CCT ASSIGNMENT S-1 SOLUTION

①

Schedule 1

$r_1(x), w_2(y), w_1(y), w_3(z), c_1, w_2(z), w_2(x), c_2, w_3(x), c_3$

Basic 2PL with Wait-die Policy

T_1	T_2	T_3
$r_1 l(x)$		
$r_1(x)$		
	$w_2 l(y)$	
	$w_2(y)$	
$w_1 l(y)$		
wait for T_2 to release y		
		$w_3 l(z)$
		$w_3(z)$
	$w_2 l(z)$	
	wait for T_3	
		$w_3 l(x)$
		T_3 Aborts as it is younger
	wakeup $w_2(z)$	
	$w_2 l(x)$	
	die as it is younger	
$w_1(y)$		
$u l_1(x)$		
$u l_1(y)$		
c_1		
	T_2 starts	
	$w_2 l(y)$	

(2)

	$w_2(y)$	T_3 starts $w_3 d(z)$ $w_3(z)$
	$w_2 d(z)$ wait for T_3	
		$w_3 d(x)$ $w_3(x)$ $ul_3(z)$ $ul_3(x)$ c_3
	wakeup $w_2(z)$ $w_2 d(x)$ $w_2(x)$ c_2	

(3)

Schedule 1

$r_1(x), w_2(y), w_1(y), w_3(z), c_1, w_2(z), w_2(x), c_2, w_3(x), c_3$

Strict 2PL with Wound Wait Policy

$r_1(x)$		
$r_1(z)$		
	$w_2(y)$	
	$w_2(y)$	
$w_1(y)$		
wound T_2		
	Aborted due to T_1	
$w_1(y)$		
		$w_3(z)$
		$w_3(z)$
$u_1(x)$		
c_1		
$u_1(y)$		
	T_2 restarts	~~$w_3(z)$~~
	$w_2(y)$	
	$w_2(y)$	
	$w_2(z)$	
	wound T_3	Aborted
	$w_2(z)$	
	$w_2(x)$	
	$w_2(x)$	
	c_2	
	$u_2(y)$	
	$u_2(z)$	

(4)

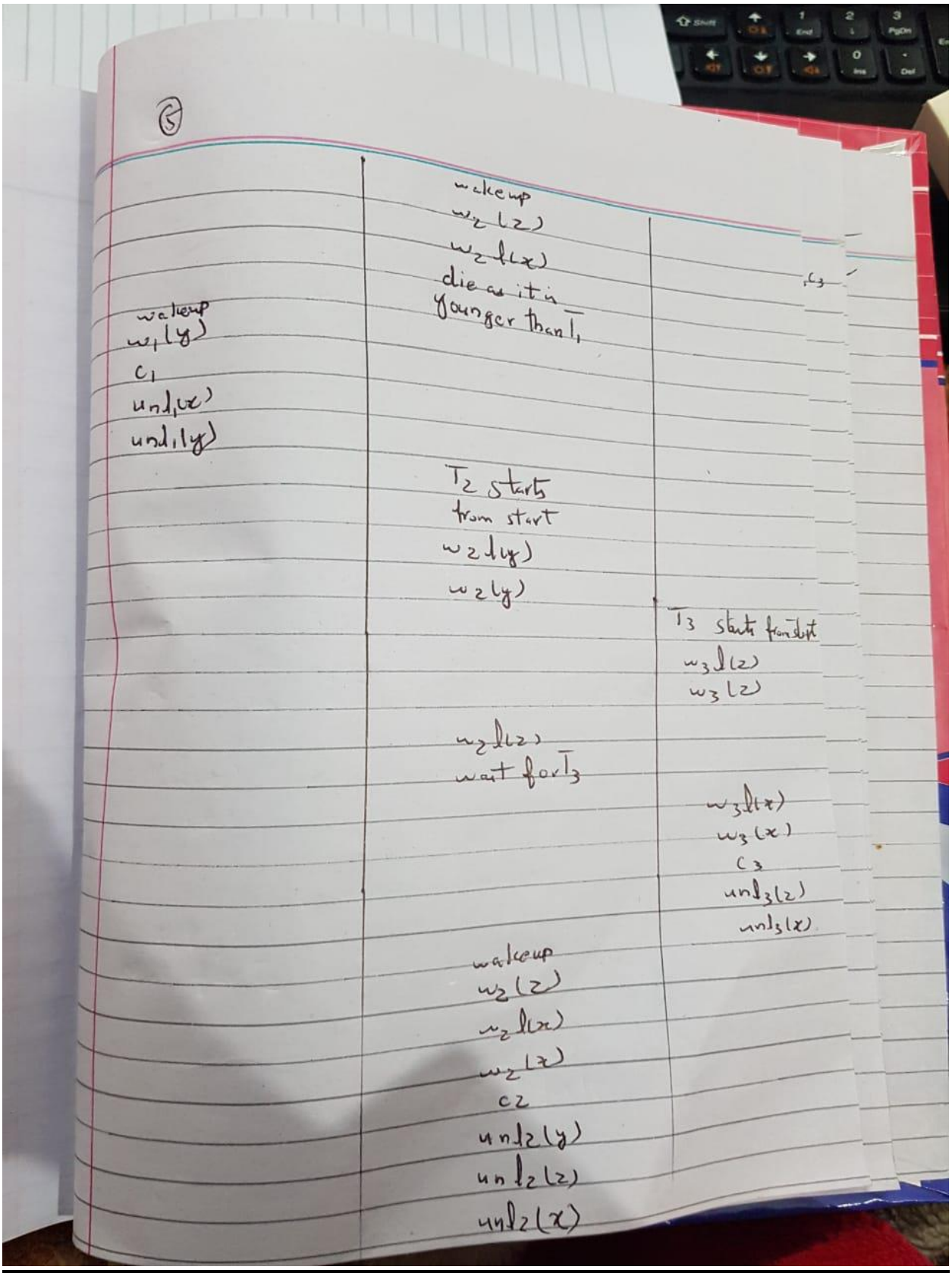
	$ul_2(x)$	
		T_3 starts
		$w_3l(z)$
		$w_3(z)$
		$w_3l(x)$
		$w_3(x)$
		c_3
		$ul_3(z)$
		$ul_3(x)$

Schedule 1

$r_1(x), w_2(y), w_1(y), w_3(z), c_1, w_2(z), w_2(x), c_2, w_3(x), c_3$

Rigorous 2PL with wait-die

$r_1l(x)$		
$r_1(x)$		
	$w_2l(y)$	
	$w_2(y)$	
$w_1l(y)$		
Wait for T_2		
		$w_3l(z)$
		$w_3(z)$
	$w_2l(z)$	
	wait for T_3	
		$w_3l(x)$
		die as it is younger than T_1


5
wakeup
w1(y)
c1
und1(x)
und1(y)
wakeup
w2(z)
w2(x)
die as it is younger than T1
T2 starts from start
w2(y)
w2(y)
w2(z)
wait for T3
wakeup
w2(z)
w2(x)
w2(z)
c2
und2(y)
und2(z)
und2(x)
T3 starts from start
w3(z)
w3(z)
w3(x)
w3(x)
c3
und3(z)
und3(x)

(b)

Schedule 1

$r_1(z), w_2(y), w_1(y), w_3(z), c_1, w_2(z), w_2(z), c_2, w_3(x), c_3$

Rigorous 2PL with Wound Wait

$r_1 l(z)$		
$r_1(z)$		
	$w_2 l(y)$	
	$w_2(y)$	
$w_1 l(y)$	⋮	
wound T_2	Aborted	
$w_1(y)$		
		$w_3 l(z)$
		$w_3(z)$
c_1		⋮
$unl_1(x)$		
$unl_1(y)$		
	T_2 starts	⋮
	$w_2 l(y)$	⋮
	$w_2(y)$	⋮
	$w_2 l(z)$	⋮
	wound T_3	Aborted
	$w_2(z)$	
	$w_2 l(x)$	
	$w_2(x)$	
	c_2	
	$unl_2(y)$	
	$unl_2(z)$	
	$unl_2(x)$	T_3 starts

(7)

		$w_3[z)$
		$w_3(z)$
		$w_3[x)$
		$w_3(x)$
		c_3
		$un[_3(z)$
		$un[_3(x)$

Schedule 1

$r_1(x), w_2(y), w_1[y), w_3(z), c_1, w_2(z), w_2(x), c_2, w_3(x), c_3$

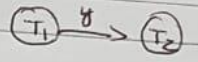
Rigorous 2PL with Deadlock Retection

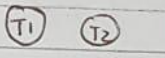
$r_1[z)$			T_1 T_2 T_3
$r_1(x)$			
	$w_2[y)$		
	$w_2(y)$		
$w_1[y)$			$T_1 \to T_2$ T_3
wait for T_2			
		$w_3[z)$	
		$w_3(z)$	
	$w_2[z)$		$T_1 \to T_2 \to T_3$
	wait for T_3		
		$w_3[x)$	
		wait for T_1	$T_1 \to T_2 \to T_3 \to T_1$

A cycle is formed

(8)

Select a victim
Abort T_3
Dropping edges





wakeup
$w_2(z)$
$w_2 l(x)$
$w_2(x)$
c_2
$ul_2(y)$
$ul_2(z)$
$ul_2(x)$

wakeup
$w_1(y)$
c_1
$ul_1(x)$
$ul_1(y)$

T_3 starts again
$w_3 l(z)$
$w_3(z)$
$w_3 l(x)$
$w_3(x)$
c_3
$ul_3(z)$
$ul_3(x)$

(9)

2) Time Stamp Ordering

Schedule 1

$r_1(x), w_2(y), w_1(y), w_3(z), c_1, w_2(z), w_2(x), c_2, w_3(x), c_3$

a. (Basic)

T_1	T_2	T_3	X		Y		Z	
			RTS	WTS	RTS	WTS	RTS	WTS
			{}	T_0	{}	T_0	{}	T_0
$r_1(x)$			$\{T_1\}$					
	$w_2(y)$					T_2		
$w_1(y)$								
Abort T_1								
as $WTS(y) > TS(T_1)$								
		$w_3(z)$						T_3
	$w_2(z)$							
	Abort T_2							
	as $WTS(z) > TS(T_2)$							
		$w_3(x)$		T_3				
		c_3		T_3		T_0		T_3

(10)

b. Strict TO

Schedule 1: $r_1(x), w_2(y), w_1(y), w_3(z), c_1, w_2(z), w_2(x), c_2, w_3(x), c_3$

T_1	T_2	T_3
$r_1(x)$		
	$w_2(y)$	
$w_1(y)$		
Abort		
as $TS(T_1) < WTS(y)$		
		$w_3(z)$
	$w_2(z)$	
	Abort	
	as	
	$TS(T_2) < WTS(z)$	
		$w_3(x)$
		c_3

X		Y		Z	
RTS	WTS	RTS	WTS	RTS	WTS
3	T_0	2	T_0	2	T_0
$\{T_1\}$			T_2		T_3
	T_3				
T_3		T_0		T_3	

c. Thomas Write Rule

Schedule: $r_1(z), w_2(y), w_1(y), w_3(z), c_1, w_2(z), w_2(z), c_2, w_3(x), c_3$

T_1	T_2	T_3
$r_1(z)$		
	$w_2(y)$	
$w_1(y)$ ignore this operation and continue		
		$w_3(z)$
c_1		
	$w_2(z)$ ignore this operation and continue	
	$w_2(z)$	
	c_2	
		$w_3(x)$
		c_3

X		Y		Z	
RTS	WTS	RTS	WTS	RTS	WTS
92	T_0	93	T_0	92	T_0
$\{T_1, 3$					
			T_2		
					T_3
			T_2		
		T_2		T_2	
		$T_2 T_3$			
		T_3		T_2	T_3

4)

Optimistic CCT

Schedule S_1: $r_1(x), w_2(y), w_1(y), w_3(z), c_1, w_2(z), w_2(x), c_2, w_3(x), c_3$

T_1	T_2	T
$r_1(x)$		
	$w_2(y)$	
$w_1(y)$		
		$w_3(z)$
c_1		
	$w_2(z)$	
	$w_2(x)$	
	c_2	
		$w_3(x)$
		c_3

For T_1

Backward Validation T_1 ReadSet $= \{x\}$, T_2 WriteSet $= \{y\}$

T_1 ReadSet $\cap$ Committed Transactions WriteSet

$\{x\} \cap \{\} = \{\}$

Forward Validation

T_1 WriteSet $\cap$ Active Transactions ReadSet

$\{y\} \cap \{\} = \{\}$

For T_2

T_2 ReadSet $= \{\}$, T_2 WriteSet $= \{x, y, z\}$

Backward Validation.

T_2 ReadSet $\cap$ Committed Transactions WriteSet

$\{\} \cap \{y\} = \{\}$

Forward Validation

T_2 Write Set	$\cap$	Active Transactions Read Set
$\{x, y, z\}$	$\cap$	$\{\}$ $= \{\}$

For T_3

T_3 Read Set $= \{\}$, T_3 Write Set $= \{z, x\}$

Backward Validation

T_3 Read Set	$\cap$	Committed Transactions Write Set
$\{\}$	$\cap$	$\{x, y, z\}$ $= \{\}$

Forward Validation

T_3 Write Set	$\cap$	Active Transactions Read Set
$\{x, z\}$	$\cap$	$\{\}$ $= \{\}$

So All transactions are validated
This Schedule will run correctly
with Optimistic CCT.