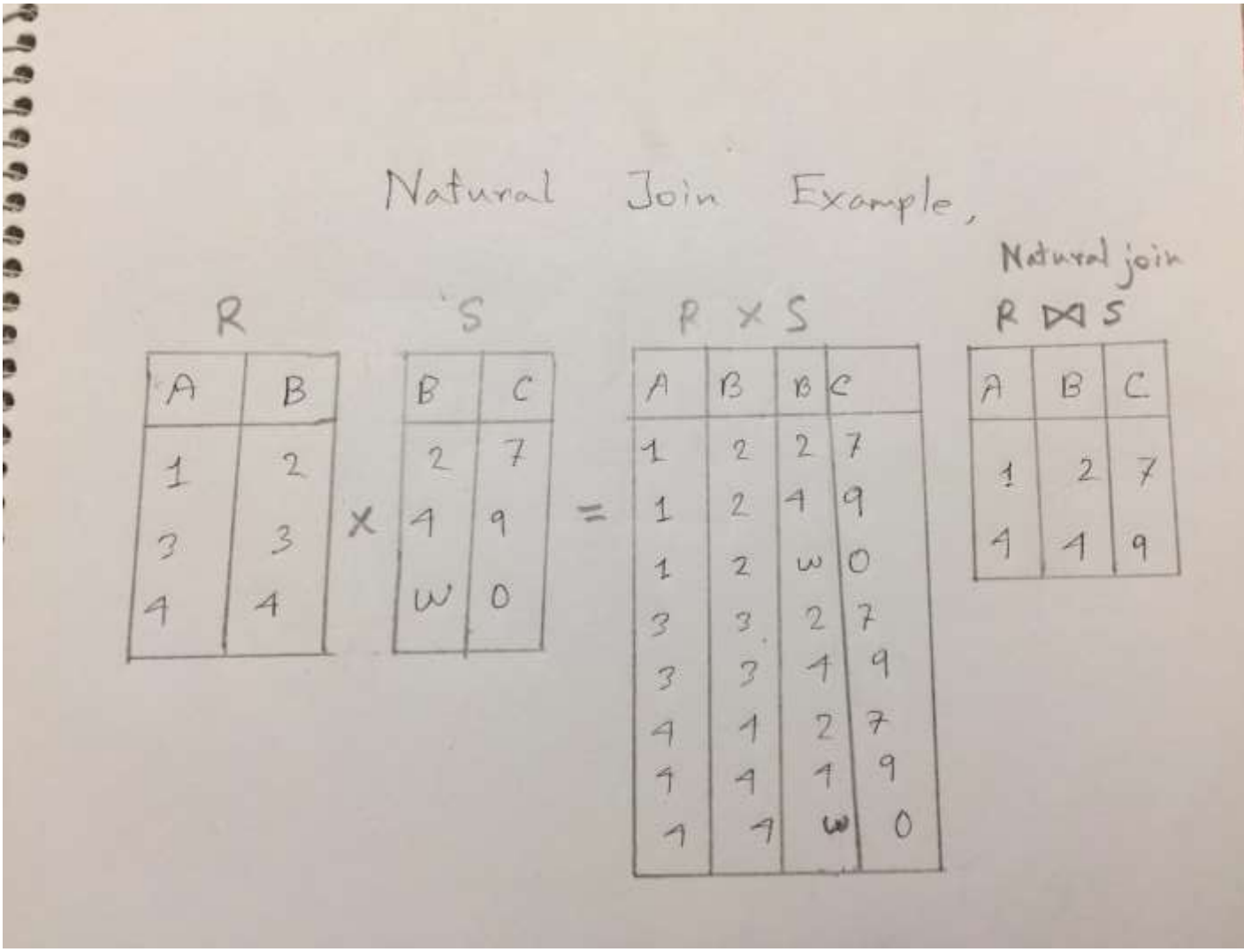
Domain: Domain D is a set of atomic values. By atomic we mean that each value in the domain is indivisible as far as the formal relational model is concerned.

Relation Schema: A Relation Schema is used to describe a relation. R is the name of this relation.

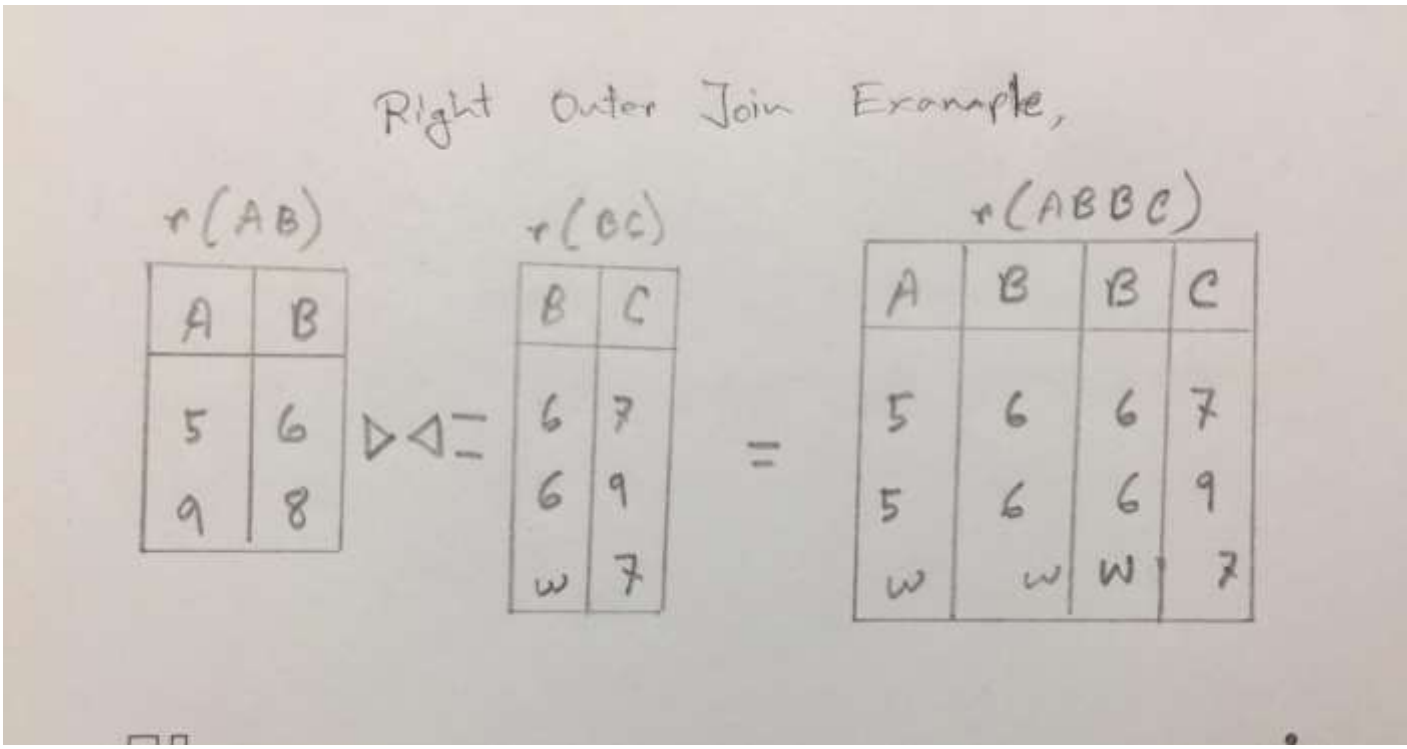
(b) Briefly, explain the following Join operations: [1.5×2=3]

Answer:

Natural Join: The natural join can be defined as an equijoin of the two relations R and S over all common attributes. One occurrence of each common attribute is eliminated from the result. For example:



Outer Join: Outer join is based on both matched and unmatched data. Outer join is again divided into 1) Left Outer Join, 2) Right Outer Join, and 3) Full Outer Join. An example of Outer join is given below:



4. Answer the questions considering the following case -

Best-East University is at present in need of a database for their student course advising. Courses are offered to the students and students choose the course and section. After the approval of course registration, a faculty and classroom are assigned to the course. In addition to the faculty, a Teacher Assistant (TA) is assigned for a section also. For a lab course, a Lab Instructor (LI) is also assigned. A faculty, TA, or LI may take many courses. A student may take up to five courses.

(a) Find appropriate database relation schemas with appropriate attributes. [2]

(b) Find Primary and Foreign Keys for all relations (tables). [1]

(c) Draw an Entity-Relationship (ER) diagram showing relation relationships. [2]

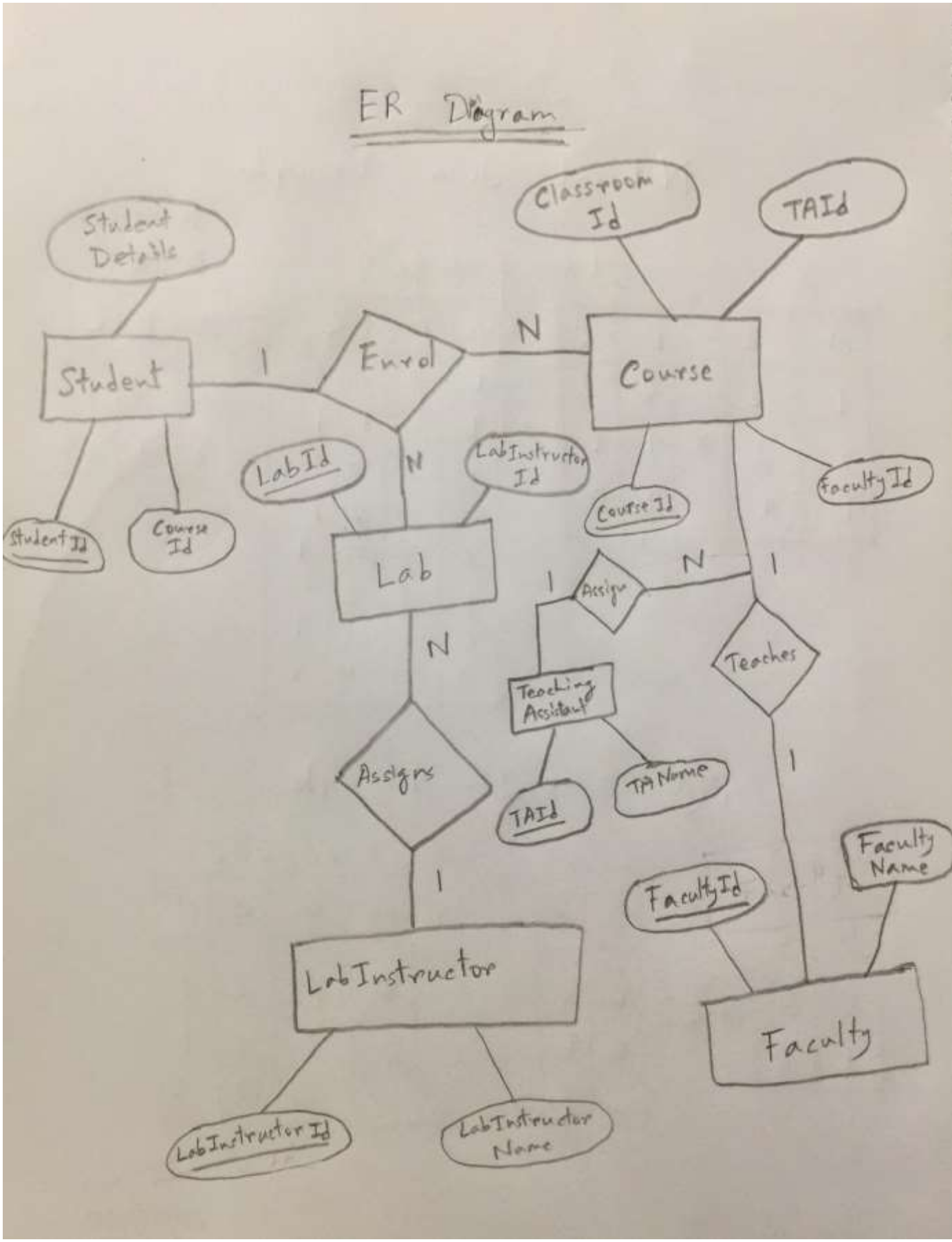
(Note: You are allowed to have necessary assumptions for the above case.)

Answer:

a) The appropriate database relation schemas with appropriate attributes are,
Student (StudentId, CourseId, StudentDetails)
Course (CourseId, FacultyId, ClassroomId, TAId)
Faculty (FacultyId, FacultyName)
Lab (LabId, LabInstructorId)
LabInstructor (LabInstructorId, LabInstructorName)
TeachingAssistant (TAId, TAName)

b) Primary Keys (In Student relation, StudentId is the primary key, In Course, CourseId is the primary key, In Faculty relation, FacultyId is the primary key, In Lab, LabId is the primary key, In LabInstructor, LabInstructorId is the primary key, In TeachingAssistant, TAId is the primary key)
Foreign Keys (In Student relation, CourseId is the foreign key, In Course, FacultyId and TAId are the foreign keys, In Lab, LabInstructorId is the foreign key).

c) An Entity-Relationship (ER) diagram showing relationships is given below:



5. (a) Given the following database state of the COMPANY, answer the questions:

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

DEPT_LOCATIONS

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

WORKS_ON

Essn	Pno	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

DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship
333445555	Alice	F	1986-04-05	Daughter
333445555	Theodore	M	1983-10-25	Son
333445555	Joy	F	1958-05-03	Spouse
987654321	Abner	M	1942-02-28	Spouse
123456789	Michael	M	1988-01-04	Son
123456789	Alice	F	1988-12-30	Daughter
123456789	Elizabeth	F	1967-05-05	Spouse

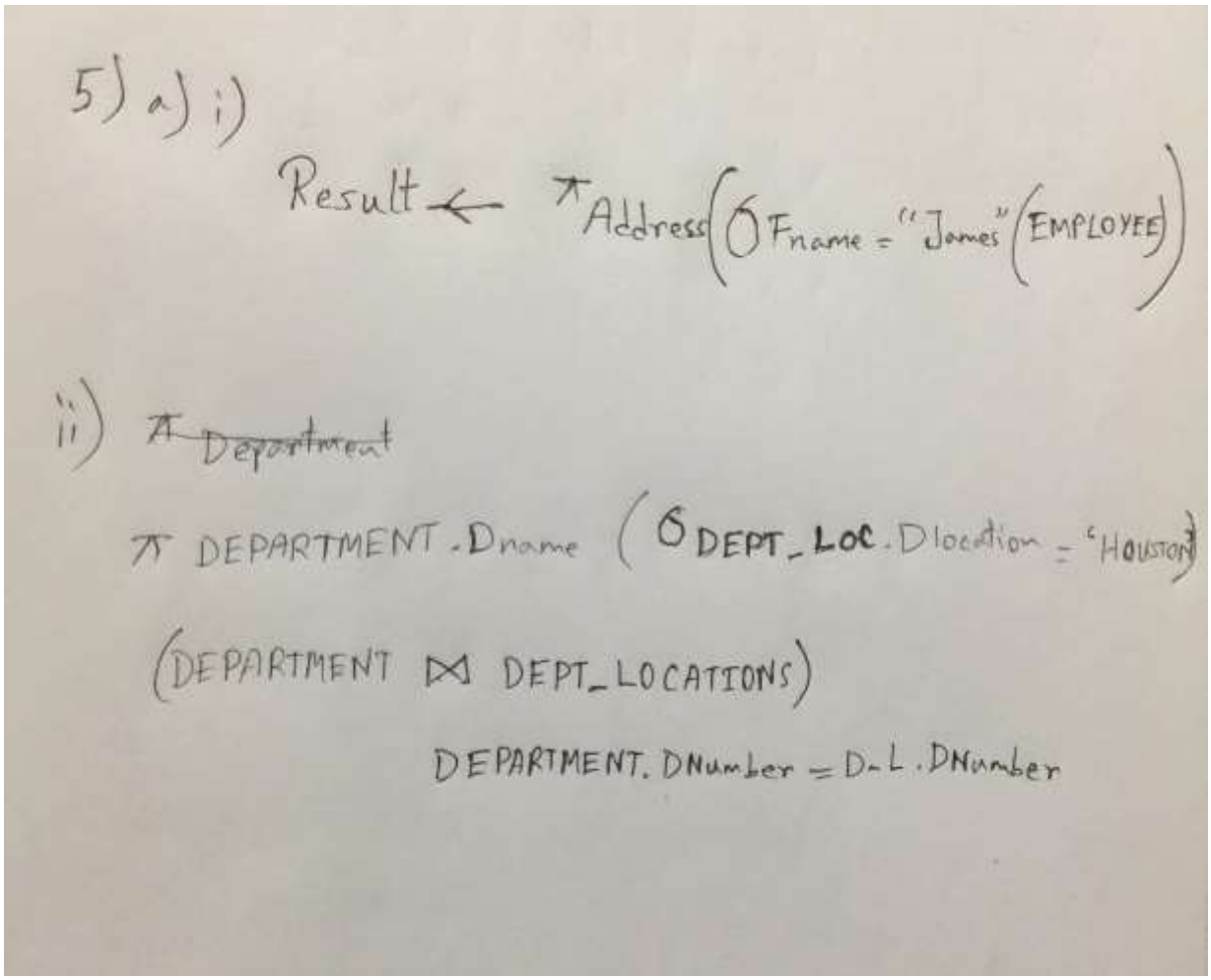
Figure 1: Reference: Fundamentals of Database Systems by Elmasri and Navathe, 6th Ed., p. 72.

(a) Write Relational Algebra for following queries:

(i) Find the Address of the employee James. [1]

(ii) Find all Administration departments located at Houston. [1]

Answer:



(b) Write SQL statements for the following queries:

(i) Find all employees who work more than 30 hours. [1]

(ii) Find all employees who are working at Headquarters. [1]

(iii) Find all employees who was absent. [1]

Answer:

i) SELECT e.Fname, e.Lname, e.Ssn, e.Bdate, e.Adress, e.Salary, e.Super_ssn, e.Dno
From EMPLOYEE
e.WORKS_ON w Where e.Ssn = w.Essn AND hours>30;

ii) SELECT *From DEPARTMENT
Where Dname = “Headquarters”;

iii) SELECT e.Fname, e.Lname, e.Ssn, e.Bdate, e.Adress, e.Salary, e.Super_ssn, e.Dno
From EMPLOYEE
e.WORKS_ON w Where e.Ssn = w.Essn AND w.Hours is Null;

-: Good Luck! :-