

Conflicts: $r_1(x) w_2(x)$ $w_1(x) r_2(x)$ $w_1(x) w_2(x)$

$S_1: r_1(x) r_2(y) w_2(y) w_1(x) r_2(x) w_2(x)$

$S_2: r_2(y) w_2(y) r_1(x) w_1(x) r_2(x) w_2(x)$

$S_3: r_2(y) w_2(y) r_1(x) r_2(x) w_2(x) w_1(x)$

S_1 & S_2 are conflict equivalent

S_1 & S_3 are not conflict equivalent

$$x = 100$$

$$r_1(x)$$

$$x = x + 10$$

$$w_1(x)$$

$$r_2(x)$$

$$x = x * 2$$

$$w_2(x)$$

$$r_1(x) \quad r_2(x) \quad w_1(x)$$

$$w_2(x)$$

$$\rightarrow 200$$

$$r_1(x) \quad r_2(x) \quad w_2(x)$$

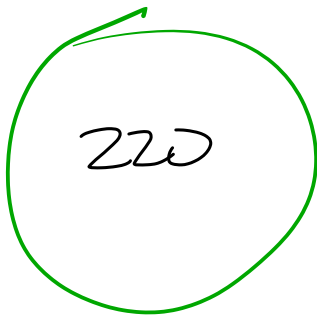
$$w_1(x)$$

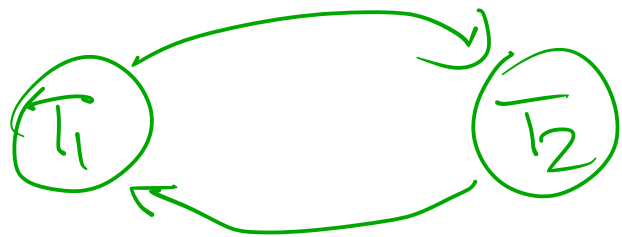
$$\rightarrow 110$$

$$r_2(x) \quad w_2(x) \quad r_1(x)$$

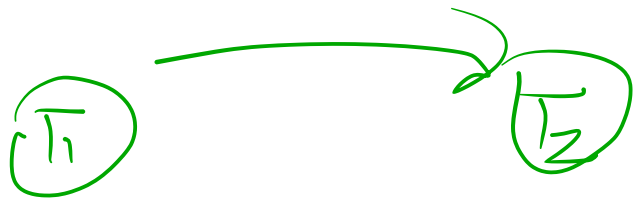
$$w_1(x)$$

$$\rightarrow 210$$

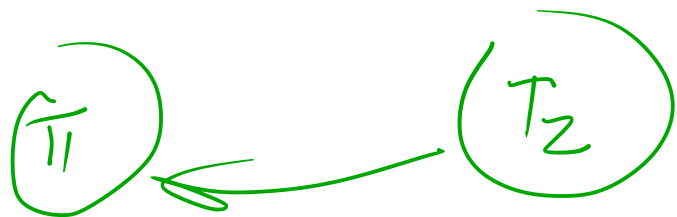




$$\tau_1(x) \quad \tau_2(x) \quad \omega_1(x) \quad \omega_2(x)$$



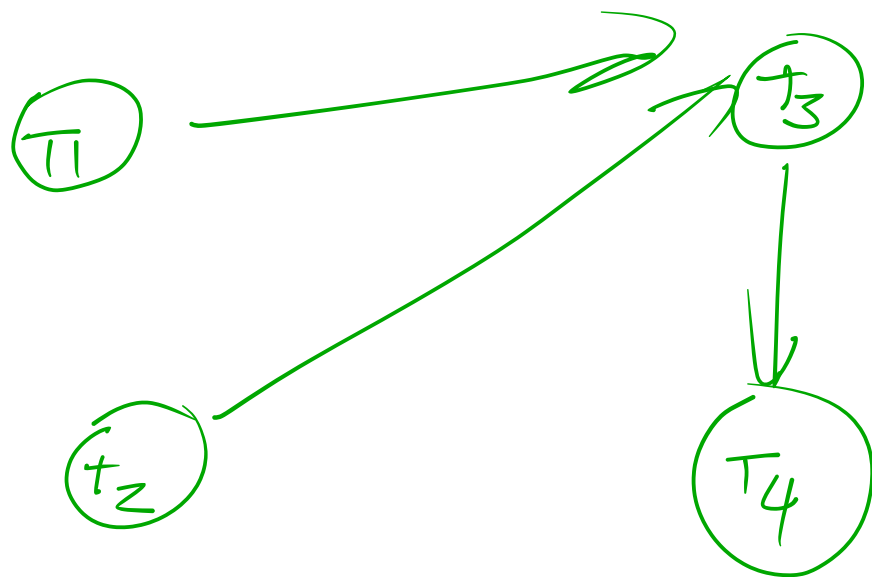
$$\tau_1(x) \quad \omega_1(x) \quad \tau_2(x) \quad \omega_2(x)$$



$$\tau_2(x) \quad \omega_2(x) \quad \tau_1(x) \quad \omega_1(x)$$

$r_1(x) \quad r_3(z) \quad w_3(z) \quad r_4(k) \quad r_2(y) \quad w_1(x) \quad w_2(y) \quad r_3(x) \quad r_3(y)$
 $r_4(z) \quad w_3(y) \quad r_3(k) \quad w_4(k)$

$w_3(z) \quad r_4(z)$
 $r_2(y) \quad w_3(y)$
 $w_1(x) \quad r_3(x)$
 $w_2(y) \quad r_3(y)$
 $w_2(y) \quad w_3(y)$
 $r_3(k) \quad w_4(k)$



No cycles, serializable!

$T_1 \quad T_2 \quad T_3 \quad T_4$
 $T_2 \quad T_1 \quad T_3 \quad T_4$

conflict
 equivalent
 serial schedules

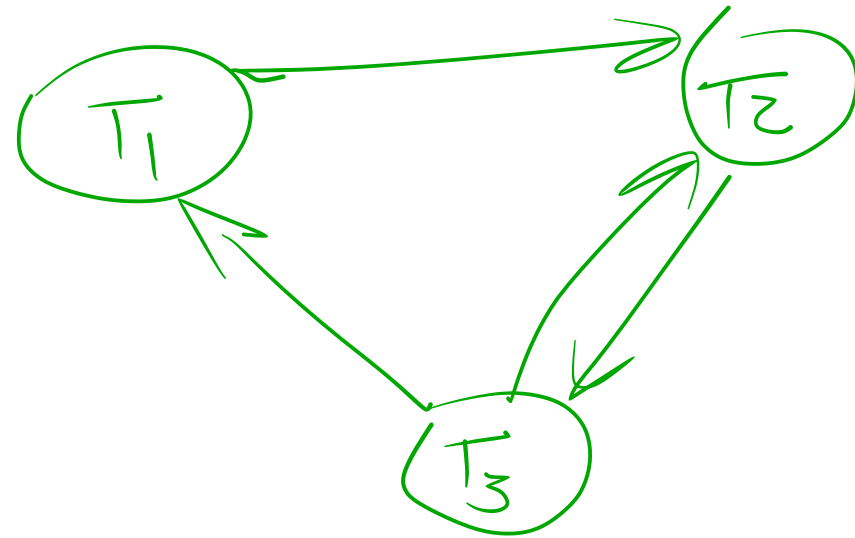
$r_1(x) \ r_3(x) \ w_3(z) \ r_4(k) \ r_2(y) \ w_1(z) \ w_2(y) \ r_3(x) \ r_3(y) \ w_2(x)$

$w_3(z) \ w_1(z)$

$w_2(y) \ r_3(y)$

$r_1(x) \ w_2(x)$

$r_3(x) \ w_2(x)$



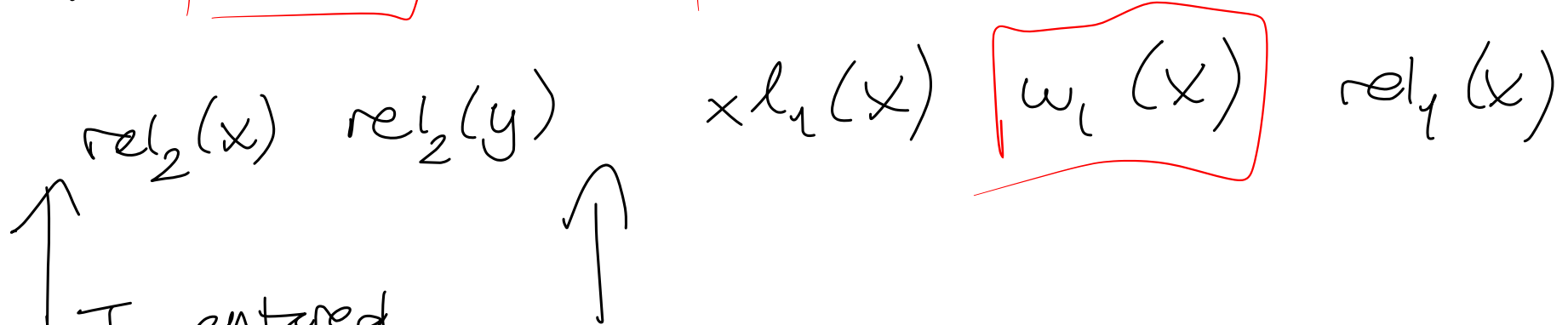
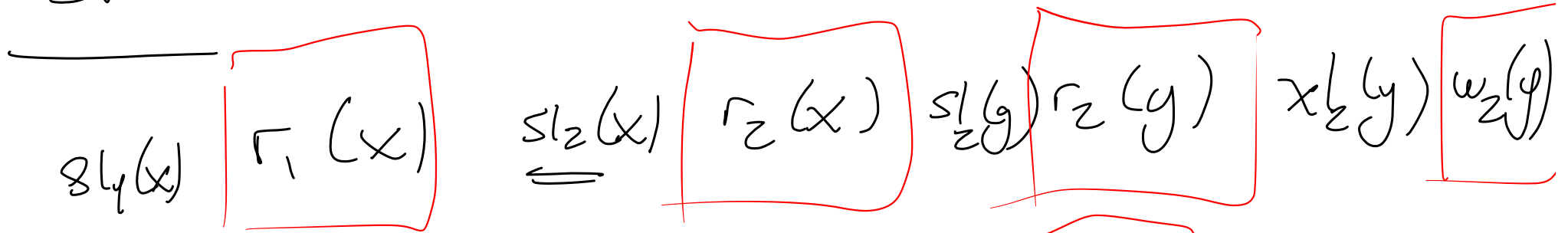
not serializable

Existing lock on an item

Requested Lock

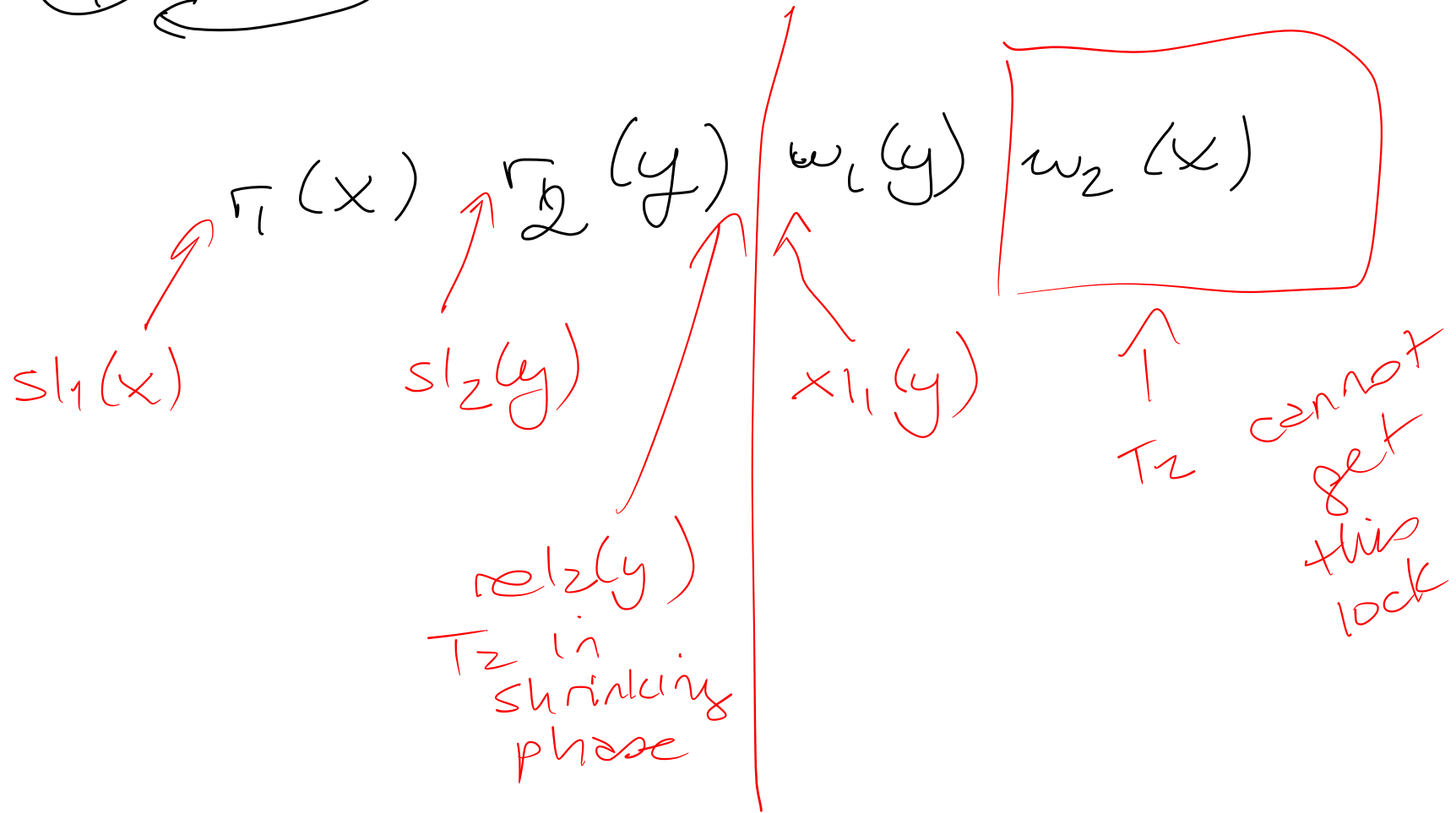
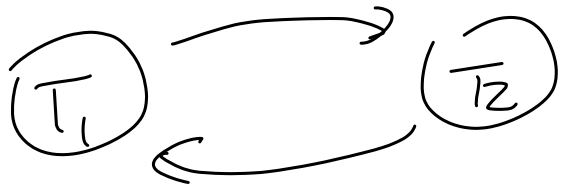
	No lock	S	X
S	✓	✓	✗
X	✓	✗	✗

ZPL



\rightarrow $r_1(x)$ $r_2(x)$ $r_2(y)$ $w_2(y)$ $w_1(x)$
 Possible schedule under ZPL

2PL guarantees serializability!



2PL guarantees serializability!

