North South University

Department of Electrical & Computer Engineering (ECE)

Mid Term Assignment

CSE311 (Database Systems) Fall 2021
15 Points
Submission Portal: Canvas

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This assignment is worth 15% of your marks in the subject.

This paper has 18 pages.

Name : Md. Saiful Islam Student ID : 1922070042

Instructions:

1. Write Name, Student ID on top of each page.
2. You need to print this assessment file.
3. Write answer for each question in the designated space.
4. Show your work. Writing just your final answer is not enough.
5. Pages without name and Student ID will not be marked.
6. This is an individual work. Any unauthorized help will result in cancellation of the script. Any examinee found adopting unfair means will be expelled from the trimester/program as per NSU disciplinary rules.
7. You should answer all questions. Write in your own words. Do not copy & paste from web.
8. Answers must be written in blue or black ink.
9. Textual answers can be in point form.
10. Submit the answer script in PDF format before due date. No late submission will be allowed. Any late submissions will be designated as incomplete.
11. Proven case of direct code copies from other students, or online sources will result in severe point deduction.

Write and sign the Honor Code pledge.

"On my honor I affirm that I have neither given nor received inappropriate aid in the completion of this exercise."

On my honor I affirm I have neither given nor recieved inappropriate aid in the completion of this exercise.

X Md. Saiful Islam

Student

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1.

This database is the central component of an information system used to manage a large city department store. The store has several departments; about each we must record its name and id, phone number, and which floor it is on. Each department has several employees working for it, and one boss (an employee) who manages it.

About each employee we record their name and id, their salary, which department they work for and which other employee is their boss.

The items that the store sells each have a name and id, a type and a color. Whenever a department sells an item, we record which item was sold, how many were sold, which department sold it – and we give each sale an integer id.

Items are delivered to the store by suppliers, about each of whom we record a name and id, and a phone number. When a delivery is made, we record how many of which item was delivered by which supplier to which department – and deliveries get an integer id too.

Case Study: The Department Store

Tasks:

For the above scenario, **draw a logical data model.**

You do not need to write a data dictionary.

If you wish, you may explain the reasoning behind any design decisions or assumptions you made.

Note that marks are largely based on a workable model that caters to all the constraints stated in the case. Marks may be lost for incorrect entities, relationships, cardinality or notation, lack of detail or internal contradictions.

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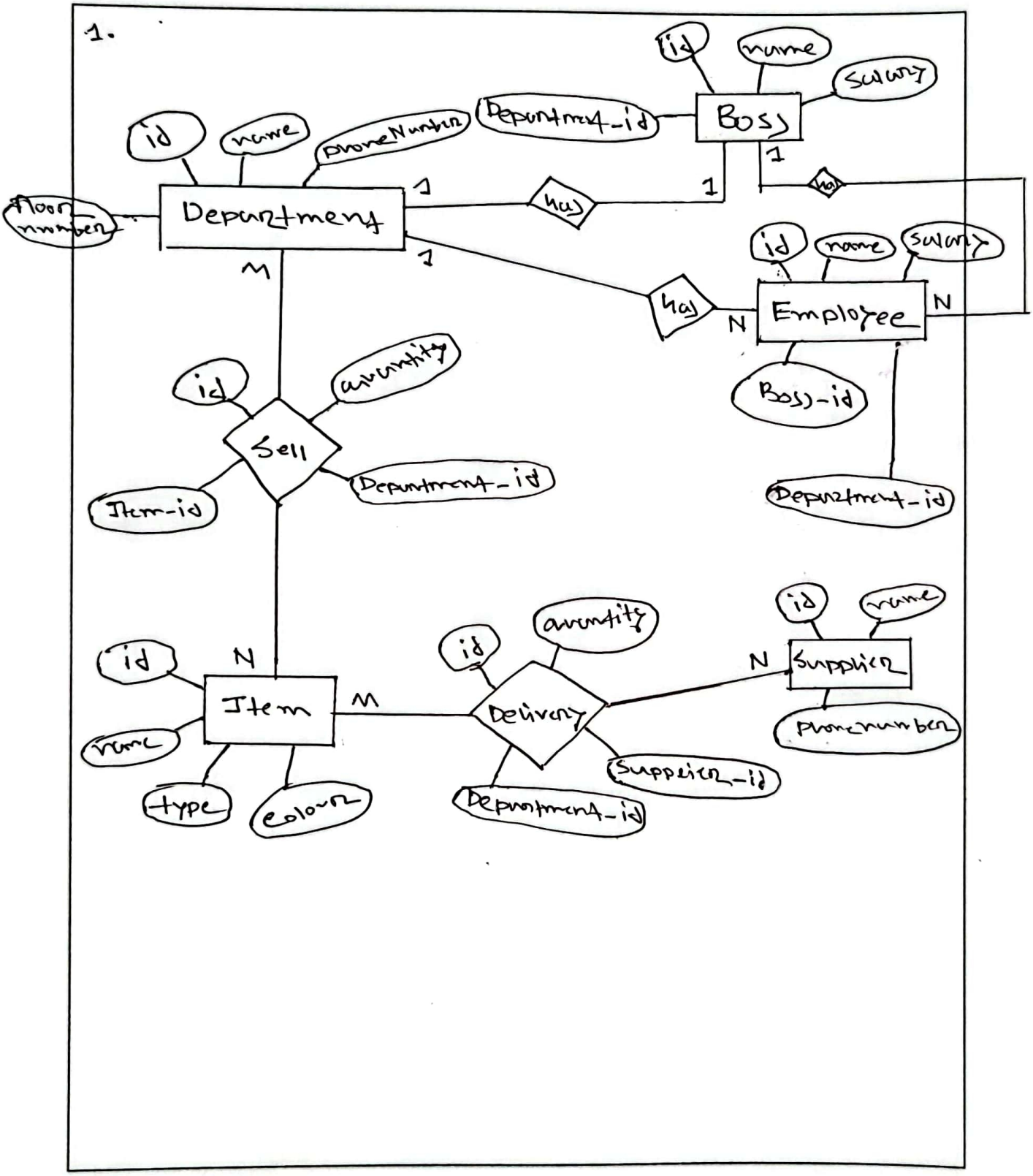
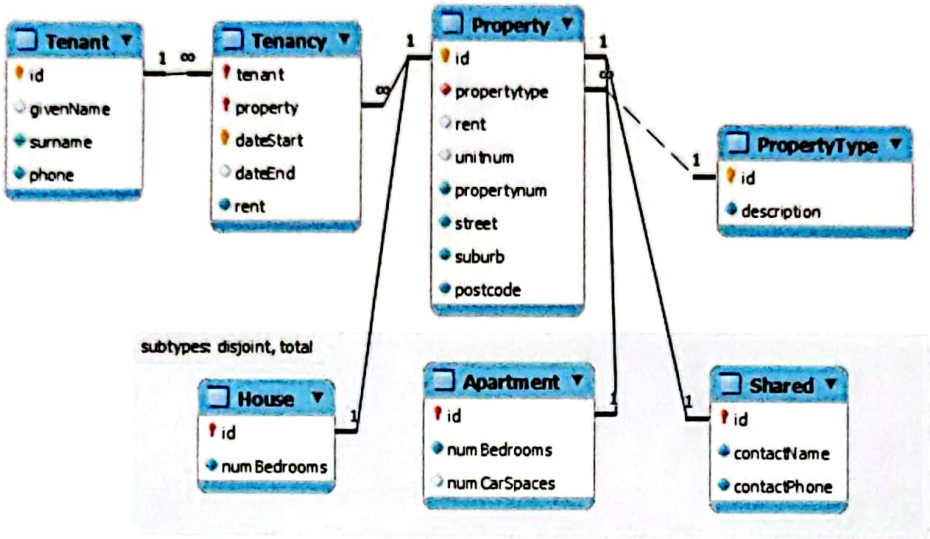
1.



Name : Md. Saiful Islam Student ID : 1922071042

2. Consider the following data model and sample data (not all data is shown) for a student real-estate system.

At any given time, an individual property is empty or occupied by one tenancy. Note that the rent charged for a particular tenancy, especially one in the past, may be different to the current advertised rent on that property.



For each of the following columns in the database shown above,
write the column's MySQL data type, include the width of the column where appropriate.

i)	Tenant.id
ii)	Tenant.surname
iii)	Tenant.phone
iv)	Tenancy.tenant
v)	Tenancy.dateEnd
vi)	PropertyType.id
vii)	Property.unitnum
viii)	Property.postcode
ix)	Property.rent
x)	Apartment.numBedrooms

Name : Md. Saiful Islam Student ID : 1922071042

2.

(i) Tenant.id --- int

(ii) Tenant.surname --- varchar (30)

(iii) Tenant.phone --- char (11)

(iv) Tenancy.tenant --- int

(v) Tenancy.dateEnd --- datetime

(vi) PropertyType.id --- int

(vii) Property.unitnum --- tinyint

(viii) Property.postcode --- char (4)

(ix) Property.rent --- decimal (7,2)

(x) Apartment.numBedrooms --- enum ('1','2','3','4')

Name : Md. Saiful Islam Student ID : 1922071042

3. Consider the following SQL queries.

Now, translate these queries into an equivalent Relational Algebra expression.

a)

```
select U.userID, U.Name, UE.gradYear
from Users U, UserEducation UE
where U.sex="Female" and UE.userID=U.userID and UE.university_Name = "NSU";
```

$$\pi_{U.userID,\ U.Name,\ UE.gradYear}\left(\sigma_{U.sex = \text{"Female"} \wedge UE.userID = U.userID \wedge UE.university_Name = \text{"NSU"}}(User\ U \bowtie UserEducation\ UE)\right)$$

b)

```
SELECT departmentfloor, count(departmentid)
FROM DEPARTMENT
GROUP BY Departmentfloor;
```

$$\pi_{departmentfloor,\ count(departmentid)}\left(departmentfloor\ \mathcal{G}_{count(departmentid)}(DEPARTMENT)\right)$$

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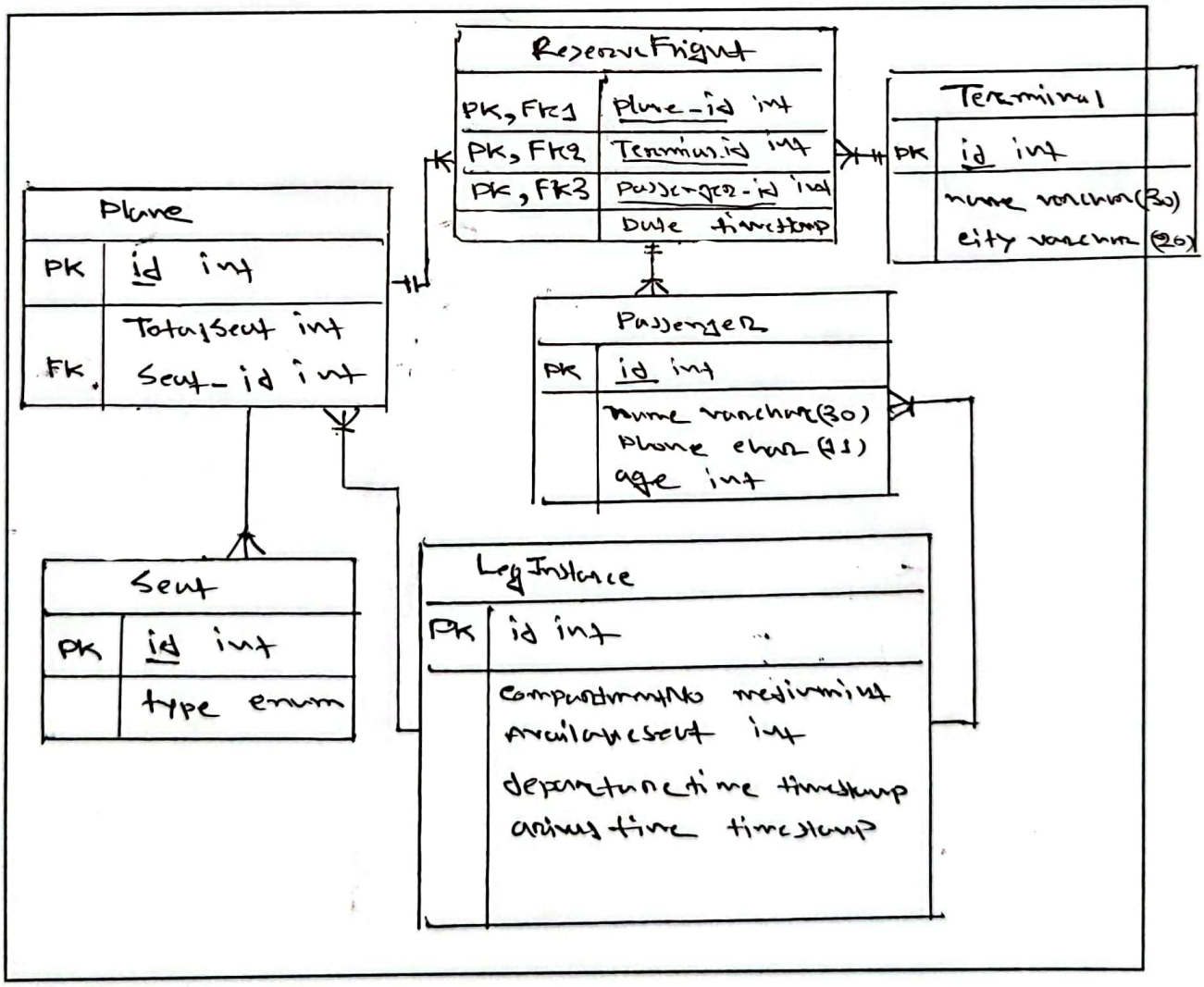
4.

We are interested to make a database for Flight Reservation System. (We will limit only for flight between Dhaka and Sylhet.) Generally, a passenger takes flight that operates between Dhaka-Chittagong-Dhaka and Dhaka-Sylhet-Dhaka. Each Plane is identified by an ID and total seating capacity. Each Plane is assigned a leg instance (an instance of a flight on a specific date) for which we will keep number of compartments, number of available seats and date. Passenger reserves seat of each leg instance. For seat, we will keep seat ID and type. Each leg instance departs from a terminal and arrives to a terminal. We will keep departure time and arrival time; and for terminal, we will store its ID, name, and city. For each passenger, we will store name, phone, and age.

Develop a complete E-R diagram (including cardinalities). Make reasonable assumptions during your development phases, if needed and state them clearly.

Translate the E-R diagram into relations (tables).



Name : Md. Saifuj Islam Student ID : 1922071042

5. Convert the following relational algebra expression into an equivalent expression that will probably be less expensive to evaluate.

$$\pi_{title}(\sigma_{suburb='Carlton'}(video \bowtie customer \bowtie borrow))$$

$\pi_{title}((\sigma_{suburb='carlton'} video) \bowtie$

$(\sigma_{suburb='carlton'} customer) \bowtie$

$(\sigma_{suburb='carlton'} borrow))$

Name : Md. Saifuli Islam Student ID : 1992071042

6. Consider the following relational schema of a corporate database for a coalition of retail stores. These tables maintain information about stores, products, and the inventories of products in different stores with following attributes:

Store (<u>StoreID,</u> StoreName)

Product (<u>ProductName</u>, UnitPrice)

Inventory (<u>ProductName</u>, <u>StoreID</u>)

Write down the following queries in relational algebra:

A. Return the name of the stores that have at least one product in their inventories whose unit price is greater than $2.

$\pi_{StoreName}(Store \bowtie (_{StoreID}\mathcal{G}_{count(*)}(\pi_{StoreID}(Inventory \bowtie (\pi_{ProductName}(\sigma_{unitprice > 2}(Product)))))$

B. Return the name of the products with the highest unit price.

$\pi_{ProductName}(Product \bowtie UnitPrice = max(\mathcal{G}_{max(unitprice)}(Product)))$

Name : Md. Saifur Islam Student ID : 1922071042

7. Consider the following relational schema

employee (ename, street, city)

works (ename, cname, salary, jdate)

company (cname, city)

manages (ename, mname)

Write down the following queries in SQL-

A. Find the names of all employees who earn more than every employee of Square Pharma.

```
Select e.ename
from employee e, works w
where e.ename = w.ename and
        salary > ( select max(salary
                   from works
                   where w.cname='Square Pharma');
```

B. Give all managers in this database a 4 percent salary raise, unless the salary would be greater than Tk.100,000. In such cases, give only a 3 percent raise.

```
update works set salary = case
when salary * 1.04 > 100000 then salary * 1.03
else salary * 1.04
end
where ename in (select distinct mname from managers)
                from managers);
```

Name : Md. Saiful Islam Student ID : 1922071042

8. Consider the following relational schema about Parts and Suppliers who supply them:

Part (p_id , p_name , p_color) // *primary key- p_id*

Supplier (s_id , s_name , s_address) // *primary key-s_id*

Supplies (s_id, p_id, price) // *primary key- s_id, p_id*

Write a single SQL query for each one of the following questions.

A. Find the names of the suppliers who supply a 'red' part at a price less than $20.

```
select sr.s_name
from supplier sr, supplies ss, part p
where sr.s_id = ss.s_id
and ss.p_id = p.p_id
and lower(p.p_color) = 'red'
and ss.price < 20;
```

B. Find the IDs of the parts that can be supplied both- by the suppliers in 'China' and by the suppliers in 'Germany'. **(Use set operation)**

```
select p.p_id
from supplier sr, supplies ss, part p
where sr.s_id = ss.s_id
and ss.p_id = p.p_id
and sr.s_address = 'China'
intersect
select p.p_id
from supplier sr, supplies ss, part p
where sr.s_id = ss.s_id
and ss.p_id = p.p_id
and sr.s_address = 'Germany';
```

Name : Md. Saiful Islam Student ID : 1922071042

C. Find the part names those are supplied by more than 10 suppliers.

```
Select P.P_name as Part_name
from Part P join supplies SS
on (P.P_id = SS.P_id)
group by P.P_name
having count (SS.id) > 10);
```

D. For each part, find its ID, its average price, and the number of suppliers -who supply it.

```
Select P.P_id as Part_id, avg(SS.price) as Average_Price,
       count(SS.S_id) as Suppliers_No

From Part P join supplies SS
on (P.P_id= SS.P_id)
group by P.Pid ;
```

Name : Md. Saifuj Islam Student ID : 1992071042

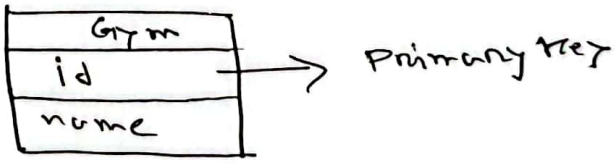
9. Discuss different types of keys that are used in database with appropriate example.

A database key is defined as either a single attribute or group of attributes can uniquely identify each record in a table.

Different types of key:

(i) Primary key: A primary key is a minimal set of attributes (column) in a table that uniquely identifies tuples (rows) in that table.

Example: For gym we have unique id for each members.



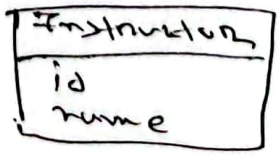
(ii) Super key: It is either a single attribute or group of attribute that can be used to uniquely identify each row in a table.

The super key is the most general form of unique key. The table can have many super keys.

It is used to retrieve a record by using

minimum number of attributes.

Examples: {I.D} and {ID, name} are both super keys of instructor.



Name: md. Saiful Islam ID: 1922071042

(iii) Candidate key: It is the key which minimal super key.

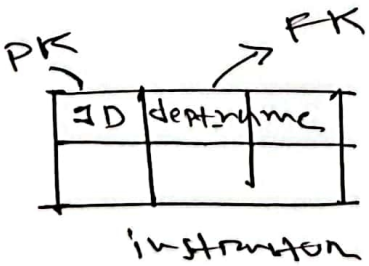
Instruction
Id
name

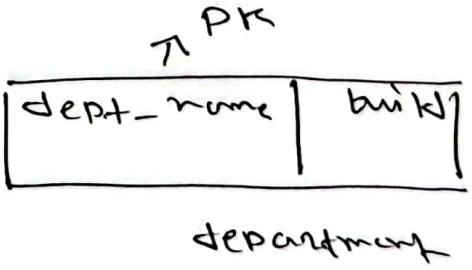
Ex: {ID} {ID, name}

↳ super keys

and {ID} minimal so its a candidate ~~ca~~ key.

(iv) Foreign Key: when a primary key of a table finds in different table then its called foreign key in that different table.





Name : Md. Saiful Islam Student ID : 1922071042

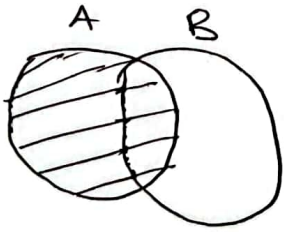
10. Discuss different types of joins that are used in database with appropriate example.

A join clause allows us to combine rows from two or more tables based on a related column.

Different types of joins:

i) Left join: It allows us to query data from multiple tables. The left join returns all rows from the left table and the matching rows from the right table. If no matching rows are found in the right table, Null are used.

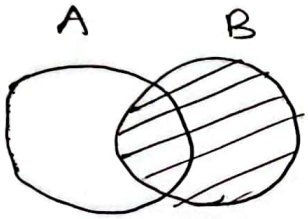
Example:



left join

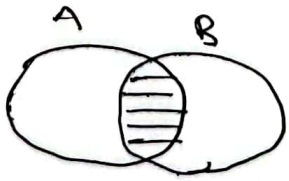
Name: Md. Saiful Islam ID: 1922071042

(ii) <u>Right join</u>: It performs a join starting with the right table. Then, any matching records from the left table will be included. Rows without match will have null column.



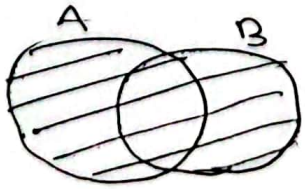
Right join

(iii) <u>Inner join</u>: It creates a new result table by combining column values of two tables (table1 and table2) based upon the join participate condition satisfies.



Inner join

(iv) <u>Full Outer join</u>: Unmatched rows in both tables will be return.



Full Outer join

Name : Md. Saiful Islam Student ID : 192207 1042

11 . Discuss different types of subqueries that are used in database with appropriate example.

A sub query is a query that is nested inside a select, insert, update or delete statement or inside another subquery.

Different types of subqueries:

i) Select clause: to find the specific column details in a table.

Example:

```
select s.id
from student s;
```

Student
name id

(ii) From clause: It starting set of data on which all other operations in a select statement can perform.

Example:

```
select s.id
from student s;
```

Student
id name

Name: Md. Saiful Islam ID: 1922073042

(iii) <u>Where clause</u>: This specifies that a statement should only affect rows that meet specified criteria.

<u>Example:</u>

Student

ID	name
1	A
2	B

```
select s.id
from student s
where s.id = 1;
```

Name : Md. Saifur Islam Student ID : 1922071042

12. Why do we need the rename operation? List two reasons why null values might be introduced into the database.

We need the rename operation because :

We are likely to want to save the outcome of a relational algebraic expression as a relation so we may use it letter by letter. Again in some circumstances, we may want to link a relation to itself by indicating which of the tables we are taking becomes one of the tables and joining it.

Two Reasons of why we use null values :

(i) Null values are used to indicate values that are absent or unknown.

(ii) Null values are used when the value of a variable will be assigned in the future.

Name : Md. Saiful Islam Student ID : 1922071042

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