Schedules: lists of operations

- operations can be interleaved
- ops from same transaction must be in same order in sched. as transaction

$r_i(X)$: transaction i reads item X
$w_i(X)$: " " writes " "
c_i : " " commits
a_i : " " aborts

Withdraw: $T_1 : r_1(x)\ w_1(x)\ c_1$

Transfer: $T_2 : r_2(Y)\ w_2(Y)\ r_2(X)\ w_2(X)\ c_2$

$S_a : r_2(Y)\ w_2(Y)\ r_1(X)\ w_1(X)\ r_2(X)\ w_2(X)$ $c_1 c_2$

$S_b : r_2(Y)\ w_2(Y)\ r_1(X)\ r_2(X)\ w_1(X)\ w_2(X)$ $c_1 c_2$

T_1: x = ~~500~~ 400
T_2: x = ~~500~~ 650

X: ~~500~~ ~~400~~ 650

correct

X: ~~500~~ ~~400~~ 550

T_1: withdraw 100
T_2: trans. 150

Conflicting operations

Two ops conflict

1. the ops are in different transactions
2. they access the same item X.
3. at least 1 op is a write

Schedule is recoverable

if no transaction T commits until all transactions T' that write some value that T later reads have committed.

T' .... $w_{T'}(x)$ ...

T . . .. $r_T(x)$

S: $w_{T'}(x)$ .... $r_T(x)$ c_T $a_{T'}$

S: ... $w_{T'}(x)$ .... $r_T(x)$ ~~c_T~~ ~~c_T~~

$a_{T'}$

cascade rollback

rollback T' causes rollback T

cascade less

- every transaction reads only items from transactions that have committed.