Yun Zhou
300442776

Q1a) ~~π Nationality~~ Select * From Painter * Painting * ArtGallery
Painter=({PK} Where Nationality = 'Australian' ∧ City != Wellington
~~π PId, PName Nationality~~ Group By PId ~~Having count(City) Wellington~~
~~+ Year of Birth, Year of Death~~
{Fects}), ~~Group By City~~ Having count(City = Wellington)
~~(σ Nationality = Australian ∧ City != Wellington ∧ Country 'New Zealand~~
Lv2& P = {Foreign table} = {NO FK(fects)}
~~(Painter * ArtGallery))~~ ~~∧ Value{PK} ∈~~ Out tables, PK... (~~Painter * ArtGallery~~))
~~σ Nationality = 'Australian'~~ ∧ {No

a) π PId, PName (σ Nationality = 'Australian' ∧ City != 'Wellington'
(Painter * Painting * ~~Gallery~~ ArtGallery)

~~b)~~

b) Select ~~*~~ P.Title, P.Style ~~Value~~ P.Value, P.PId, ~~GId~~, P.GId, P1.PName
From Painting P ~~* Painter P1~~ Natural Join Painter P1
Where value > "Cass" And P1.PName = "Rita Angus";

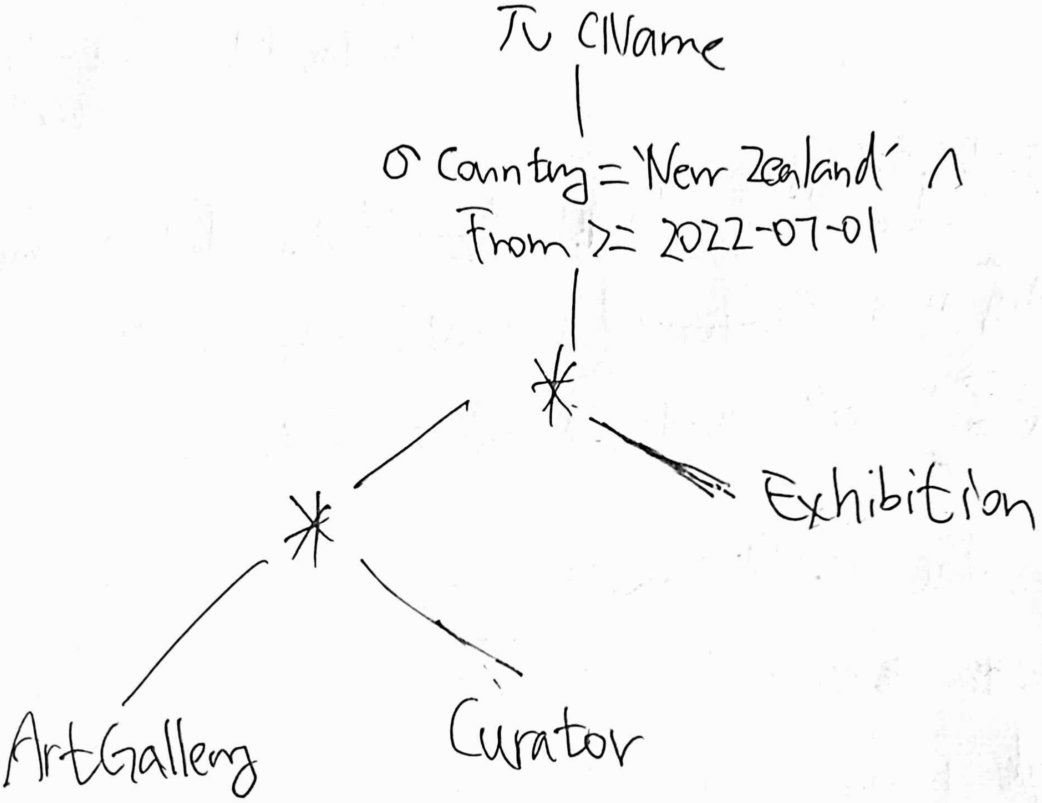
c) Select p.value, p.PId, p.Title, p1.PName
From Painter ~~p~~p1 ~~* Painting P~~ Natural Join Painting p
Where ~~p.Style~~ p1.YearofDeath = null
Group By p1.PId
Having AVG(p.style) = 'Impressionism';

d) Select p1.PId, P1.PName
From Painter P1, ~~Natural Join~~ ~~Outer Join~~ Painter P2 ~~On~~
Where P2.PName = 'Rita Angus' ~~And~~
~~P1.~~
Having ~~count(P1.PId~~
Count(P1.title) >= Count(P2.title);

Q2 a) $\pi_{CName}(\sigma_{Country='New Zealand' \wedge From \geq 2022\text{-}07\text{-}01}((AGallery * Curator) * Exhibition))$

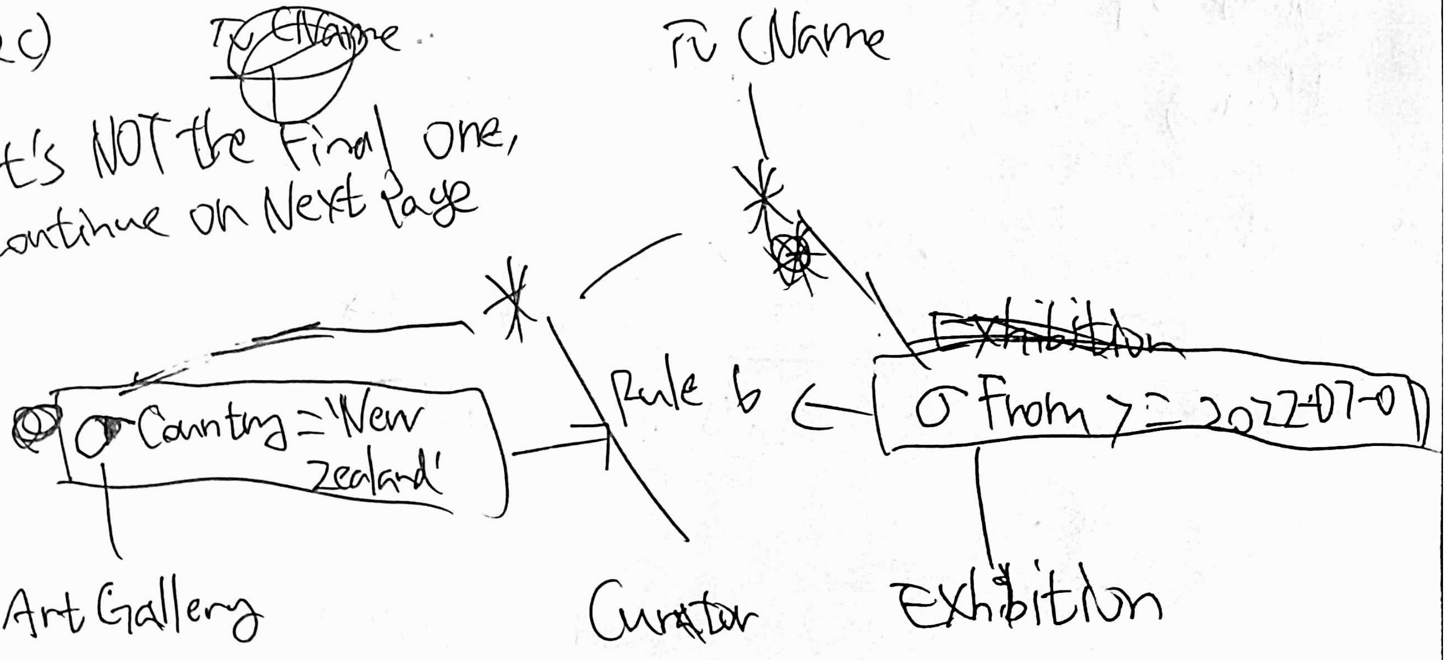
Retrive all names of Curator ~~whose~~ who is working for the ~~gallery~~ art gallery that is based on "New Zealand" And organize an exhibition that ~~is~~ take place in New Zealand ~~and since the start date~~ and the start date of this exhibition is on or after 2022-07-01.

b)

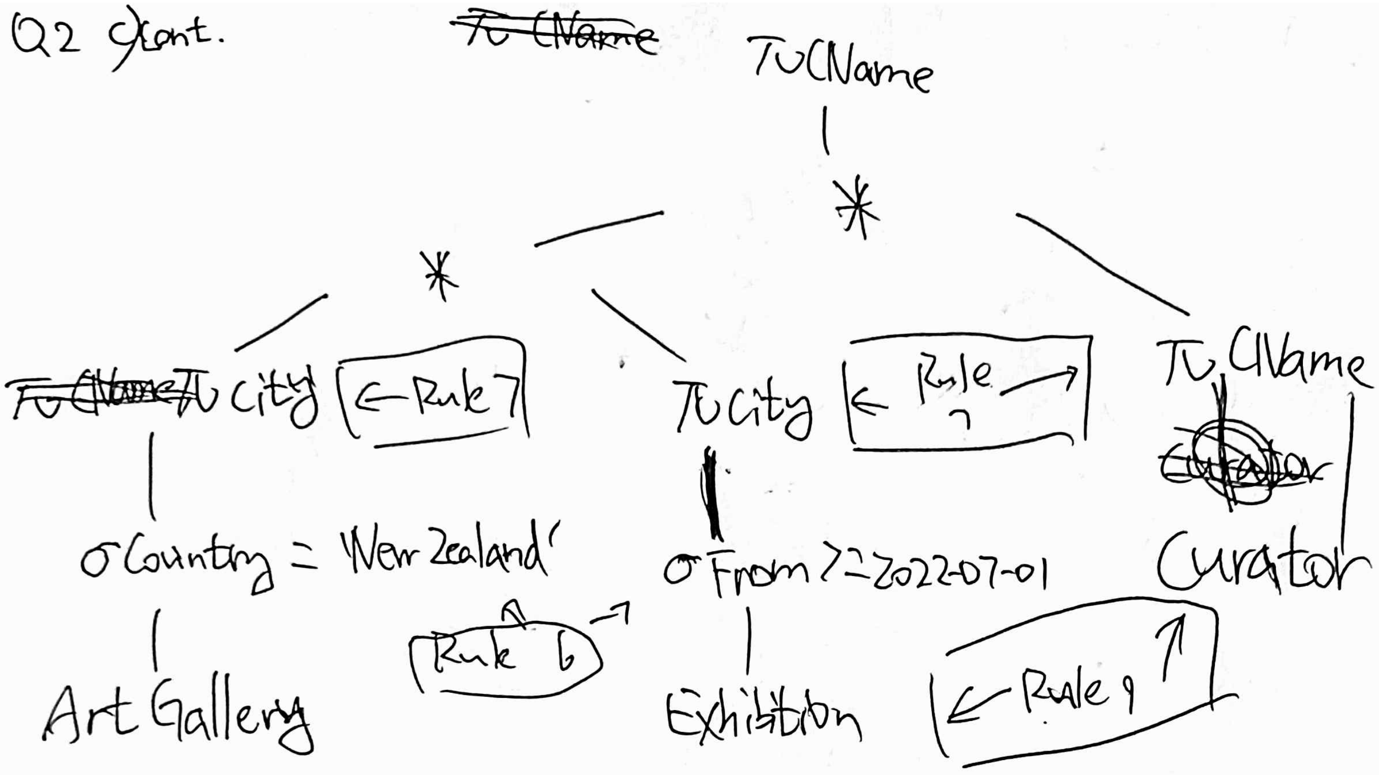


Q2c)

It's NOT the Final one, continue on Next Page



Q2 Cont.



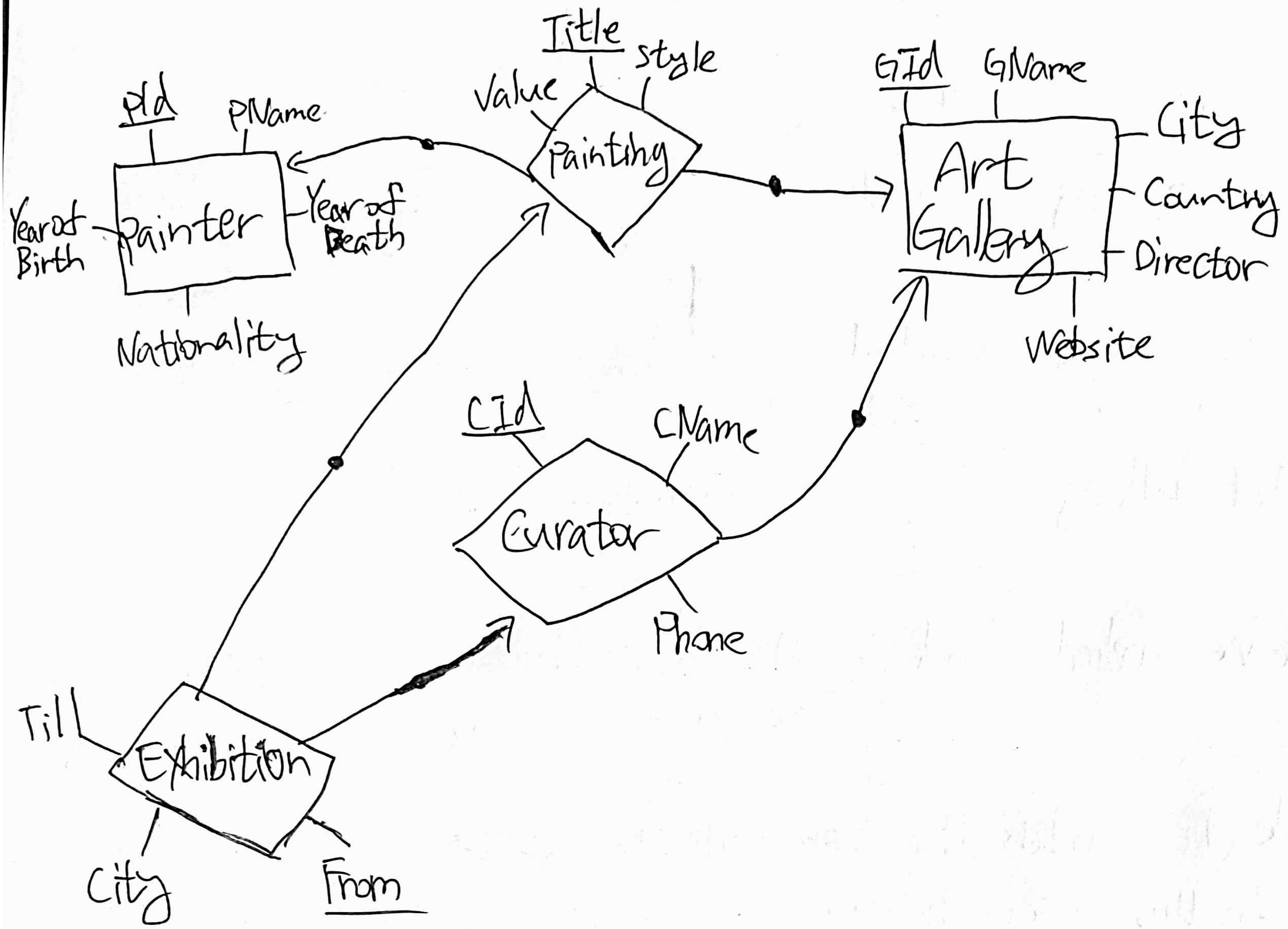
We've applied: Rule ⑥: More down the Selections operations to the earlier stage

Rule ⑨: Switch the more restrictive ~~[illegible]~~ one to the earliest stage In this case, Exhibition got a selection that From >= 2022-07-01 and curator do Not have, So Exhibition is more restritive so it is moving down such that Before JOIN, there can be less tuples overall

Rule ⑦: ~~Move Add~~ Apply projection π operation as early as possible, So only attributes that are needed are remained. It further reduce ~~the amount~~ total amount of tuples before Join.

Also Rule ⑫ is NOT applied since it is used for replacing the Cartesian Product × to the normal ~~Inner~~ Join ⋈, but in there we have Natural Join *, so it's not applied

Q3a) Draw Extended ER Diagram



Level 0:

Painter=({PId, PName, YearofBirth, YearofDeath, Nationality},
{PId})

Art Gallery=({GId, GName, City, Country, Director, Website},
{GId})

Level 1:

Painting=({Painters Art Gallery}, {Title, Value, Style},
{Painter, title})

Yun Zhou

300442776

Q3 a) continue:

Level 1:

Curator = ({ArtGallery}, {CId, CName, phone}, {CId})

Level 2:

Exhibition = ({Painting, Curator}, {Till, city, From}, {Painting, From})

Q3 b) ~~{ ⊇ {~~

Cluster:

~~Ent~~ means_of_transportation

Entity: Taxi = ({company, make, numberplate}

{numberplate})

Bus = ({company, line} {company})

Cluster:

travellen

Entity:

Features, Primary key

Individual = ({phone, name, email}, {phone})

Group = ({phone ~~xg~~, size, discount, groupleder},

primarykey = {phone})

Component: Features:

transport = ~~@~~{date, time, from, to}

Primary keys = {date, time}

foreign keys = {[phone] ⊆ traveller[phone], [company] ⊆ mean_of_transportation [company]} ~~[company]⊆~~ ~~[numberplate]⊆ Taxi[numberplate],~~ ~~[company, line] ⊆ Bus~~

Yun Zhou

300442776

Q4 a) A+= A
B+= BDA
C+= C
D+= DA
E+= EBDAC
AB+= ABD

The minimal key of R with Respect to F is E since all attributes can be implied by E.

b) ~~F={B->D, C->E, D->A, D~~

~~B~~ It's NOT 3NF is because it violates the ~~condition~~ constraint of 3NF that no prime-attribute can be transitively Implied by the schema key E, in this F, we can get D via B only, which means D is transitive ~~depedend~~ dependented on key E via B, so it violates the constrait, so it's NOT 3NF

c) 1: find Mimal Cover

B->D, C->E, D->E, D->A, E->B, E->C

The given one is the mimal cover

2. ({BD, B} {CDE, CD} {DA, D} {EB, E} {EC, E})

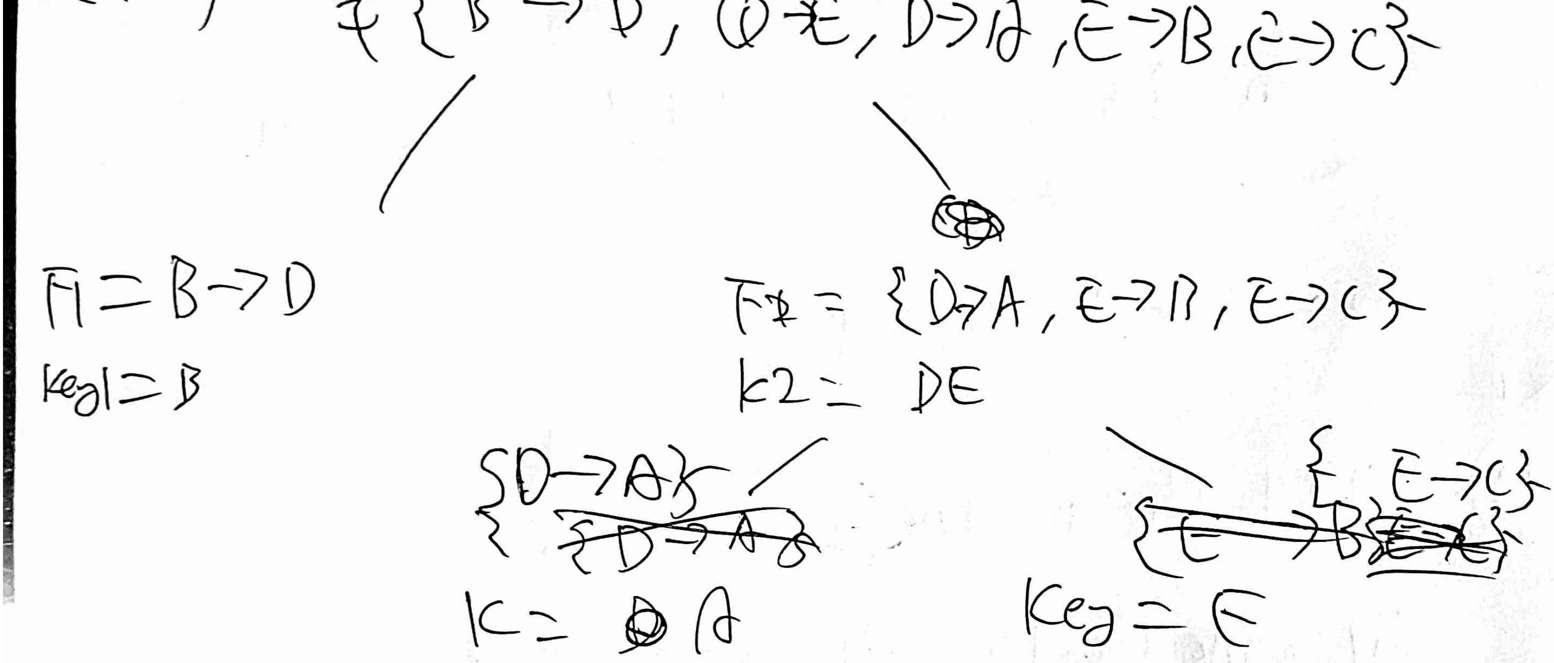
3.

key(R,F) = DEAB

~~Q4~~ d) It's NOT BCNF ~~she~~ since BCNF requires all LHS of ~~e~~ each FD must ~~co~~ contains the schema Key E, ~~but~~ and they areall non-trival, but:

From B→D, D→A, CD→E, we can see that LHS ~~is~~ does not contain the key E, so it's NOT BCNF

Q4 e)



Step1: CD→E is lost

K = B, DE

Step2: ~~E~~ D→A lost, E→B lost

K = ~~D~~EB

F = {~~B→D, D→A~~, E→B, ~~E→C~~}

{B→D, E→C, BD→A}

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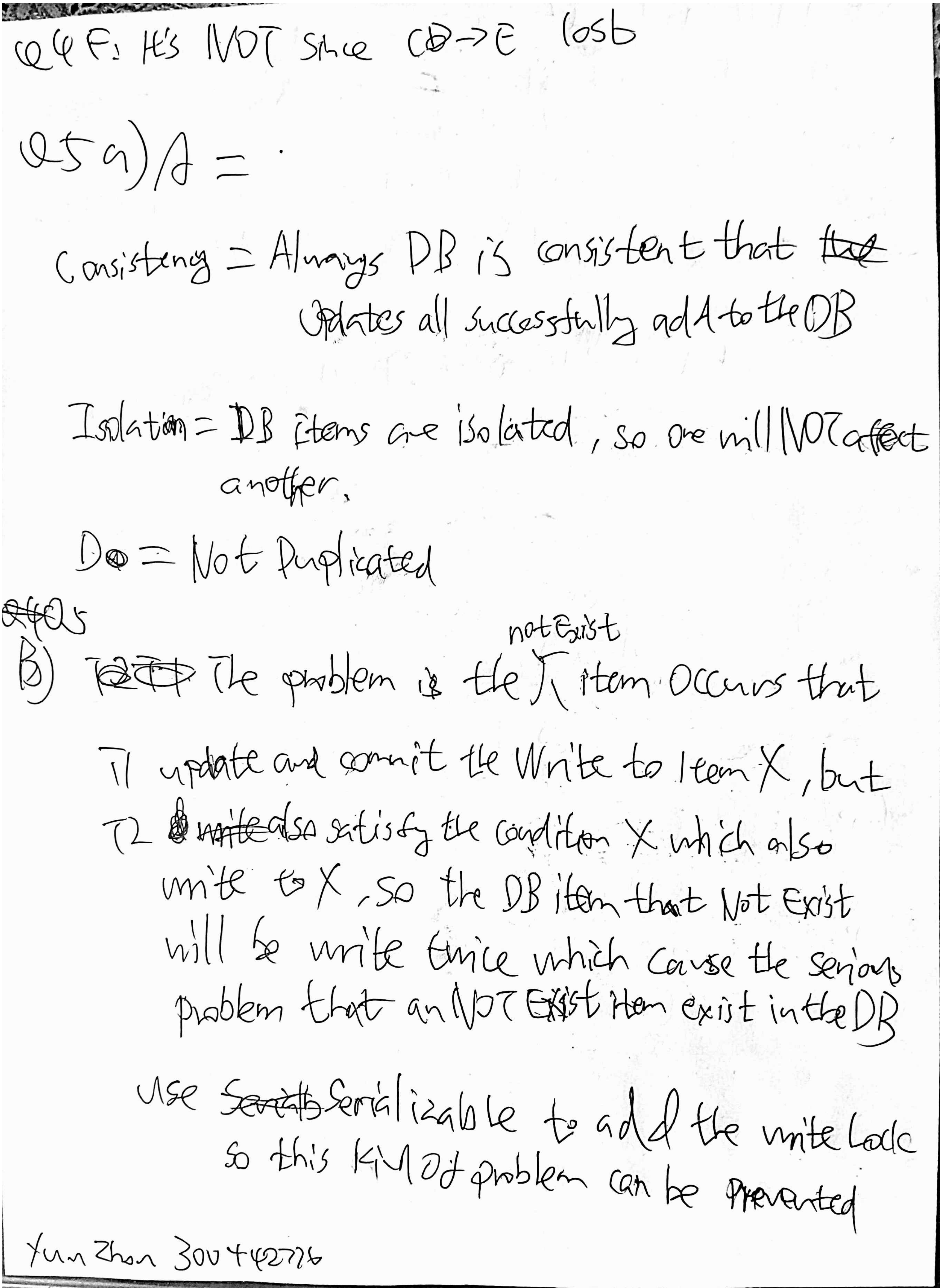

Q4 F: It's NOT since CD->E losb

Q5 a) A =

Consistency = Always DB is consistent that ~~the~~ Updates all successfully add to the DB

Isolation = DB items are isolated, so one will NOT affect another.

D = Not Duplicated

~~Q4~~Q5

B) ~~T2T~~ The problem is the not exist item occurs that T1 update and commit the Write to Item X, but T2 ~~write~~ also satisfy the condition X which also write to X, so the DB item that Not Exist will be write twice which cause the serious problem that an NOT Exist item exist in the DB

use ~~Serials~~ Serializable to add the write Lock so this kind of problem can be Prevented

Yun Zhou 300442776

Yun Zhou

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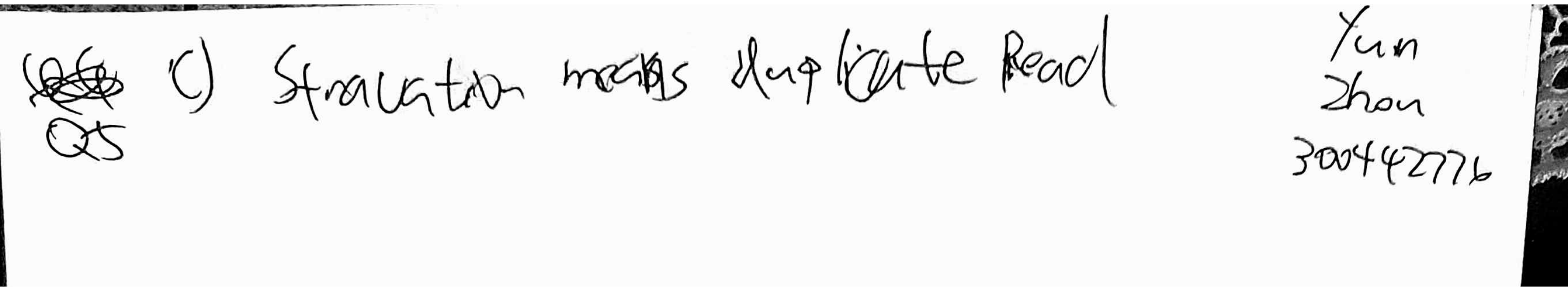

Q5 C) Stravation makes duplicate Read

Yun
Zhou
300442776