**Application**: TPC-C

**Txn**: do\_new\_order

**Inv**: O\_OL\_CNT = [the number of rows in the ORDER-LINE table for the corresponding order]

**Similar Invariants**: sum(O\_OL\_CNT) = [number of rows in the ORDER-LINE table for this district]

**Inv Type**: ???

**Contract (Initial):**

No contract.

**Counter Example (if SAT)**:

Order\_Add effect of current txn visible to invariant’s Order\_Get but

Orderline\_Add effect of current txn not visible to invariant’s Orderline\_Get.

**Contract**:

f12 a b c d =

[oper(a)=oadd ^ oper(b)=oladd ^ oper(c)=oget ^ oper(d)=olget ^

so(a,b) ^ so(c,d) ^ sameobj(a,c) ^ sameobj(b,d)]

=>

[vis(b,d) ^ vis(a,c)] v [¬vis(b,d) ^ ¬vis(a,c)]

**Counter Example (if SAT)**:

Concurrent Order\_Add effect with same order id, warehouse id and district id visible to invariant.

**Contract**:

f12' a b =

[o\_id(a)=o\_id(b) ^ o\_d\_id(a)=o\_d\_id(b) ^ o\_w\_id(a)=o\_w\_id(b)]

=>

a=b

**Counter Example (if SAT)**:

UNSAT

**Application**: TPC-C

**Txn**: do\_new\_order

**Inv**: D\_NEXT\_O\_ID - 1 = max(O\_ID)

**Similar Invariants**: max(O\_ID) = max(NO\_O\_ID),

D\_NEXT\_O\_ID – 1= max(NO\_O\_ID)

**Inv Type**: ???

**Contract (Initial):**

No contract.

**Counter Example (if SAT)**:

District\_IncNextOid effect of current txn visible to invariant’s District\_Get but Order\_Add effect of current txn not visible to invariant’s Order\_Get.

**Contract**:

f11 a b c d =

[oper(a)= dincnoid ^ oper(b)=oadd ^ oper(c)=dget ^ oper(d)=oget ^

so(a,b) ^ so(c,d) ^ sameobj(a,c) ^ sameobj(b,d)]

=>

[vis(b,d) ^ vis(a,c)] v [¬vis(b,d) ^ ¬vis(a,c)]

**Counter Example (if SAT)**:

Concurrent District\_IncNextOid visible to invariant but not to current txn

**Contract:**

f11' a b =

[oper(a)=dincnoid ^ oper(b)=dget ^ currtxn(b) ^ sameobj(a,b)]

=>

sametxn(a,b) v vis(a,b)

**Counter Example (if SAT)**:

Concurrent District\_IncNextOid visible to current txn but not to invariant.

**Contract (Corrected Version of previous contract):**

f11' a b =

[oper(a)=dincnoid ^ oper(b)=dget ^ sameobj(a,b)]

=>

sametxn(a,b) v vis(a,b)

**Counter Example (if SAT)**:

UNSAT

**Application**: TPC-C

**Txn**: do\_payment

**Inv**: W\_YTD = sum(H\_AMOUNT)

**Similar Invariants:** D\_YTD = sum(H\_AMOUNT), W\_YTD = sum(D\_YTD)

**Inv Type**: ???

**Contract (Initial):**

No contract

**Counter Example (if SAT)**:

Current txn’s History\_Append effect is visible to invariant’s History\_Get but Current txn’s Warehouse\_AddYtd is not visible to invariant’s Warehouse\_Get.

**Contract:**

f23 a b c d =

[oper(a)=waddytd ^ oper(b)=hadd ^ oper(c)=wget ^ oper(d)=hget ^

so(a,b) ^ so(c,d) ^ sameobj(a,c) ^ sameobj(b,d)]

=>

[vis(b,d) ^ vis(a,c)] v [¬vis(b,d) ^ ¬vis(a,c)]

**Counter Example (if SAT)**: UNSAT

**Application**: TPC-C

**Txn**: combination of do\_payment & do\_delivery

**Inv**: C\_BALANCE = sum(OL\_AMOUNT) - sum(H\_AMOUNT)

**Inv Type**: ???

**Contract (Initial):**

No contract

**Counter Example (if SAT)**:

History\_Append of current txn is visible to History\_Get of invariant but the corresponding effects on Customer table is not visible to invariant.

**Contract:**

f31 a b c d =

[oper(a)=caddbal ^ oper(b)=hadd ^ oper(c)=cget ^ oper(d)=hget ^

so(a,b) ^ so(c,d) ^ sameobj(a,c) ^ sameobj(b,d)]

=>

[vis(b,d) ^ vis(a,c)] v [¬vis(b,d) ^ ¬vis(a,c)]

**Counter Example (if SAT)**