———— MODULE *Blockchain* ————

EXTENDS *Integers, Sequences, TLC, Naturals*

CONSTANTS *Customers*
VARIABLES *ledger, contractStates, actions*
$EventTypesStrings \triangleq \{$ "anomaly", "pauseBilling" $\}$
$States \triangleq \{$ "ready", "actioned" $\}$

$Init \triangleq$
$\quad \wedge ledger = \langle \rangle$
$\quad \wedge contractStates = [c \in Customers \mapsto$ "ready" $]$
$\quad \wedge actions = \langle \rangle$

$RecordAnomaly(customer, eventTypeStr) \triangleq$
$\quad \wedge eventTypeStr =$ "anomaly"
$\quad \wedge ledger' = Append(ledger, [type \mapsto eventTypeStr, customerId \mapsto customer])$
$\quad \wedge$ UNCHANGED $\langle contractStates, actions \rangle$

$TriggerContract \triangleq$
$\quad \exists i \in 1 .. Len(ledger) :$
$\quad\quad \wedge ledger[i].type =$ "anomaly"
$\quad\quad \wedge contractStates' = [contractStates$ EXCEPT $![ledger[i].customerId] =$ "actioned" $]$
$\quad\quad \wedge actions' = Append(actions, [type \mapsto$ "pauseBilling", $customerId \mapsto ledger[i].customerId])$
$\quad\quad \wedge ledger' = ledger$

$Next \triangleq$
$\quad (\exists c \in Customers, etStr \in EventTypesStrings : RecordAnomaly(c, etStr))$
$\quad \vee TriggerContract$

$vars \triangleq \langle ledger, contractStates, actions \rangle$
$Spec \triangleq Init \wedge \Box[Next]_{vars}$

Properties
$LedgerImmutability \triangleq \forall i \in 1 .. Len(ledger) :$
$\quad\quad\quad\quad\quad\quad\quad\quad \forall j \in i .. Len(ledger) : ledger[i] = ledger[j]$

$ContractStateInvariant \triangleq \forall c \in Customers : contractStates[c] =$ "actioned"
$\quad\quad\quad\quad\quad\quad\quad\quad\quad \Rightarrow \exists i \in 1 .. Len(ledger) :$
$\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad ledger[i].customerId = c \wedge ledger[i].type =$ "anomaly"

$TypeOK \triangleq$
$\quad \wedge ledger \in Seq([type : \{$ "ready", "actioned" $\}, customerId : Customers])$
$\quad \wedge contractStates \in [Customers \rightarrow States]$
$\quad \wedge actions \in Seq([type : \{$ "ready", "actioned" $\}, customerId : Customers])$

$INVARIANTS \triangleq$
$\quad TypeOK \wedge LedgerImmutability \wedge ContractStateInvariant$

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(* Renamed to avoid clash, parameterized *)

    (* Action is only enabled if *eventTypeStr* is "anomaly" and leads to a state change. *)

    (* Otherwise, this specific action instance is disabled. *)