13/1/19

Class-05

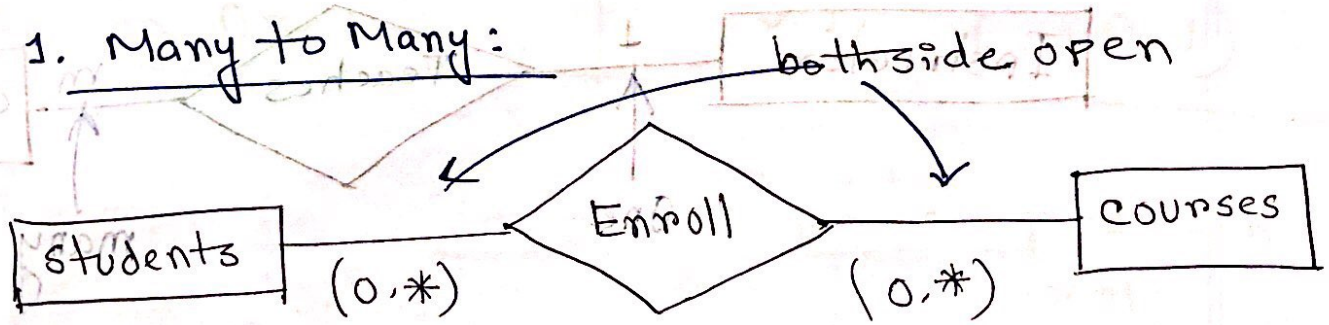
Cardinality Constraints of Relationship

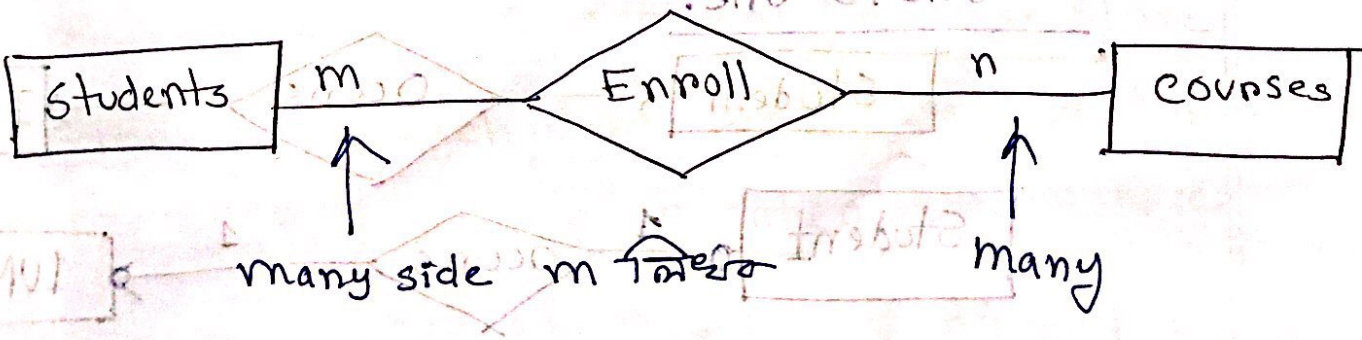
Express the maximum number of Entity that can be associated with another Entity via a relationship.

4 types of Cardinality Constraints:

i) Many to Many
ii) Many to One
iii) One to Many
iv) One to One

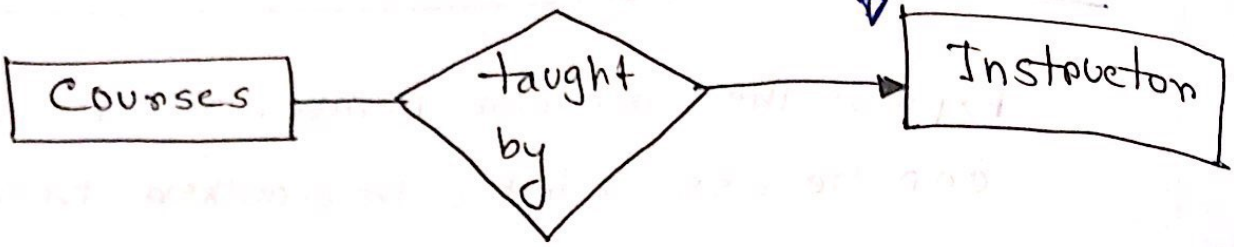
1. Many to Many:

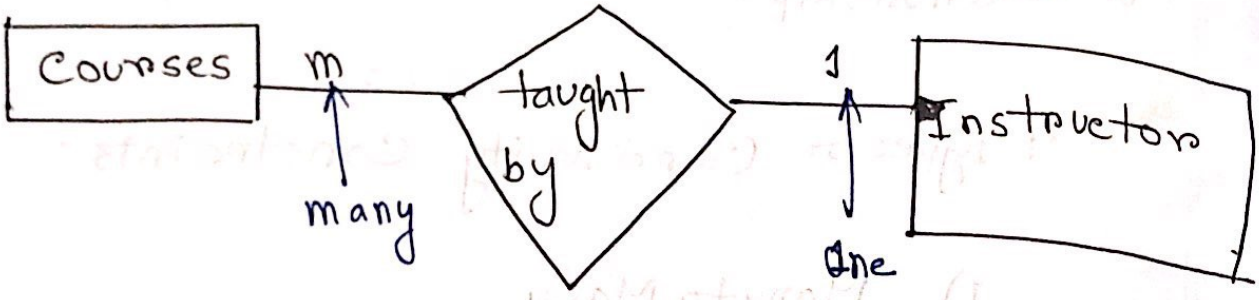




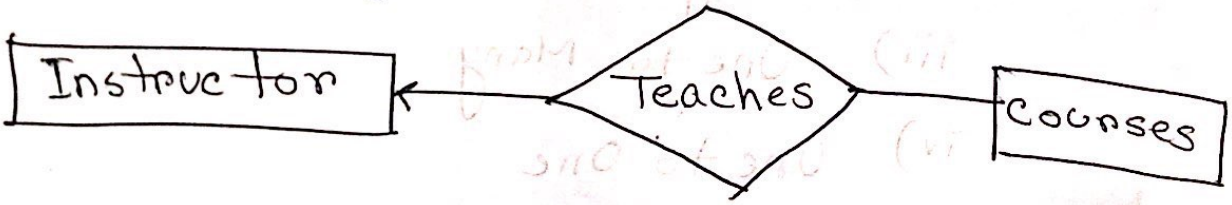
2. Many to One:

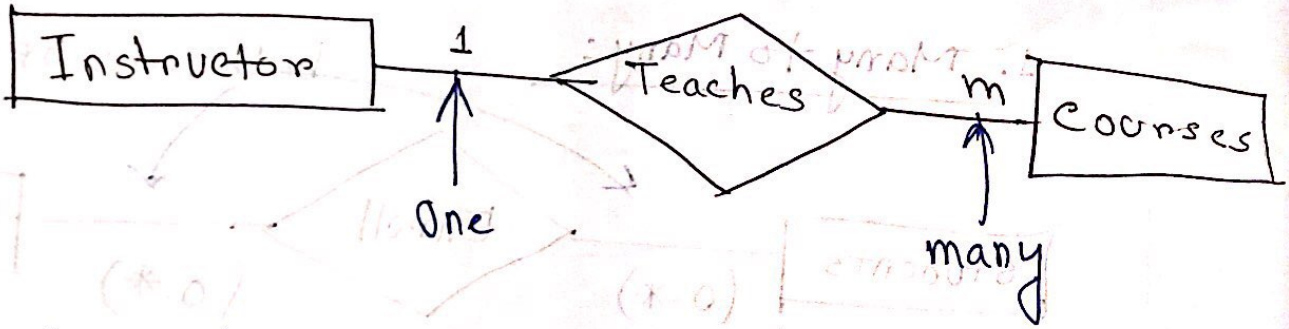
One side arrow



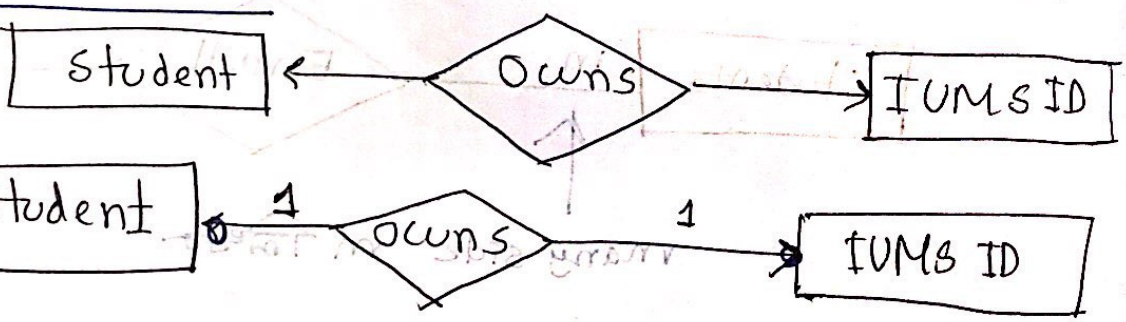


3. One to Many:





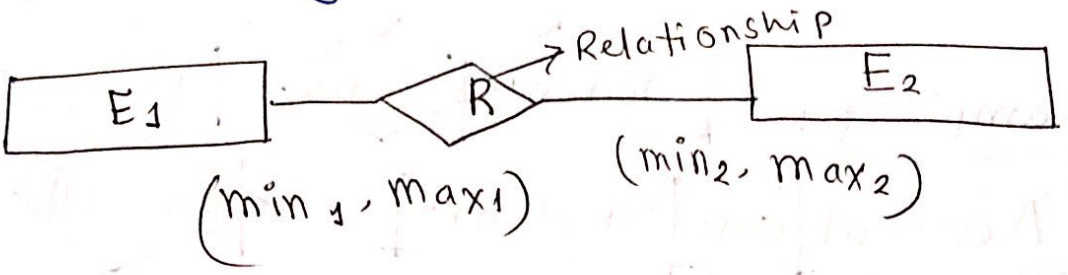
4. One to One:



max → * → asterical

একটা data কতোবার access করতে পারে।

Cardinality Limit:



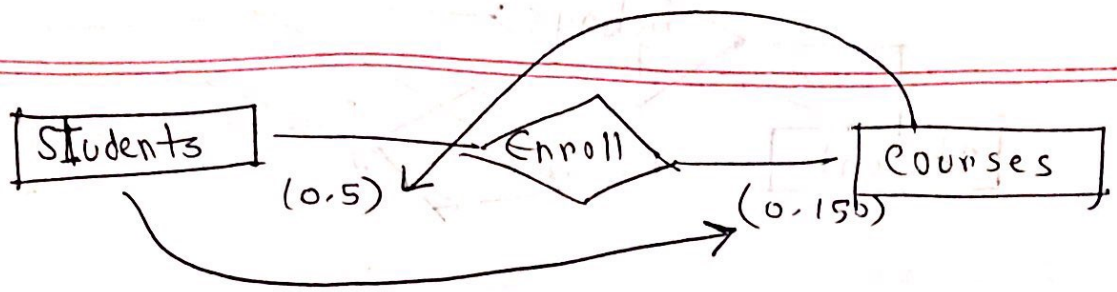
Relationship	(min1, max1)	(min2, max2)
Many-to-many	(0, *)	(0, *)
Many to One	(0, 1)	(0, *)
One to Many	(0, *)	(0, 1)
One to One	(0, 1)	(0, 1)

Example-1: Student take courses and each Student belongs to particular department. Students grade in different courses are stored. Each department has multiple Students and department offer multiple courses. A course can be offered by a

single department on multiple departments.

Example-2: Students owns a IUMS Account and Students can Enroll in different course through the IUMS.

A student should have an Instructor and and an Instructor may ~~arise~~ advise at most 60 students. Instructor may take several courses but the some course will not have multiple faculty. Instructor may also have an IUMS account.



Student can take → 5 courses.

Total students → 150

① Noun — Student courses ~~department~~ department

Verb — grade take ~~offer~~ ~~belong~~ belong

Ex-1

Example:

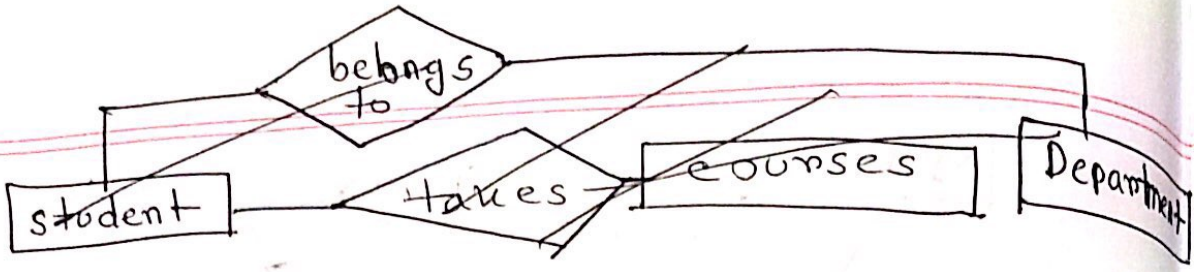
Entity: Students, course, Department

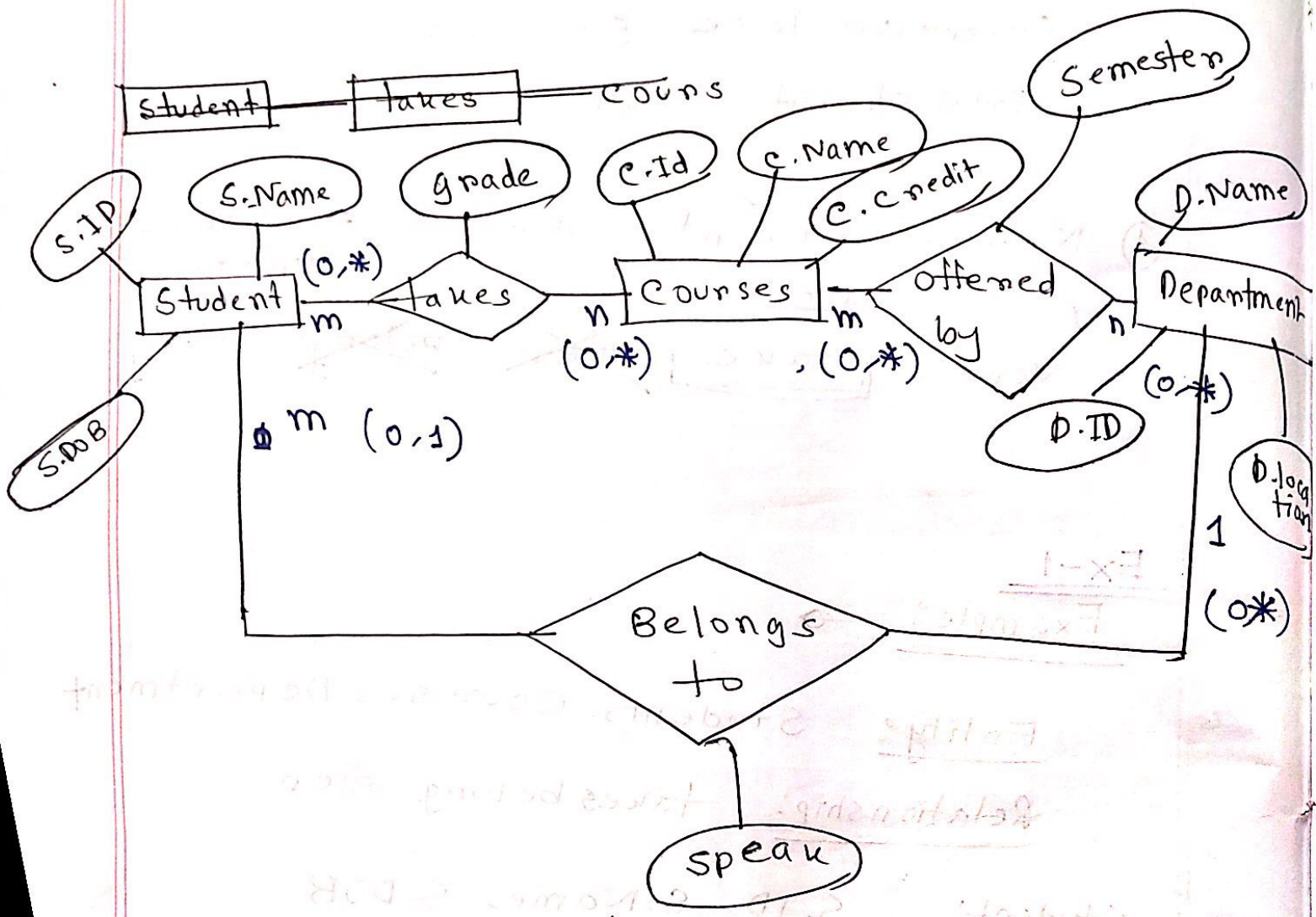
Relationship: takes belong, offer.

Student: S.ID, S.Name, S.DOB

courses: C.ID C.Name, C.credit

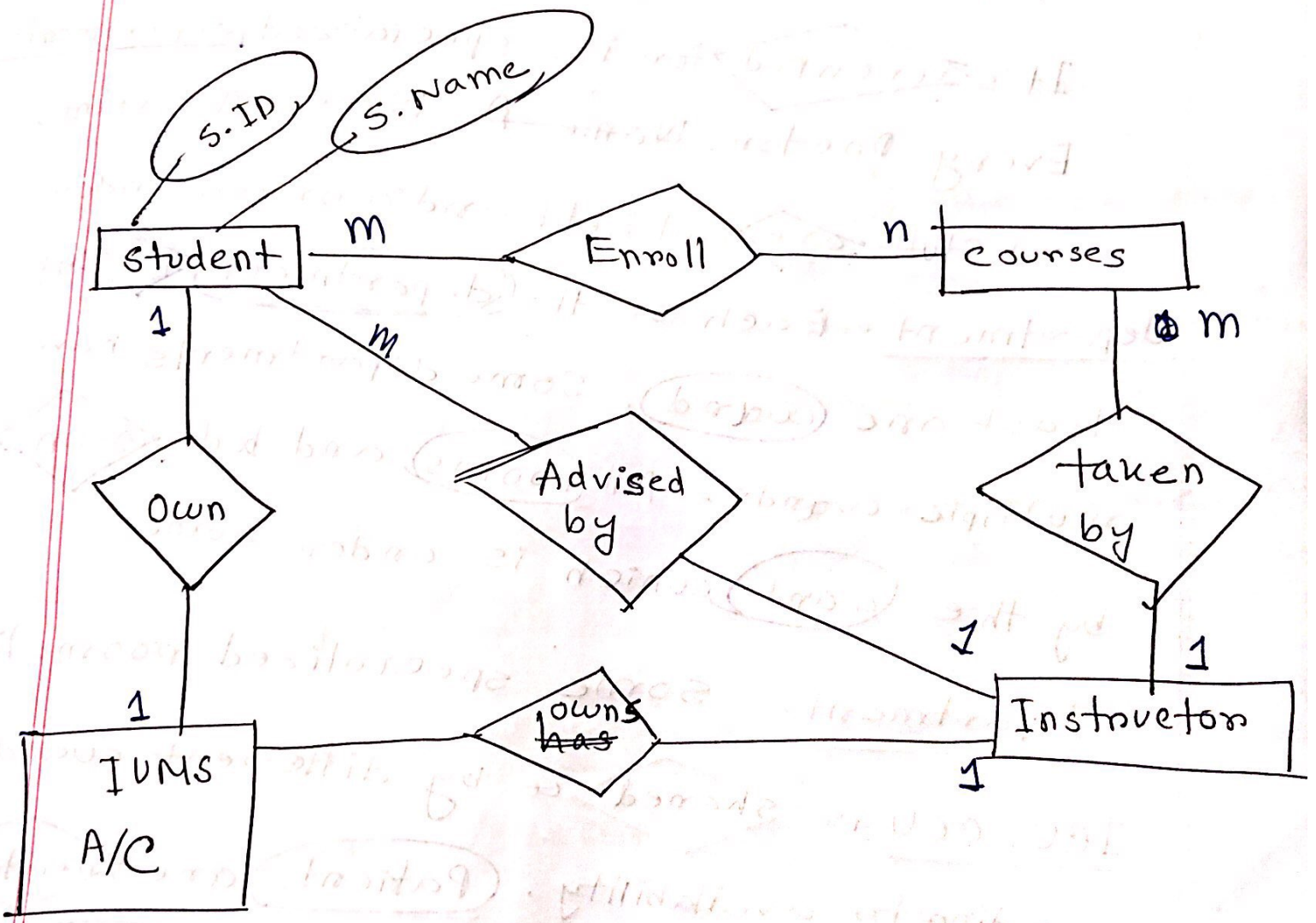
Department: D.ID, D.Name, ~~$~~ location





Ex:-2

Entity → Students, IUMS account,



15/1/19

Class-06

ERD Practice:

Apollo hospital is one of the largest private hospital situated in Dhaka, Bangladesh.

It's renowned for it's specialized departments. Every Doctor, ~~Name, A~~ Nurse, Assistant, and stuff are qualified and worked under a department. Each of the department has at least one ward. Some departments have multiple wards. All rooms and beds own by the ward which is under some department. Some specialized rooms like ICU, CCU is shared by different wards according to availability. Patients are treated in a ~~simple~~ single ward by the doctors assign to them. Usually each patient will be assigned by a single doctor, but some times they will have many doctors

from different departments. Assistant also attend to the patient and a number of nurses are associated with each patients. Patients needs diagnosis for treatment purpose in the same place. Bill will have be generated from the ward and also from the diagnosis point. Patient only get the release from hospital when the full bill b will be paid from patients.

Draw an ERD with appropriate symbols. Assume the meaningful attributes and Primary key.

1. Entity
2. Relationship
3. Attributes
4. Primary key
5. Draw a general diagram on Entity, Relationship and attributes.

Class-07

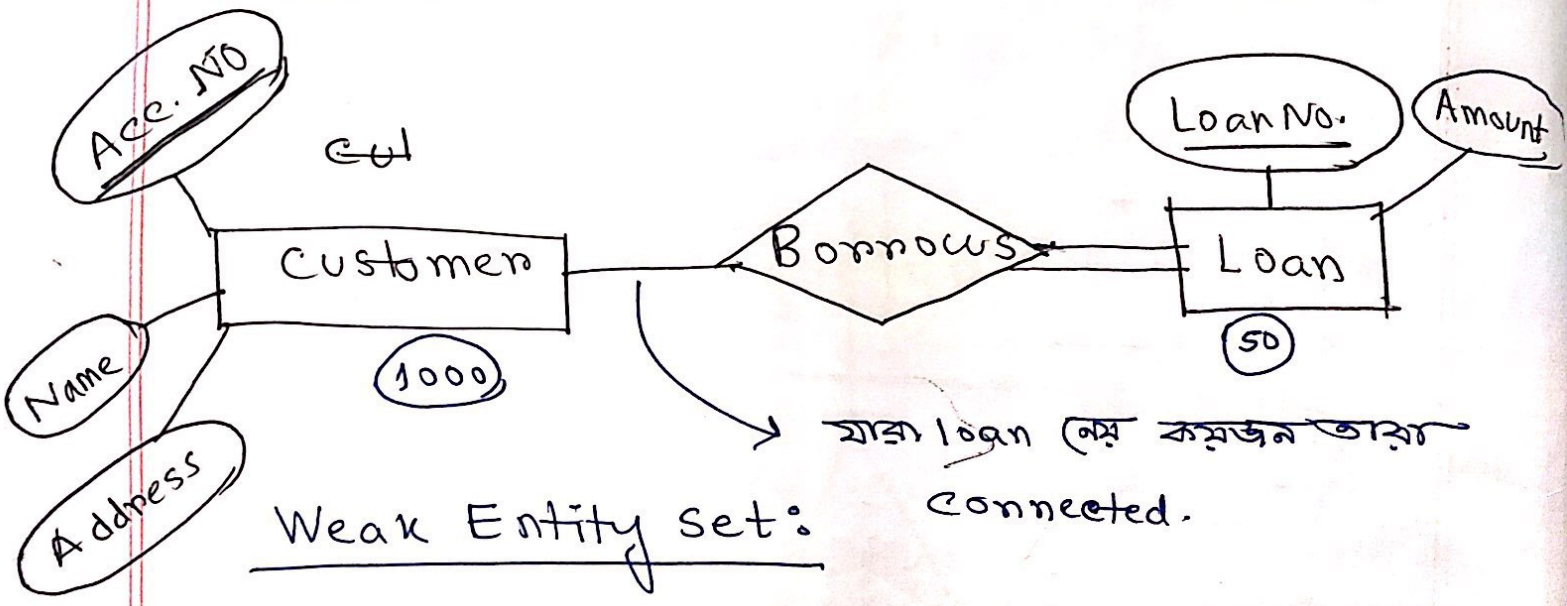
17/1/19

Participation Constraints:

1) Total Participation ═══ (double line)

2) Partial Participation ——— (Single line)

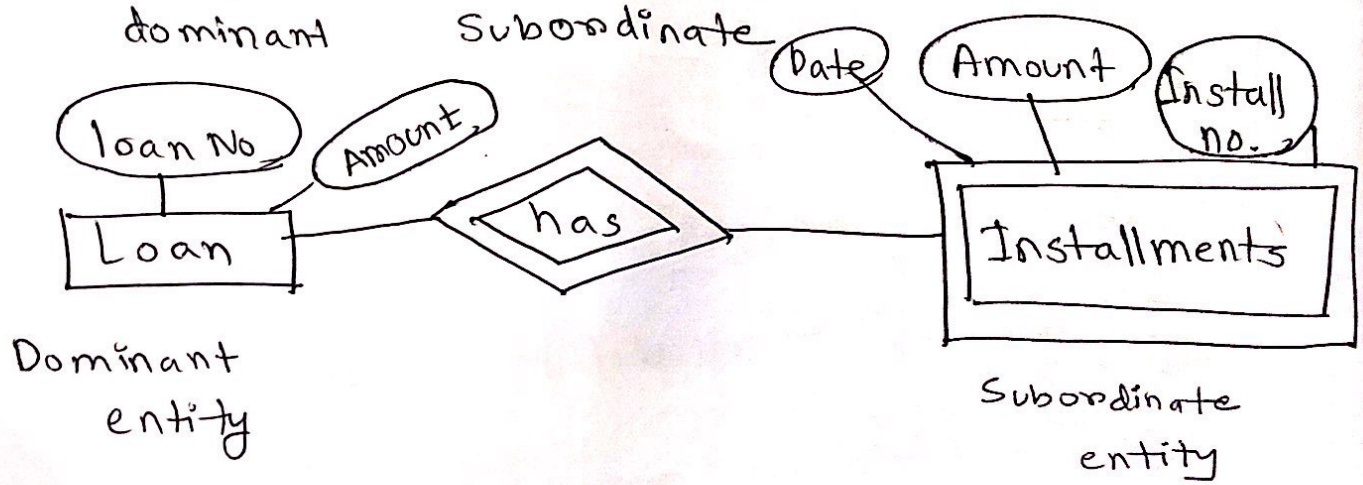
Example:



Weak Entity set:

→ One-to-Many Relationship

dominant — Subordinate



Dominant entity

Subordinate entity

→ Subordinate entity set depends on dominant entity set.

→ The relationship is connected with a weak entity set is a weak relationship.

Installment:

Date	Amount	Installment no	loan No
17/1/19	10,000৳	10	L 1234
17/1/19	5,000৳	21	L 8761
17/1/19	2,500৳	13	L 5689

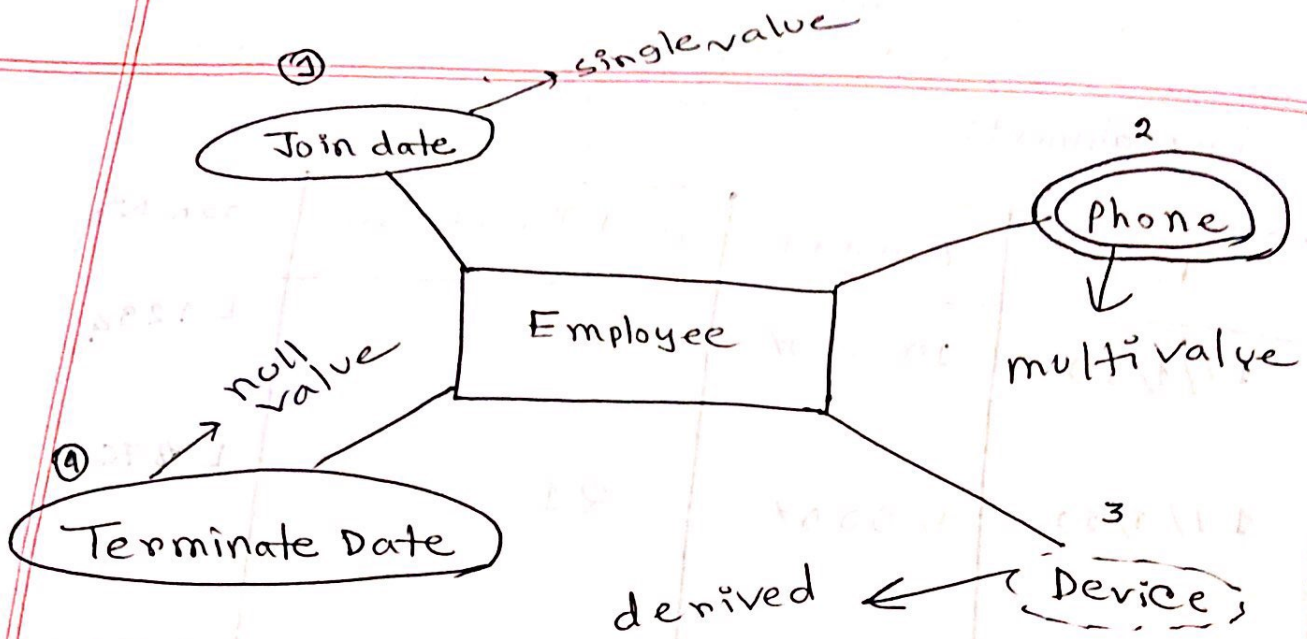
Attribute type:

① Single valued 

② Multi valued 

③ Derived 

④ Null  → যেটা future এ use করতে হতে পারে।

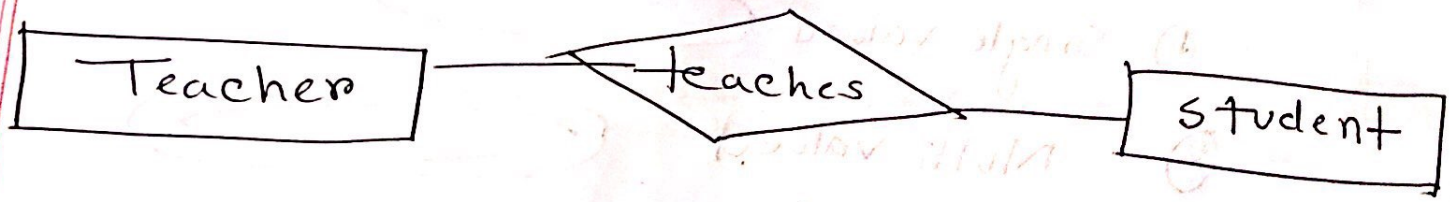


Degree of Relationship:

derived value জন্য use করব dashed ellipse.

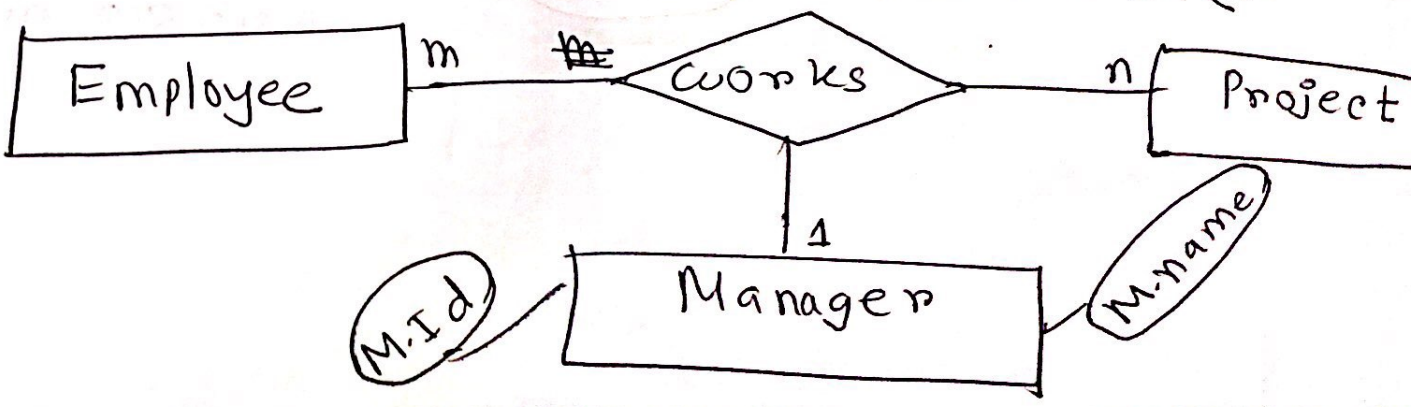
Binary

২টা table মিলে relationship connect হলে।

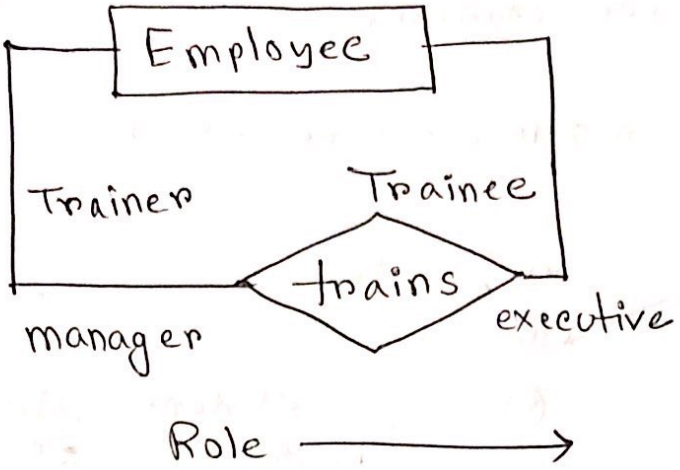


Ternary

৩টি table এর মধ্যে relationship সবগুলো connect হলে।



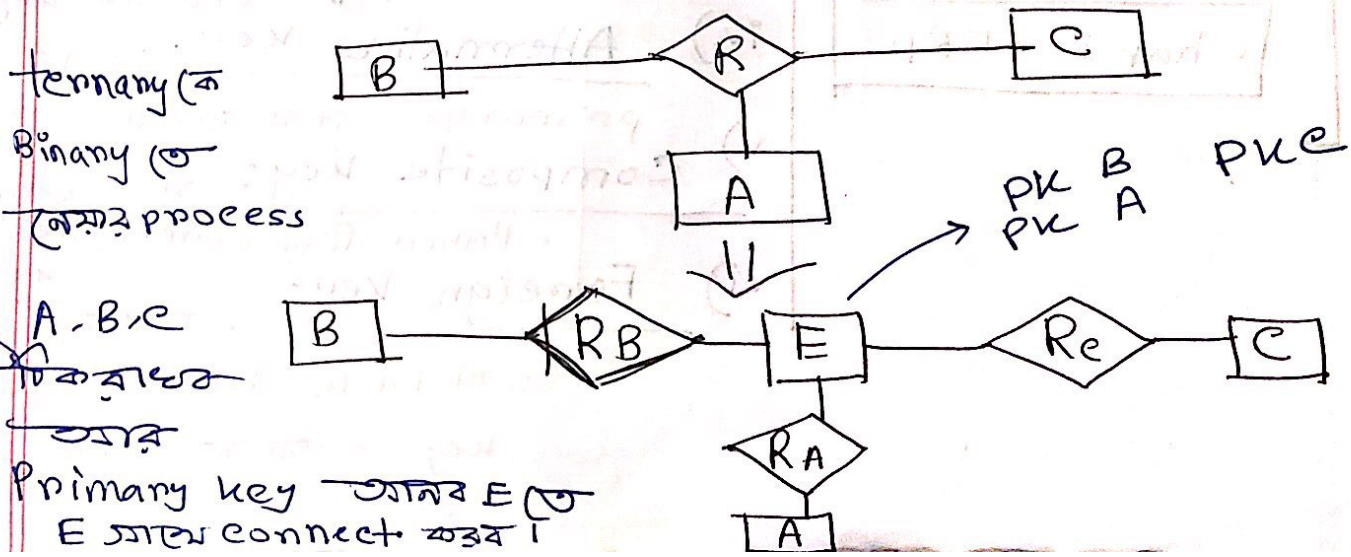
Unary / Recursive



একটি table থেকে তথ্য খুঁজতে table যাবে।

N-Any: More than 3 table. Try to avoid Unary and Ternary relationship, cause they are ~~preferable~~ problemetic after implementation.

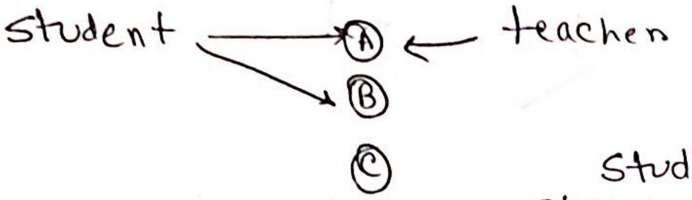
Converting Non-Binary To Binary:



কোন কোন project কোন

project under কোন কোন employee তা জানা যাবে না

যদি E তে master store করি।



Student = {Id, name, Phone, DOB}

P(Student) = $2^n = 2^4 = 16$

A = {1, 2, 3}

P(A) = { {1}, {2}, {3}, {1, 2}, {2, 3}, {1, 3}, {1, 2, 3}, ∅ }

Class - 08

20/1/19

Quiz - 1

27 Jan 2019

Classtime

Syllabus

Chap 1 + ERD

keys:

i) Super keys: n = attribute num

2^n → super keys.

ii) Candidate keys: minimal (super key)

যেই value দেখামাত্র বুঝা যায়

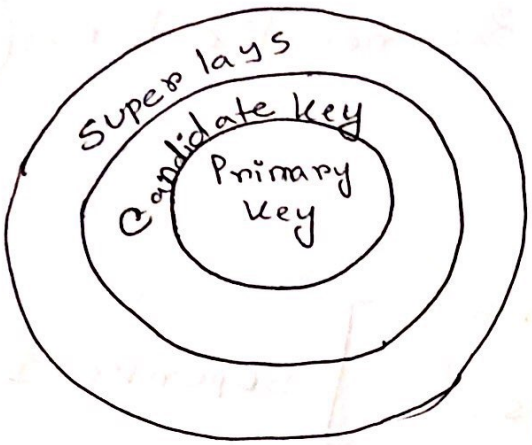
uniqueness pattern মেনে চলে

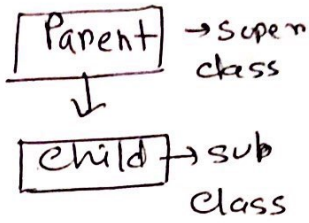
iii) Primary key: unique (→ Candidate key)

iv) Alternative key: যাদের primary key করা হয় না candidate key থেকে

v) Composite key: যখন 2/তার attribute মিলে primary key form করা হয়।

vi) Foreign key: যখন অন্য - একটি table এর primary key কে আরেক table এ use করি, তখন foreign key





Alternative lay = Candidate key - Primary key

Enhanced ER model:

→ In some cases, an Entity type has a number of subgroups.

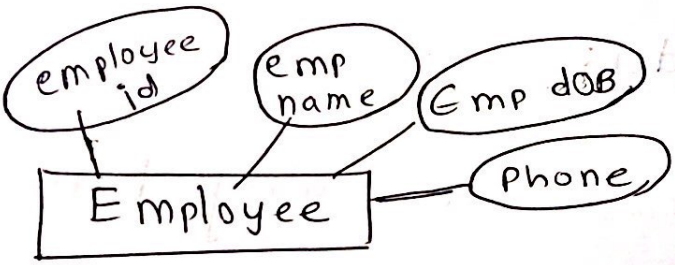
→ Relationship and attributes of superclass are inherited to sub-class.

→ Sub class can have additional attributes.

Two types: 1) Specialization (↓ Top down)
2) Generalization. (↑ Bottom up)

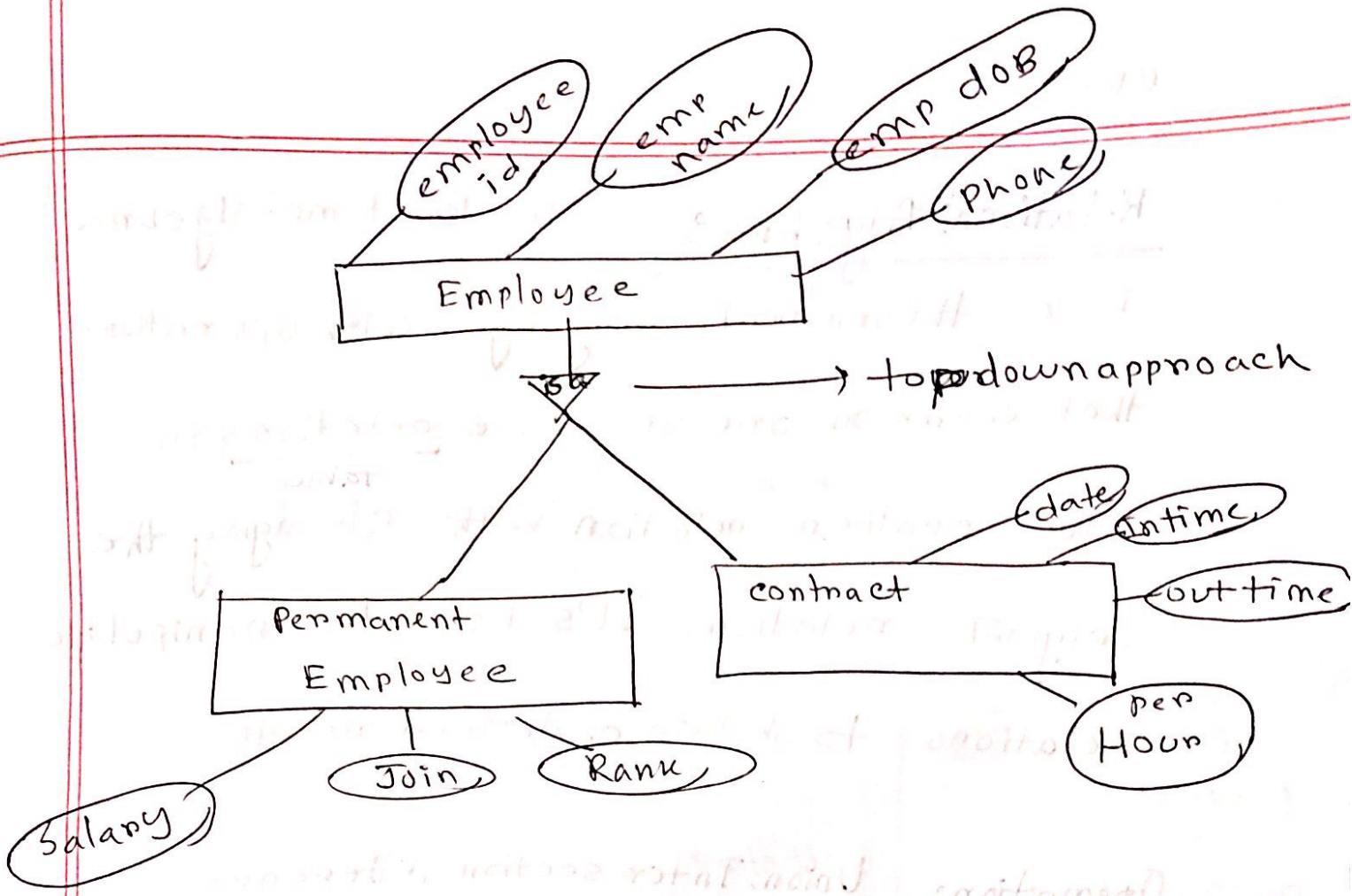
n = attributes number
2^n → super keys.] Super keys

Specialization :

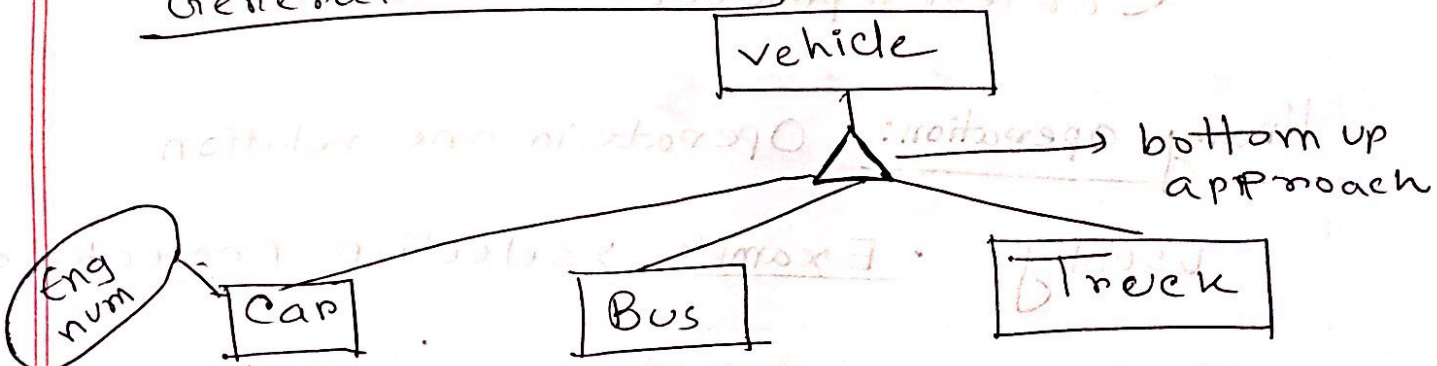


Join date	Terminate time	Salary	Not Null intime	Not Null out time
1/1/19		20K		

২টা pattern same table এ সমাধান problem.



Generalization:



একটি table এ into এর same common attribute vehicle থাকবে।

Subclass. superclass attribute access করতে পারবে।

Class-09

Relational Algebra: The Relational algebra is a theoretical language with operations that work on one or more relations (table) to define another relation with changing the original relation. It's used to manipulate relations to obtain a desired result.

Operation: Union, Intersection, difference, division, renaming, selection, projection, Cartesian product, join etc.

Unary operation: Operate in one relation usually. · Example → selection, projection etc.

Binary operation: Operate in two relation.

Example :→ Union, intersection, join etc.

N-ary operation: Operate in more than two relations.

Selection Operation: [works like ~~where~~ WHERE in SQL]

Syntax: $\sigma_{predicate}(R)$

$\sigma_{condition}(relation)$

σ = selection (sigma)

predicate = condition

R = relation

Symbols: $>, <, \geq, \leq, =, \neq, \wedge$ (and)

$\vee$, $\neg$.

↳ OR ↳ NOT

Employee

Name	Age	Salary
Manly	25	9000
Luky	40	3000
Mark	36	4500
John	42	3900

Questions: 1. Find the Employees whose age is less than 30 years?

⇒ $\sigma_{Age<30}(Employee)$

σ — condition; Age < 30 — Relation; Employee — Database name / table name

2. Find the Employee whose age less than 40 and salary 4000?

⇒ $\sigma_{Age<40 \wedge Salary=4000}(Employee)$

3. Find the Employee whose name is 'Luky'?

⇒ $\sigma_{Name='Luky'}(Employee)$

4. Find the Employee whose Age is between 35 to 45?

⇒ $\sigma_{Age \geq 35 \wedge Age \leq 45}(Employee)$

Projection Operation:

[works like SELECT in SQL]

Syntax: $\Pi_{a_1, a_2 \ldots a_n}(R)$

Π = projection (pie)

$a_1 \ldots a_n$ = attributes

R = relation.

Staff:

Name	Gender	DOB	Salary
Rony	M	01/12/85	20 000
Tony	M	09/7/95	30 000
Sarah	F	03/12/88	25 000

Questions: 1) Show ~~the~~ name sand Date of Birth of the staffs ?

⇒ $\Pi_{Name, DOB}(Staff)$

↑ column name লিখতে হবে

2. Find the Employee name whose salary is more than 30000?

condition দিলে selection apply করতে হবে।

⇒

$$\Rightarrow \Pi_{name}(\sigma_{Salary > 30000}(Staff))$$

(selection)

প্রথমে projection কে pro র ভিতরে bracket দিব।
selection part টাকে bracket এ নিবো।

```
Select Name
From Staff
Where Salary > 30000;
```

Customer

Name	Street	city	Phone	Age
Ruhi	abe	DHAKA	123	12
Adnan	def	KHULNA	456	16
Upoma	ghi	RAJSHAHI	789	17
Sazzad	jkl	DHAKA	135	19

1. Show the Customer names and city who lives in Dhaka or Khulna?

⇒ ~~σ (Π Name, city (σ Customer))~~

~~Dhaka $\vee$ Khulna~~

$\Pi_{name, city}$ ($\sigma_{city = 'Dhaka' \vee city = 'KHULNA'}$ (customer))

2. Find the Customer whose age greater than 15 and lives in any city except Dhaka?

⇒ Π ~~σ~~ $_{Name, Street, City, Phone, Age}$ ($\sigma_{Age > 15 \wedge city \neq 'Dhaka'}$ (customer))

starts with 9 → 9%

ends with 9
↳ %9

যেখানে digit সম্পর্কে % use করতে হয়।

3) Find the customer names and phone whose phone number starts with 1?

$$\Rightarrow \prod_{name,phone} \left(\sigma_{phone = '1\%'} (customer) \right)$$

016%5373
middle ভুলে গেলে ?

%HA%
↓
middle আছে মনে করলে

Class-10

24/1/19

Binary Operation Compatibility:

To perform the Binary Operation, relations should be UNION Compatible. 2 relations are UNION compatile if they have some number of attributes and belongs to some domain.

→ Columns number need to be same.

→ Domain Type need to be some.

R

A	B
varcha	varcha

S

A	B
varcha	varcha

→ এই operation কাজ করবে as same data। but আসলে করা যাবে না। XX

Compatible

R

A	B

S → data type

C	D

not compatible

cause (R) B অন্যটির column কে (S) B এর column কে use করতে দেয় না।

R

A	B

S

A	B	C

not compatible

Suppose -

R

A	B
α	1
α	2
B	1

S

A	B
α	2
B	3

UNION OPERATION:

$R \cup S =$

A	B
α	1
α	2
B	1
B	3

Intersection Operation :

$R \cap S =$

A	B
α	2

S-R

A	B
B	3

Difference operation:

R-S

A	B
α	1
B	1

Rename Operation:

→ When tables are not compatible.

→ When some table need to compare.

To rename table: $\rho_A(B)$ → old table; A → new name of B

↓ new table

To rename attribute:

$\rho_{\text{old name} \to \text{new name}}(R)$

R → relation.

Example: ~~Stff~~ Staff (Name, Branch, Salary)

we need to change Branch to Location and salary to Pay. We also want to change ~~the table~~ name Staff to example Employee (Name, Location, Pay)

$P_{Branch, salary} \rightarrow Location, Pay (Staff)$

Section

$P_{Employee} (Staff)$

Courseid	Semestre	Year	Room No	Department
CSE 3103	SPRING	2018	7A05	CSE
EEE 1200	FALL	2018	7A06	EEE
CSE 3293	SPRING	2018	7A03	CSE
CSE 3213	SPRING	2017	7A07	CSE
MATH 1203	FALL	2017	7A03	AS
CSE 3100	SPRING	2018	7A05	CSE

1) Show the ~~co ourse~~ courses ~~that~~ are taught in SPRING 2018 Semester?

2) Show the courses ~~that~~ one taught in Fall ~~18~~ 2018 semester?

3) show all the courses ~~that~~ are taught in SPRING 2018 and Fall 2018?

4) Show the courses ~~that~~ are taught in SPRING 2018 ~~be~~ but NOT in 2018 ~~2017~~ 2017 Fall semester?

AND OR

5) Find the courses which are taught in Both of Spring 2018 and Fall 2018 semester?

$A = \{1, 2, 3\}$

$B = \{1, 4\}$

$A \cup B = \{1, 2, 3, 4\}$

$A \cap B = \{1\}$

$A - B = \{2, 3\}$

$B - A = \{4\}$

① $\Pi_{course\_id}\left(\sigma_{Semester = 'SPRING' \cap Year = 2018}(Section)\right)$

② $\Pi_{course\_id}\left(\sigma_{Semester = 'FALL' \cap year = 2018}(Section)\right)$

③ ~~σ_{se}~~ $\left(\Pi_{course\_id}\left(\sigma_{Semester = 'SPRING' \cap Year = 2018}(Section)\right) \cup \left(\Pi_{course\_id}\left(\sigma_{Semester = 'FALL' \cap Year = 2018}\right.\right.\right.$

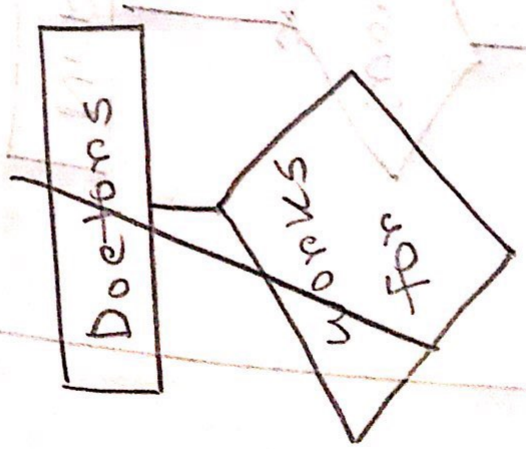
(section))

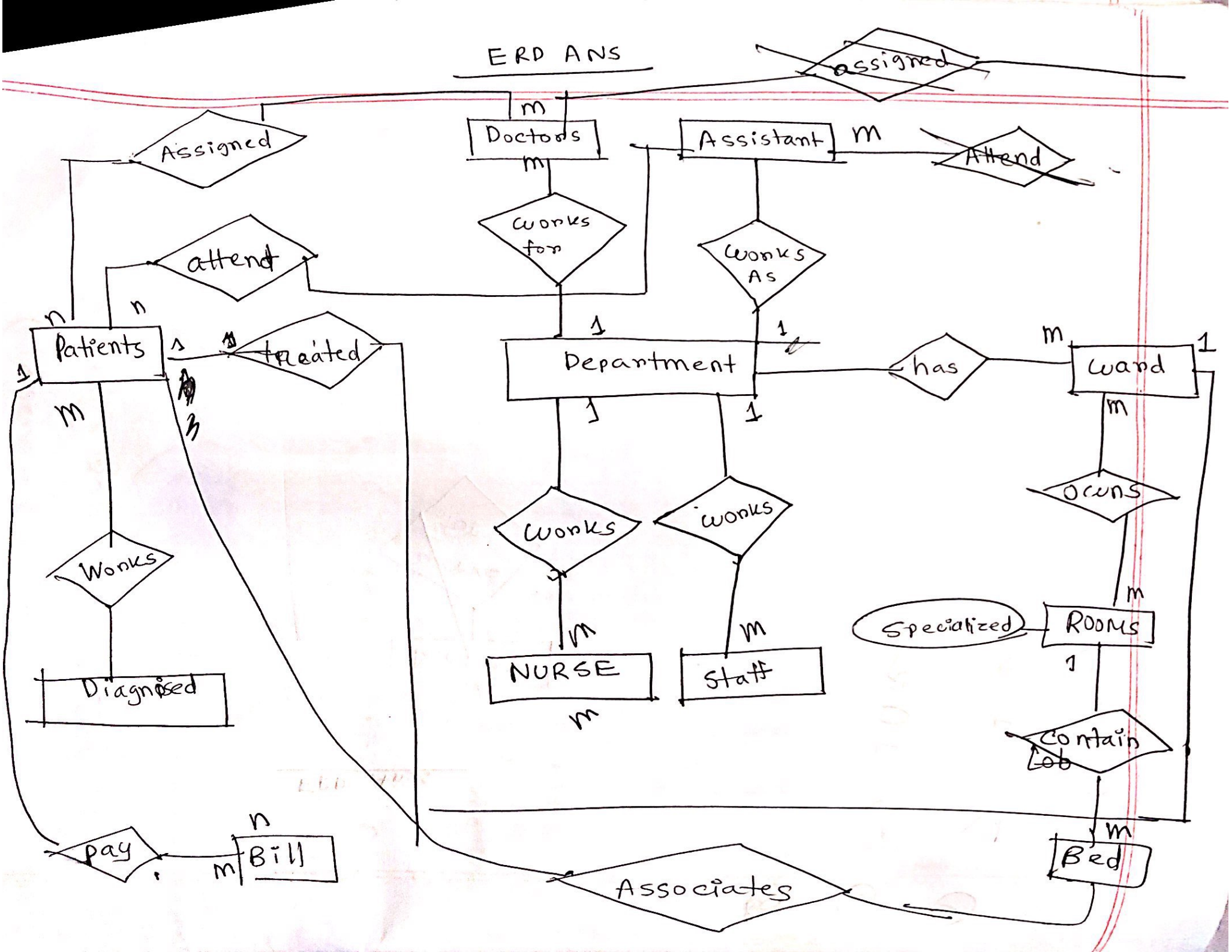
④ ⇒ 1 − 2

⑤ ⇒ 1 ∩ 2

⑥

ERD Ans:





Class-11

29/11/19

Cartesian Product Operation:

R

A	B
α	1
β	2

S

B	C
1	x
2	y

$\rho_{B \to D(S)}$ name er change

$R \times S =$

A	B	D	C
α	1	1	x
α	1	2	y
β	2	1	x
β	2	2	y

→ table small not

→ Attribute match

] cartesian product

Borrow

Loan

Name	Loan-No
KAMAL	L-17
JAMAL	L-23

Loan-No	Branch	Amount
L-14	KAKRAIL	75000
L-23	MOTIJHEEL	50000

1) Find the name of the customer who have a loan in the Motijheel Branch?

Join or cross প্রডাক্ট

motijheel branch? loan নাম্বার rename

$\rho_{B \to D(S)}$

Π_{name}

Borrow X Loan

Name	B. Loan-No	L. Loan-No	Branch	Amount
KAMAL	L-17	L-14	KAKRAIL	7500 0
KAMAL	L-17	L-23	MOTIJHEEL	5000 0
JAMAL	L-2,3	L-14	KAKRAIL	75000
JAMAL	L-23	L-23	MOTIJHEEL	50000

Natural Join ($\bowtie$):

↳ cross with blocks.

Chainman;

faculty

Name	Department
Smith	CSE
John	EEE
Paul	EEE

Department	Head
EEE	Brown
CSE	Alen
MCE	White

→ most common at least 1 column with

→ common column merge admin.

Ans:

Π_{name} ($\sigma_{B.Loan\,No = L.Loan\text{-}no \cap Branch = "MOTIJHE}$ (Borrow X Loan)

ρ_{ename} $\rho_{Loan\_No \to B.Loan\_No}$ (Borrow)

σ $P_{Loan\text{-}no} \longrightarrow L.Loan\text{-}NO$ (Loan)

Branch = MOTIJHEEL

⋈ faculty ⋈ chairman

Name	Department	Head
Smitch	CSE	Alen
John	EEE	Brown
Paul	EEE	~~Alen~~ Brown

MCE white → Joining ব ফলে যদি কোন table ব row বাদপড়ে যায় তখন তাকে বলা হয় →

↳ Dangling ~~Tap~~ Tuple *

~~Cat~~

Chairman ⋈ faculty

Department	Head	Name
EEE	Brown	John
CSE	Alen	Smith
MCE	White	✓
EEE	Brown	Paul

২টা data থাকাতে এখানে তাই হবে data insert করতে হবে।

→ এখানে null create হচ্ছে।

Borrow ⟕ Loan

Name	Loan_No	Branch	Amount
~~Kamal~~	~~L-17~~		
Jamal	L-23	Motijheel	50000

← ~~dnt~~ dangling হওয়াতে Borrow তে ~~হয়েছে~~ যেহেতু ঐ table ~~হতে~~ আছে-

(Borrow ⋈ Loan) = A

Π_{name} ($\sigma_{Branch = 'Motijheel'}$ (Borrow ⋈ loan))

column বেশি হলে table বড় হয়ে যায়।

column operation সংখ্যা বেশি হলে join operation করব।

Cross এর disadvantage → ~~অনেকগুলো~~ অপ্রয়োজনীয় data ও বের করে। এতে row বেশি generate হয়ে database এর volume বাড়িয়ে দেয়। আর sorting time delay করে। Operational cost বেড়ে যায় → column বাড়লে।

অনেক value → ~~kam~~ value null দেয়া থাকলে zero হবে কোনো value থাকবে না।

31/1/19

C.W. Class-12

~~Ao~~

Aggregation: Aggregate function take a collection of values and return a single value as a result.

Notation: $G\mathcal{G}_{F(A)}(R)$

G = group by

$\mathcal{G}$ = Aggregation

F = Function

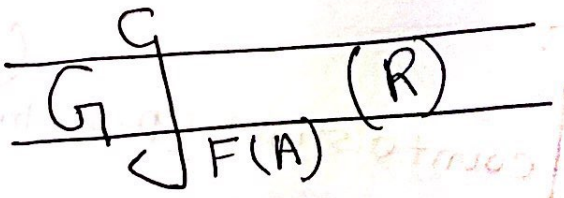
A = Attribute

R = Relation

Function:

- ~~Max~~ Max
- Min
- Sum
- Count
- Count distinct
- Average (Avg)

Example: Instruction:



ID	Name	Department	Salary
01	Alex	CSE	20,000
21	Brown	EEE	15,000
51	Cook	ME	20,000
22	Dowson	EEE	35,000
43	Emly	CSE	45,000
56	Frank	ME	30,000

1) How many departments are there on Instruction Relation?

$_{Department}\mathcal{G}_{count\ distinct\ (Department)}\ (Instruction)$

② Find the average salary of the instructions according to the department?

$$\text{Department } \mathcal{G}_{\text{avg(salary)}} (\text{Instructor})$$

Assignment Operator ($\leftarrow$)

Assignment operator is ~~useful~~ used to write a large query in step by step.

Example

$temp1 \leftarrow R \times S$

variable

$temp2 \leftarrow Salary > 6500 \wedge Age < 35$

$temp3 \leftarrow Department = 'CSE'$

$\Pi_{names} \left(\sigma_{temp3 \vee temp2} (temp1) \right)$

যেই variable নিব সেটা table র নাম হিসেবে নিতে পারব না।

~~variable~~ existing variable না নিয়ে অন্য value নিতে হবে নামের।

Class-13

3|2|19

Theta Join: Join with a comparison operator.

Notation: $(R \bowtie S)_{condition}$

or,

$\sigma_{condition}(R \bowtie S)$

Example :-

Deposition (Customer-No, Name, Account-No, Branch)

Account (Account-No, Branch, Balance)

- Find the name of the customer who have an account in the Bank and having Balance greater than 65,000?

$\Pi_{names}(\sigma_{Balance>65000}(Depositor \bowtie Account))$

Or

$\Pi_{name}(Depositor \bowtie Account)$ Balance > 65000

Outer Join:

1) ✓ Left Outer Join → left table এর কিছু value আর বাকি টেবিলের ডাটা নিয়ে আসব যেগুলি হবে Null তার

2) Right Outer Join

3) Full Outer Join

R1

E.Name	Department
Smith	Sales
Black	Production
White	Production

R2

Department	Head
Production	Mapy
Marketing	Brown

Left Outer Join: (⟕)

Right " " : (⟖)

Full " " : (⟗)

left outer join : $(R_1 ⟕ R_2)$ (A)

E.Name	Department	Head
Smitch	Sales	Null
Black	Production	Mary
White	Production	Mary

fixed থাকে

Right Outer Join ($R_1 \bowtie R_2$) :

(B)

E.Name	Department	Head
Black	Production	Mary
NULL	Marketing	Brown
White	Production	Mary

Full Outer Join ($R_1 \bowtie R_2$)

= leftouterJoin ($R_1 \bowtie R_2$) ∪ Rightouter Join ($R_1 \bowtie R_2$)

E.Name	Department	Head
Smith	Sales	NULL
Black	Production	Mary
White	Production	Mary
Null	Marketing	Brown

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6/2/19

Chapter-12

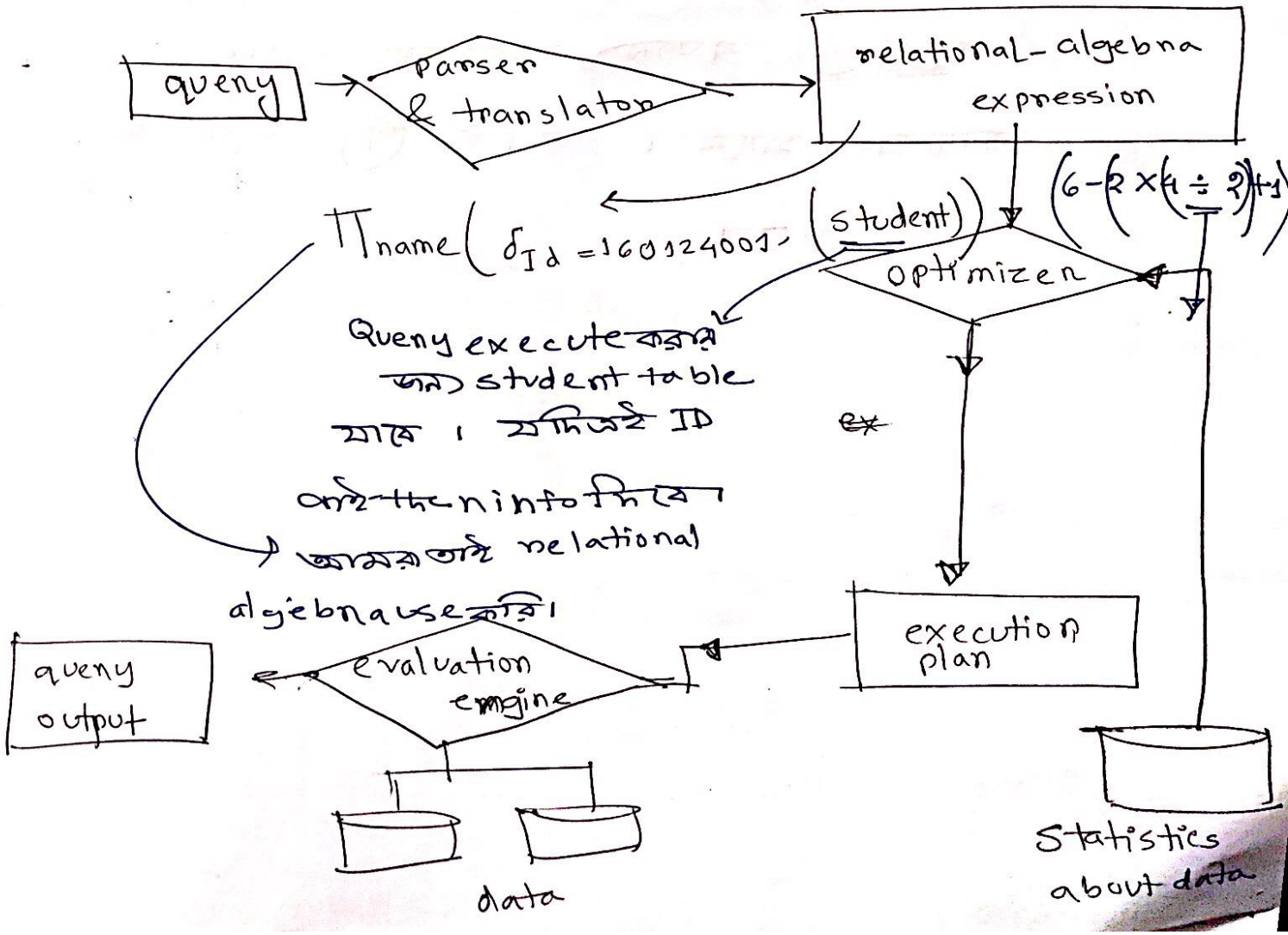
Query Processing

Measures of query cost:

Basic Steps in Query Processing:

Parsing:
↓
খুঁজে বের করা

Select Name
From Student → table name
Where ID = 160124001



10000

Π_{name} ($\sigma_{ID=1602040028 \wedge courseID=CSE3113}$ (Student ⋈ Course))

(i) First ⋈ join করব then ID, course check করব

(ii) ID, course বের করব then Student, course join করব।

যে কোনটা ~~কম~~ হলে ভাল।

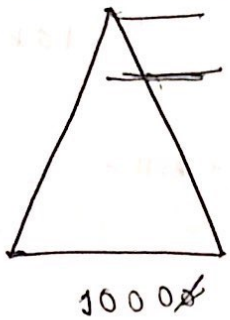
Student ⋈ course এভাবে করলে dangling ছাড়া অনেক value আসে যাবে। তাই (i) process easy হবে।

Class-15

7/2/19

block

Whichone is the bestway?



B → 256MB → 32×8

t_T → 3 ms.

S → 10

t_s → 5 ms

Select *

From Result

Where name = ssc

~~* * *~~ Final এ আসবে।

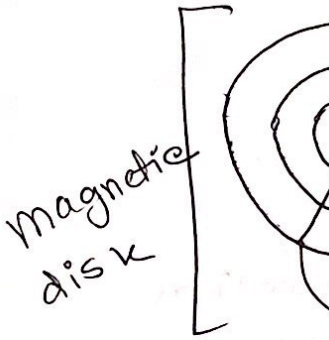
$B \times t_T + S * t_s$

↓

$32 \times 3\,ms + 10 \times 5\,ms$

~~= 3×~~

seek → database এ data খুঁজবে।



(একাধিক disk)

(11)

$= 32 \times 3 \times 10^{-3} +$

$10 \times 5 \times 10^{-3}$

$= \underline{0.14}$

$= \underline{0.07}$ যদি হার্ড time হয়

তাহলে 0.07 হবে।

13/2/19

Sunday Quiz

Relational Algebra

Table ফরম্যাটকে ডেটা থেকে Algebra লিখতে হবে

0 — 10 Marks each

Transaction Concept:

Transaction Processing

A ~~100~~ 50

Read(A)

A−50

Write(A)

B ~~200~~ 250

Read(B)

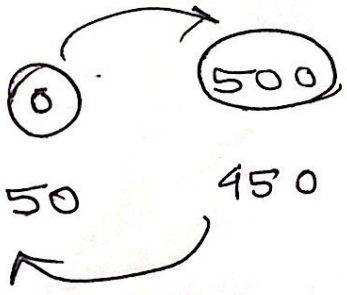
B+50

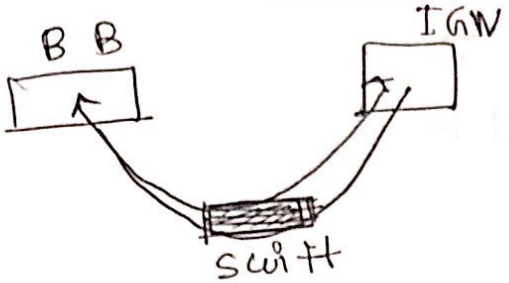
Write(B)

100+200=300

50+250=300

Transaction equal হলে solid transaction





transaction হলে
সব গুলো step ই
হতে হবে। কোন একটা বাদ
পড়লে পুরোটা step
বাদ যাবে।

Atomicity requirement:

$A \rightarrow B + 50$ T_1

$C \rightarrow B + 20$ T_2

Acid Properties:

durability → successfully database complete হলে durability ~~~~ তে তথ্য store থাকবে।

table এর schema

Result (ID, course No, Name)

Student (Id, name, DOB, Phone)

Address (Id, House, Road)