# 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 Introduce Basic Types

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

**Example** [X]

### 3.3.2 Example Schema

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

**Template**

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

**Example**

$$
\begin{array}{|l}
\hline
\_Counter _____ \\
ctx : \mathbb{N} \\
\hline
0 \le ctr \le max \\
\hline
\end{array}
$$

**Variables**

$$
\begin{array}{|l}
\hline
\_Counter _____ \\
ctx : \mathbb{N} \\
\hline
\\
\hline
\end{array}
$$

- the variable ctx is a natural number

**Predicates**

$$
\begin{array}{|l}
\hline
\_Counter _____ \\
\hline
0 \le ctr \le max \\
\hline
\end{array}
$$

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

### 3.3.3 Initialisation

The starting conditions

**Template**

$$
\begin{array}{|l}
\hline
\_Init[VarName] _____ \\
\ NameOfExistingSchema \\
\hline
\ InitStateOfVarsWithinRefSchema \\
\hline
\end{array}
$$

**Example**

$$
\begin{array}{|l}
\hline
\_InitCounter _____ \\
\ Counter \\
\hline
\ ctr = 0 \\
\hline
\end{array}
$$

- the value of the counter starts at 0

### 3.3.4  Operations

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

**Template**

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

**Example**

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

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

$$\begin{array}{l}
\underline{\quad Decrement \quad\rule{0pt}{0pt}} \\
\Delta Counter \\
d? : \mathbb{N} \\
\hline
ctr \geq d? \\
ctr' = ctr - d? \\
\end{array}$$

- input params suffixed with ?

$$\begin{array}{l}
\underline{\quad Display \quad\rule{0pt}{0pt}} \\
\Xi Counter \\
c! : \mathbb{N} \\
\hline
c! = ctr \\
\end{array}$$

- 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