COMPUTER SCIENCE

Database Management System

Transaction & Concurrency Control

Recoverable Schedule

Lecture_7

Vijay Agarwal sir

01 Finding Conflict Serializable Schedule

02 Recoverable Schedule

ACID Properties.

Schedule

Serial

Non Serial Schedule

ml

serializable Schedule

Conflict

View

Problem Bcz of Concurrent execution

1. WR
2. RW
3. WW
4. Phantom Table

(M) Transaction

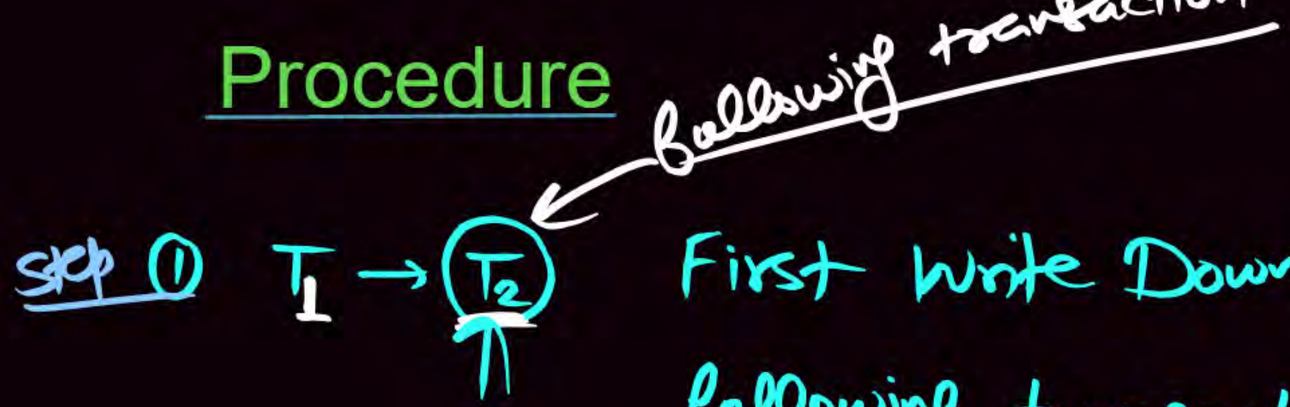
Total Number of Concurrent Schedule

Total # Serial Schedule $\Rightarrow$ $m!$

Total # Non Serial Schedule.

Total Number of Conflict Serializable.

Procedure



First Write Down all the operation of the following transaction (Later transaction [eg T_2])

Step 2 then starts from last operation of I^{st} transaction & Check & placed at the correct position.

T_i T_j $i \neq j$

Conflict operation.

- $R(A) - W(A)$
- $W(A) - R(A)$
- $W(A) - W(A)$

Q.1

Two transactions T_1 and T_2 are given as

T_1: $r_1(X)$ $w_1(X)$ $r_1(Y)$ $w_1(Y)$

T_2: $r_2(Y)$ $w_2(Y)$ $r_2(Z)$ $w_2(Z)$

Where $r_i(V)$ denotes a read operation by transaction T_i on a variable V and $w_i(V)$ denotes a write operation by transaction T_i on a variable V. The total number of conflict serializable schedules that can be formed by T_1 and T_2 is 54 Ans

[NAT:2017–2M]

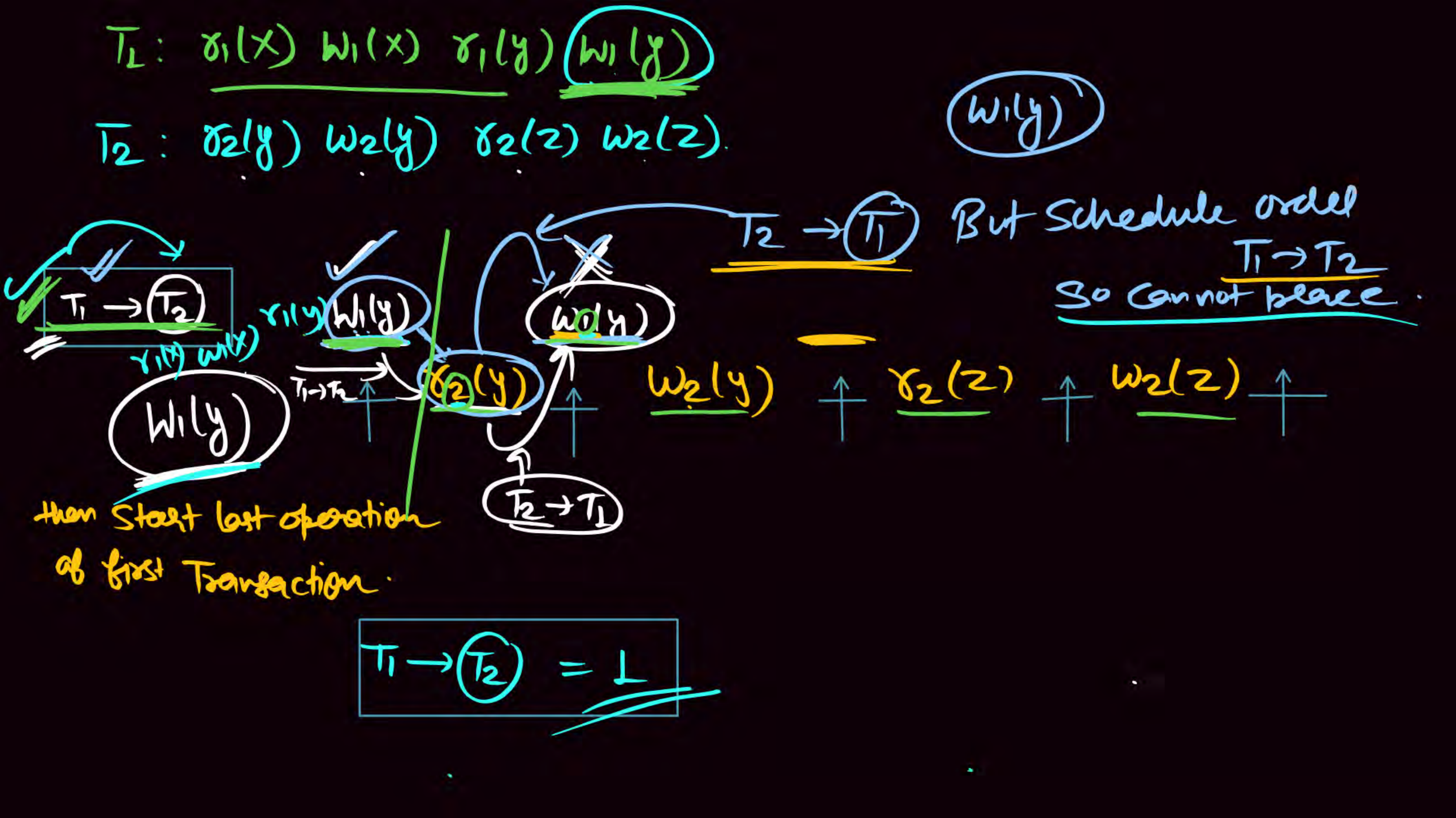
$T_1 \rightarrow (T_2)$ [T_1 followed by T_2] : 1

$T_2 \rightarrow (T_1)$ [T_2 followed by T_1] : 53

Total : 54 Ans.

T_1 : $r_1(x)$ $w_1(x)$ $r_1(y)$ $w_1(y)$

T_2 : $r_2(y)$ $w_2(y)$ $r_2(z)$ $w_2(z)$



$T_1 \rightarrow T_2 = \perp$

T_1 : $r_1(x)$ $w_1(x)$ $r_1(y)$ $w_1(y)$

T_2 : $r_2(y)$ | $w_2(y)$ | $r_2(z)$ $w_2(z)$

$r_2(z)$ $w_2(z)$ can be placed Any Where But After $w_2(y)$

(No conflict)

Q) (Why Placed Any Where ?)

Sol) Bcz Different Data Item so No Conflict

$T_2 \rightarrow T_1$

$w_2(y)$

Case III: $w_2(y)$ ✓ — $r_1(x)$

Case II: $w_2(y)$ ✓ — $w_1(x)$

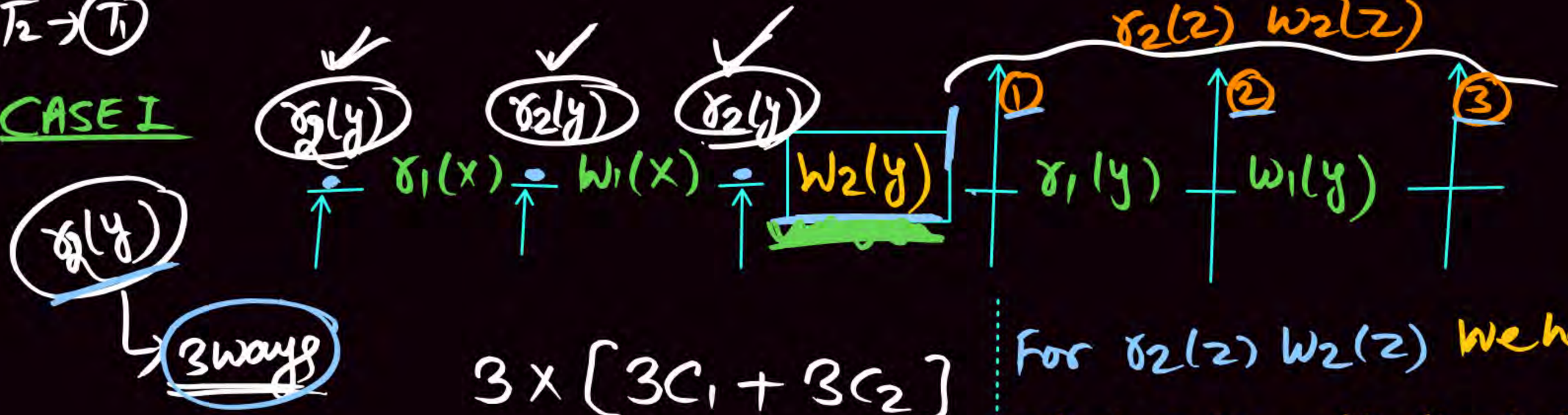
Case I: $w_2(y)$ ✓ — $r_2(y)$ — $w_2(y)$ — $w_1(y)$

$T_2 \rightarrow T_1$, $T_1 \rightarrow T_2$ X X

$\Rightarrow T_1 \rightarrow T_2$ (But Given is $T_2 \rightarrow T_1$)

$T_2 \rightarrow (T_1)$

CASE I



r2(y) → 3 ways

$3 \times [3C_1 + 3C_2]$

$3 \times [3 + 3] \Rightarrow 3 \times 6$

Case I = 18 Ways

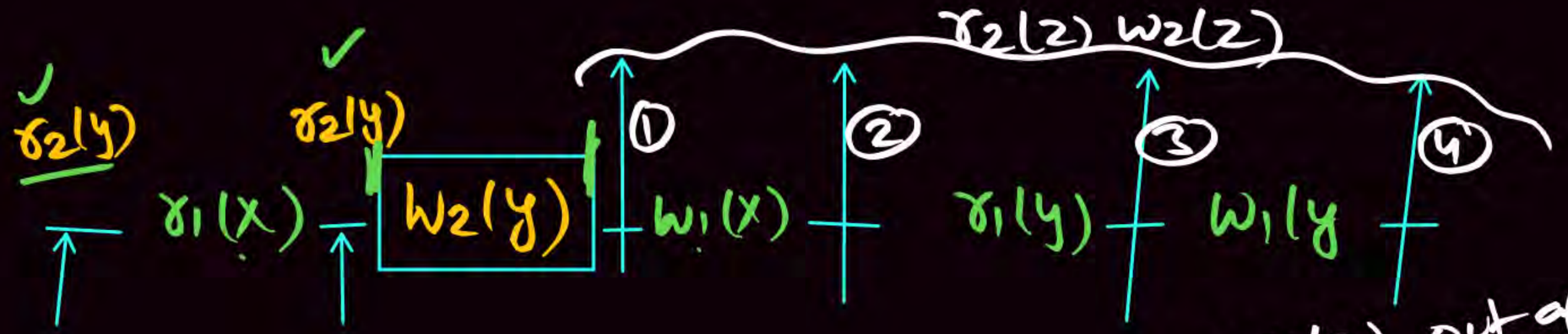
For $r_2(z)\ w_2(z)$ we have 3 place out of 3 place (position) place them Together $[3C_1]$

(or)

Place them separately $[3C_2]$.

$\therefore$ for $r_2(z)\ w_2(z) \Rightarrow \underbrace{3C_1}_{\text{Together}} + \underbrace{3C_2}_{\text{separately}}$.

Case II



$r_2(y)$ → 2 ways

$2 \times [\,{}^4C_1 + {}^4C_2\,]$

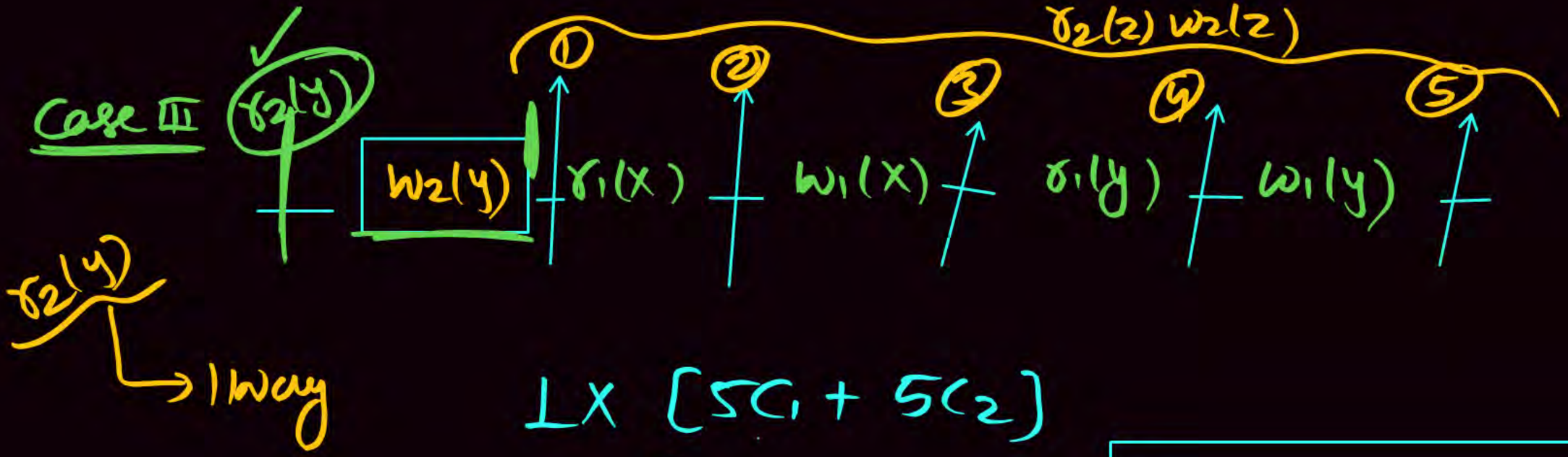
$2 \times [4+6]$

2×10

Case II : 20 Ways

$r_2(2)\, w_2(2)$ out of 4 place

$\Rightarrow \underbrace{{}^4C_1}_{\text{Together}} + \underbrace{{}^4C_2}_{\text{separately}}$



$$1 \times [5C_1 + 5C_2]$$

$$1 \times [5 + 10]$$

Case III = 15 Ways

$T_2 \rightarrow T_1$

CASE I : 18
CASE II : 20
CASE III : 15
53

& $T_1 \rightarrow T_2$: 1

So Total Conflict Serializable

$T_1 \rightarrow T_2$: 1
$T_2 \rightarrow T_1$: 53
54 Ans

∴

Q.2

Consider the transaction T_1 and T_2 given below: [NAT]

T_1 : $R_1(A)$ $R_1(B)$ $W_1(B)$

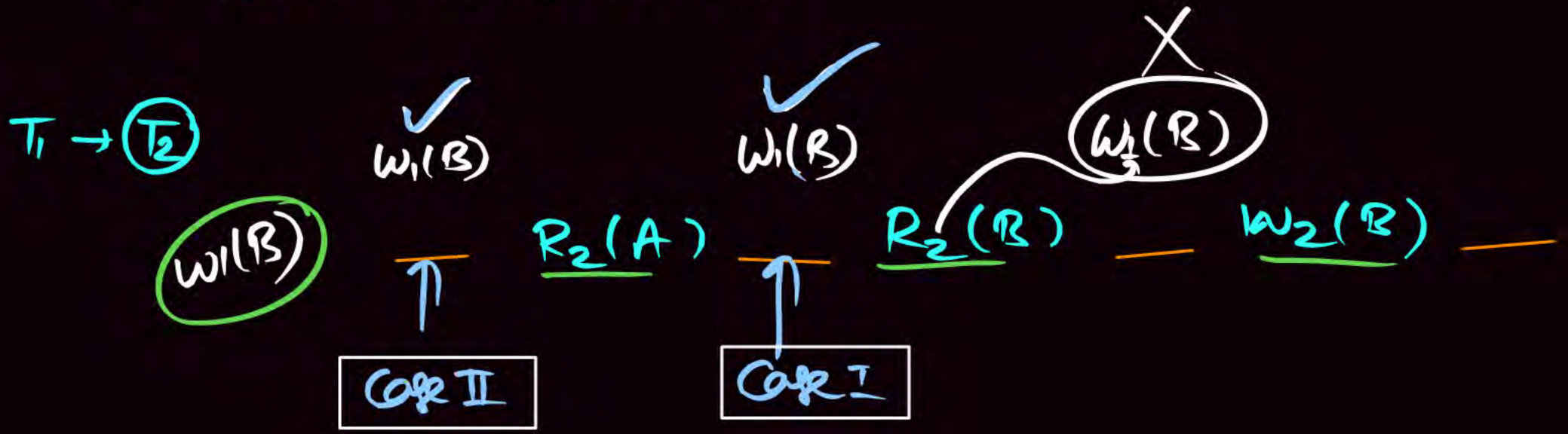
T_2 : $R_2(A)$ $R_2(B)$ $W_2(B)$

Where $R_i(A)$ denote a read operation by transaction T_i on a Data Item (A) W_i (B) Denote a write operation by transaction T_i on a Data Item B.

The Total number of conflict serializable schedule is____.

T_1: $R_1(A)$ $R_1(B)$ $W_1(B)$

T_2: $R_2(A)$ $R_2(B)$ $W_2(B)$



CASE I: $R_2(A)$ $R_1(B)$ $R_2(A)$ $R_1(B)$ $R_2(A)$ $W_1(B)$ $R_2(B)$ $W_2(B)$

$R_2(A)$ $R_1(B)$

$2C_1 + 2C_2 \Rightarrow 2 + 1 = 3$ ways

for $R_1(A)$ $R_1(B)$: Sit together $2C_1$ or select $2C_2$

CASE II: $R_2(A)$ $R_1(B)$ $W_1(B)$ $R_2(A)$ $R_2(B)$ $W_2(B)$

Case II : 1 ways

$T_1 \rightarrow T_2$: CASE I : 3
CASE II : 1

4

$T_2 \to T_1$

$W_2(B)$ ✓ $W_2(B)$ ✗ $W_2(B)$

$W_2(B) \quad R_1(A) \quad R_1(B) \quad W_1(B)$

CASE II ↑ $W_2(B)$ — CASE I ↑ $W_2(B)$

CASE I:

$R_2(A)R_2(B)$

$R_2(A)R_2(B)$ $\quad$ $R_2(A)R_2(B)$

$R_1(A) \quad W_2(B) \quad R_1(B) \quad W_1(B)$

$2C_1 + 2C_2 = 2 + 1 = 3$ ways

CASE II:

$R_2(A)\ R_2(B)$ — $W_2(B)$ → 1 way.

$R_1(A) \quad R_1(B) \quad W_1(B)$

$T_2 \to T_1$: 4 way.

=

∴

4 + 4

(i) Total Conflict Serializable = 8 Ans

(ii) Non Serial Conflict Serializable = 8 - 2 = 6 Ans

Serial Schedule = 2! = 2 Serial Schedule

Q.3

Consider the transaction T_1 and T_2 given below: [NAT]

T_1 : $R_1(A)$ $R_1(B)$ $W_1(B)$

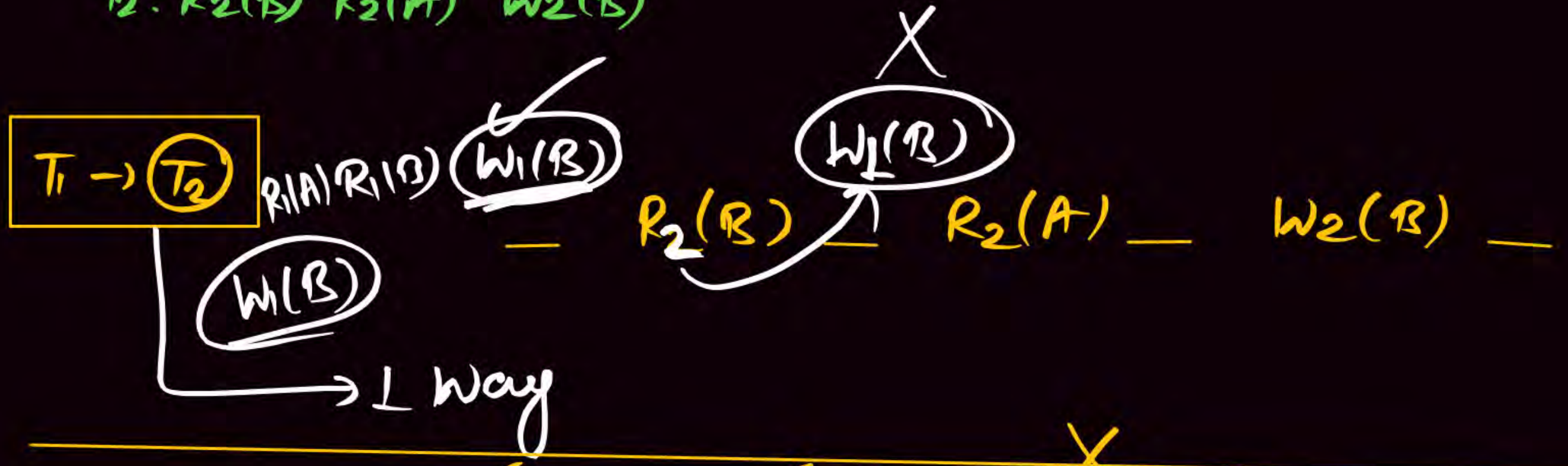
T_2 : $R_2(B)$ $R_2(A)$ $W_2(B)$

Where $R_i(A)$ denote a read operation by transaction T_i on a Data Item (A) W_i (B) Denote a write operation by transaction T_i on a Data Item B.

The Total number of conflict serializable schedule is____.

T_1: $R_1(A)$ $R_1(B)$ $W_1(B)$

T_2: $R_2(B)$ $R_2(A)$ $W_2(B)$



Case I:

$R_2(B)\,R_2(A)$ ✓

$R_2(B)\,R_2(A)$

$R_1(A)$ | $W_2(B)$ | $R_1(B)$ | $W_1(B)$

$2C_1 + 2C_2 \Rightarrow 2+1 = 3$ way

Case II:

$R_2(B)\,R_2(A)$

$W_2(B)$ | $R_1(A)$ | $R_1(B)$ | $W_1(B)$

$R_2(B)\,R_2(A)$ → 1

$T_2 \rightarrow (T_1) \Rightarrow 3+1 = 4$

(i) Total Conflict serializable = 1 + 4 = (5) Ans

(ii) Non Serial Conflict Serializable = 5 − 2 = (3) Ans

Today Transaction Concept

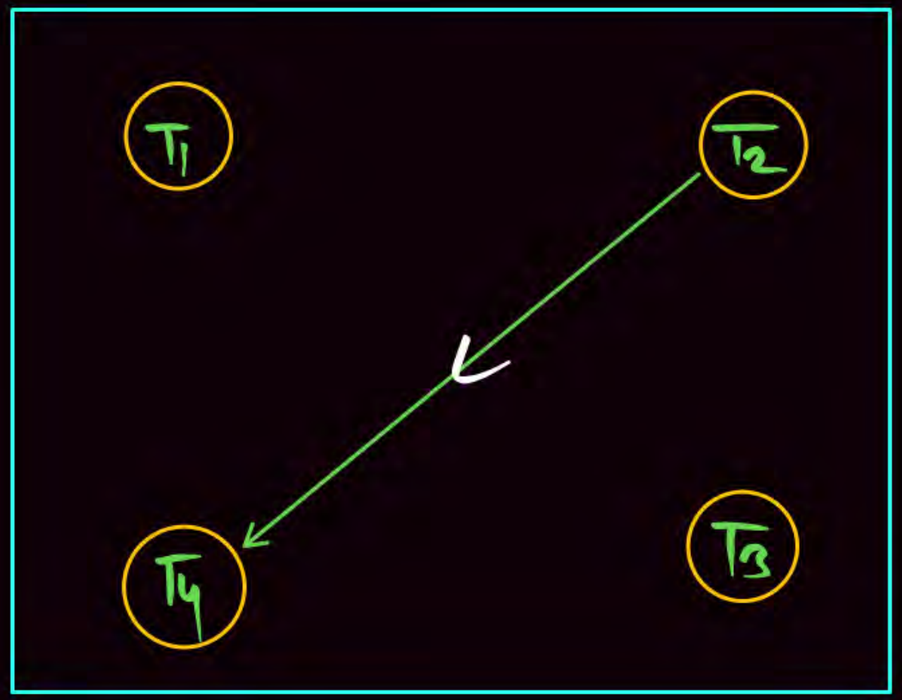
(a) enjoying & Love & cc

(5) cc

(6) c

(d) Doubt

Q.9 There are four [4] Transaction then possible sequence?



$T_2 \longrightarrow T_4$

First T_2, T_4 comes After T_2.

& T_1, T_3 Can be placed Any Where.

$T_2 \Rightarrow T_4$

T_1 & T_3

① T_2 ② T_4 ③

T_1 & T_3 Can be placed Any where $\Rightarrow T_1 T_3 \Rightarrow 3!$

$3! \; 2! \Rightarrow$ **12 Ans**

$3 \times 2 \times 2 =$

OR

for Other Method PT.O

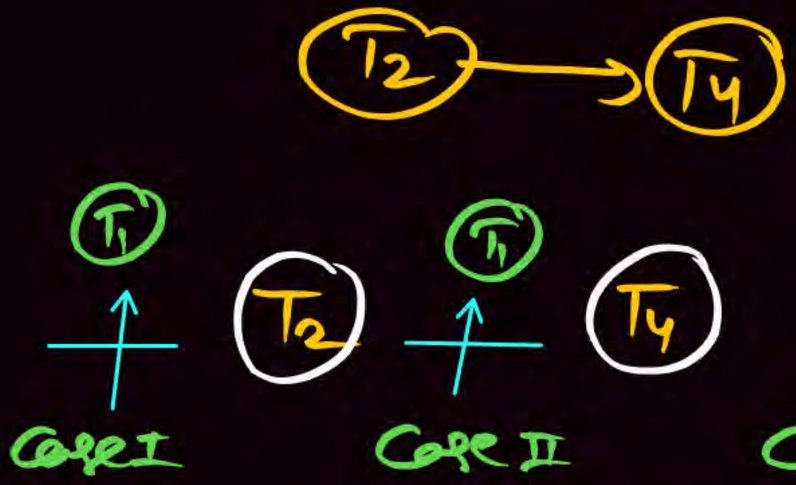
Here T_1 & T_3 are Indepent

T_1 & T_3 $\Rightarrow 2!$

Interchange

T_1 & T_3

First take T_1



Now for T_3

CASE I: ① T_1 ② T_2 ③ T_4 ④

Case II ① T_2 ② T_1 ③ T_4 ④

CASE III ① T_2 ② T_4 ③ T_1 ④

CASE I

I: T_3 T_1 T_2 T_4

II T_1 T_3 T_2 T_4

III T_1 T_2 T_3 T_4

IV T_1 T_2 T_4 T_3

Each case has 4 possibility

So total $3 \times 4 = 12$ Ans

Q.4

Consider the transaction T_1 and T_2 given below: [NAT]

T_1 : $R_1(A)$ $W_1(A)$ $R_1(B)$ $W_1(B)$

T_2 : $R_2(A)$ $W_2(A)$ $R_2(B)$ $W_2(B)$

Where $R_i(A)$ denote a read operation by transaction T_i on a Data Item (A) W_i (B) Denote a write operation by transaction T_i on a Data Item B.

The Total number of conflict serializable schedule is____.

[HOMEWORK]

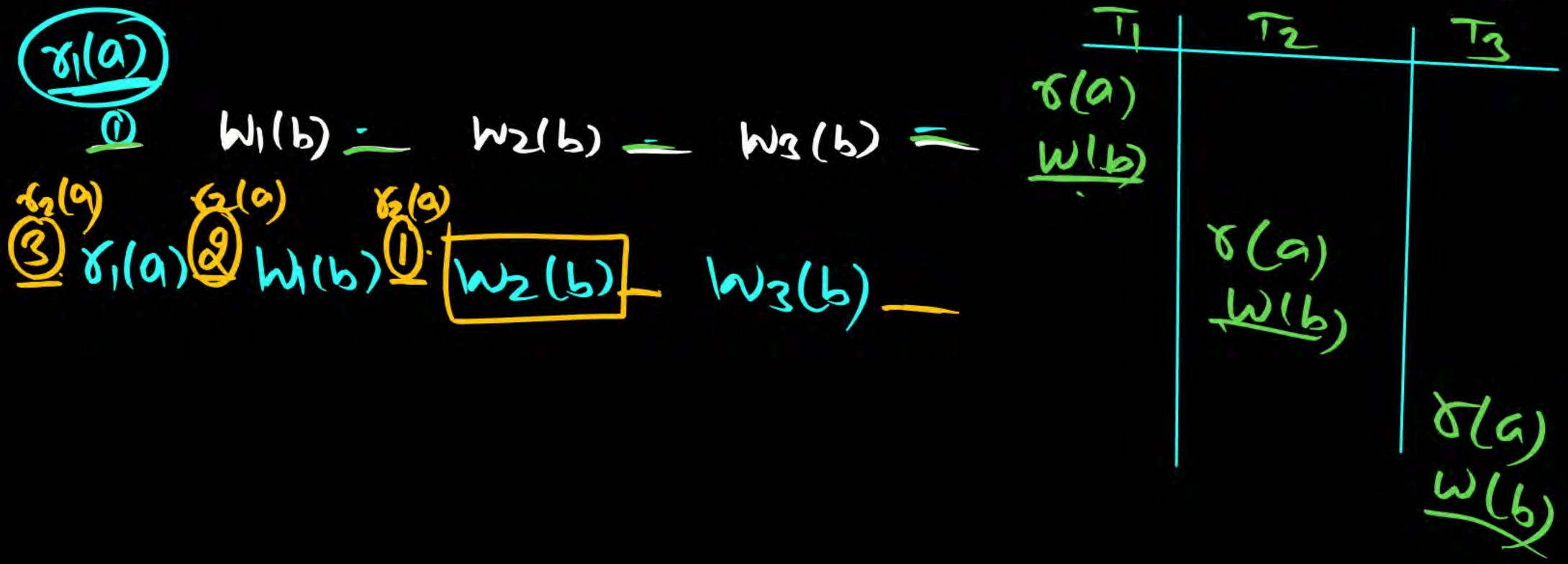
Q.5

Consider the following schedule:

S: $r_1(a)\ w_1(b)\ r_2(a)\ w_2(b)\ r_3(a)\ w_3(b)$

The number of conflict equivalent schedules is/are____.

[NAT]



S: $r_1(a)$ $w_1(b)$ $r_2(a)$ $w_2(b)$ $r_3(a)$ $w_3(b)$

$r_1(a)$

① $w_1(b)$ ② $w_2(b)$ ③ $w_3(b)$ ④

$r_1(a)$ can be placed Any where out of four position but

$r_1(a)$ * before $w_1(b)$ So Only 1 possibility (or 1 Place for $r_1(a)$

① $r_1(a)$ ② $w_1(b)$ ③ $w_2(b)$ ④ $w_3(b)$ ⑤

$r_2(a)$ ① $r_1(a)$ ② $w_1(b)$ ③ $w_2(b)$ ④ $w_3(b)$ ⑤

Step 2

(1) $r_2(a)$

$r_2(a)$ $r_2(a)$ $r_2(a)$

① $r_1(a)$ ② $w_1(b)$ ③ $w_2(b)$ ④ $w_3(b)$ ⑤

Case III Case II Case I

$r_2(a)$ can be placed Any where out of 5 position But before $w_2(b)$

$r_2(a)$ Work Done

CASE I ① $r_1(a)$ ② $w_1(b)$ ③ $r_2(a)$ ④ $w_2(b)$ ⑤ $w_3(b)$ ⑥

CASE II ① $r_1(a)$ ② $r_2(a)$ ③ $w_1(b)$ ④ $w_2(b)$ ⑤ $w_3(b)$ ⑥

CASE III ① $r_2(a)$ ② $r_1(a)$ ③ $w_1(b)$ ④ $w_2(b)$ ⑤ $w_3(b)$ ⑥

Step3 $\gamma_3(a)$

$\gamma_3(a)$ out of 6 Place can be placed at Any Position But Before $W_3(b)$, So for $\gamma_3(a)$ ∃ 5 position for each case.

CASE I : 5
CASE II : 5
CASE III : 5

$3 \times 5 = 15$ Ans

$\gamma_2(a)$ Work Done

CASE I ① $\gamma_1(a)$ ② $W_1(b)$ ③ $\boxed{\gamma_2(a)}$ ④ $W_2(b)$ ⑤ $\boxed{W_3(b)}$ ⑥

CASE II ① $\gamma_1(a)$ ② $\boxed{\gamma_2(a)}$ ③ $W_1(b)$ ④ $W_2(b)$ ⑤ $\boxed{W_3(b)}$ ⑥

CASE III ① $\boxed{\gamma_2(a)}$ ② $\gamma_1(a)$ ③ $W_1(b)$ ④ $W_2(b)$ ⑤ $\boxed{W_3(b)}$ ⑥

Calculate Total Number of Conflict serializable

1. When schedule is Not given (Only Transaction is given)

   like T_1:

   T_2:

   $T_1 \rightarrow T_2$ & $T_2 \rightarrow T_1$

   Q.1, 2, 3 & 4

2. When one schedule is given

   Like S: . - - - - - -

   Q.3 Q.5

Number of View Serializable

(i) Initial Read Pair
(ii) Final write Pair
(iii) Write-Read Pair

Any Doubt ?

THANK YOU!