Question Name

intro text for the question

1 Ideal Statements

paragraph or list describing the ideal input statements

1.1 statement parameters to utilize

- first param
- second param
- third param

2 TLA Statement problems

paragraph talking about known data issues within current TLA implementation

3 Algorithm

3.1 Summary

1. step 1
2. step 2
3. step 3

3.2 Symbol Definition

Symbol definitions with example values

```
f(x) = x^2
g(x) = \frac{1}{x}
F(x) = \int^a_b \frac{1}{3}x^3
```

3.3 Z Specifications

Outline of Z, includes templates and an example of a system used to check staff members in and out of a building

3.3.1 xAPI Statement(s) Schema

[Statement] [Actor] [Verb] [Object] [Result] [Context] [Timestamp]

$$
\begin{array}{|l}
\hline
Statement \\
\hline
s : Statement \\
\hline
s = \{Actor, Verb, Object, Timestamp\} \lor \\
\quad \{Actor, Verb, Object, Timestamp, Context\} \lor \\
\quad \{Actor, Verb, Object, Timestamp, Result\} \lor \\
\quad \{Actor, Verb, Object, Timestamp, Result, Context\} \\
\hline
\end{array}
$$

- The variable s is of type Statement and consists of an Actor, Verb, Object, Timestamp and optionally Context and Result

$$
\begin{array}{|l}
\hline
Statements \\
\hline
S : Statements \\
\hline
S = \{ s : Statement \mid S \neg \emptyset \} \\
\hline
\end{array}
$$

- The variable S is of type Statements and is a set of objects s, each of type Statement
- The variable S is a non empty set

3.3.2 Introduce Basic Types

Template [Name of variable(s) of type set]

Example [X]

3.3.3 Example Schema

Basic unit of specification, defines state variables, system state, operations, etc.

Template

$$
\begin{array}{|l}
\hline
SchemaName \\
\hline
VariableDeclarations \\
\hline
Predicate/Invariants \\
\hline
\end{array}
$$

Example

$$
\begin{array}{|l}
\hline
Counter \\
\hline
ctx : \mathbb{N} \\
\hline
0 \leq ctr \leq max \\
\hline
\end{array}
$$

Variables

$Counter$

$ctx : \mathbb{N}$

- the variable ctx is a natural number

Predicates

$Counter$

$0 \leq ctr \leq max$

- ctr is greater than or equal to 0
- ctr is less than or equal to max

3.3.4 Initialisation

The starting conditions

Template

$Init[VarName]$

$NameOfExistingSchema$

$InitStateOfVarsWithinRefSchema$

Example

$InitCounter$

$Counter$

$ctr = 0$

- the value of the counter starts at 0

3.3.5 Operations

an operation is specified in Z with a predicate relating the state before and after the invocation of that operation

Template

$$
\begin{array}{|l}
\hline
\textit{OperationName} \\
\Delta SchemaName \\
inputParam? : SomeType \\
outputParam! : SomeType \\
\hline
InvariantPredicate \\
NewValForVar' = OperationOnInput/OutputParams \\
\hline
\end{array}
$$

Example

$$
\begin{array}{|l}
\hline
\textit{Increment} \\
\Delta Counter \\
\hline
ctr < max \\
ctr' = crt + 1 \\
\hline
\end{array}
$$

- There is an implicit conjunction (logical-and) between successive lines of the predicate

$$
\begin{array}{|l}
\hline
\textit{Decrement} \\
\Delta Counter \\
d? : \mathbb{N} \\
\hline
ctr \geq d? \\
ctr' = ctr - d? \\
\hline
\end{array}
$$

- input params suffixed with ?

$$
\begin{array}{|l}
\hline
\textit{Display} \\
\Xi Counter \\
c! : \mathbb{N} \\
\hline
c! = ctr \\
\hline
\end{array}
$$

- output params suffixed with !
- the greek symbol means that the operation cannot change the state of Counter

3.4 Pseudocode

Algorithm 1: How to write algorithms

Input: this text
Result: how to write algorithm with LaTeX2e
initialization;
while *not at end of this document* **do**
    read current;
    if *understand* **then**
        go to next section;
        current section becomes this one;
    else
        go back to the beginning of current section;
    end
end

3.5 Result JSON Schema

3.6 Visualization Description

description of the associated visualization in english

3.7 VEGA example

This section will be updated to include a VEGA JSON blob for prototype viz