We declare the types of $DECLARATION$ to store all declarations. We also need to declare the types $EXPRESSION$ and $DEFINITION$ which will go into the schemaText.

We say that a schemaText is made up of many $LINES$

$$[DECLARATION, EXPRESSION, DEFINITION, LINES]$$

We need a type to contain terms and sets. We will call this $VARS$.

$$[VARS]$$

ZcgaState

$$declarations : VARS \leftrightarrow EXPRESSION$$
$$expressions : \mathbb{P}\, LINES$$
$$definitions : \mathbb{P}\, LINES$$
$$definedConstants : \mathbb{P}\, VARS$$
$$TermDeclaration : VARS \leftrightarrow EXPRESSION$$
$$SetDeclaration : VARS \leftrightarrow EXPRESSION$$
$$terms : \mathbb{P}\, VARS$$
$$sets : \mathbb{P}\, VARS$$
$$dvar : \mathbb{P}\, VARS$$

$$TermDeclaration \subseteq declarations$$
$$SetDeclaration \subseteq declarations$$
$$dvar \subset sets \cup terms$$
$$sets \cap terms = \{\}$$

InitZcgaState

$$ZcgaState'$$

$$declarations' = \{\}$$
$$expressions' = \{\}$$
$$definitions' = \{\}$$
$$definedConstants' = \{\}$$
$$TermDeclaration' = \{\}$$
$$SetDeclaration' = \{\}$$
$$terms' = \{\}$$
$$sets' = \{\}$$
$$dvar' = \{\}$$

CorrectTermDeclaration

$\Delta ZcgaState$
$dvarExpression : EXPRESSION$
$var : VARS$

$var \notin dvar$
$TermDeclaration' = TermDeclaration \cup \{var \mapsto dvarExpression\}$
$terms' = terms \cup \{var\}$
$dvar' = dvar \cup \{var\}$

CorrectSetDeclaration

$\Delta ZcgaState$
$dvarExpression : EXPRESSION$
$var : VARS$

$var \notin dvar$
$SetDeclaration' = SetDeclaration \cup \{var \mapsto dvarExpression\}$
$sets' = sets \cup \{var\}$
$dvar' = dvar \cup \{var\}$

This schema desribe constants giving terms for example $\#S$ takes set S and gives the cardinality of S which is a term.

CorrectConstantTerm

$\Delta ZcgaState$
$constant : \mathbb{P}\, VARS \nrightarrow VARS$
$parameters : \mathbb{P}\, VARS$
$newTerm : VARS$

$parameters \subseteq sets \cup terms$
$parameters \neq \{\}$
$newTerm = constant\ parameters$
$terms' = terms \cup \{newTerm\}$

This schema describes constants giving sets, for example $S \cup T$ gives a set with elements from S and elements of T.

CorrectConstantSet

$\Delta ZcgaState$
$setconstant : \mathbb{P}\, VARS \nrightarrow VARS$
$setparameters : \mathbb{P}\, VARS$
$newset : VARS$

$setparameters \subseteq sets \cup terms$
$setparameters \neq \{\}$
$newset = constant\ parameters$
$sets' = sets \cup \{newset\}$

CorrectExpression

$\Delta ZcgaState$

$expressConstant : \mathbb{P}\ VARS \pfun EXPRESSION$

$expressParameters : \mathbb{P}\ VARS$

$newExpression : EXPRESSION$

$expressParameters \subseteq sets \cup terms$

$expressParameters \neq \{\}$

$newExpression = expressConstant\ expressParameters$

$expressions' = expressions \cup \{newExpression\}$

CorrectDefinitions

$\Delta ZcgaState$

$definedSet : \mathbb{P}\ VARS \pfun VARS$

$newdefinition : \mathbb{P}\ VARS \pfun LINES$

$parameters : \mathbb{P}\ VARS$

$newConstant : VARS$

$newConstant \notin sets$

$parameters \subseteq sets \cup terms$

$newConstant = definedSet\ parameters$

$definedConstants' = definedConstants \cup \{newConstant\}$

$sets' = sets \cup \{newConstant\}$

$definitions' = definitions \cup \{newdefinition\ parameters\}$

CorrectSchemaText

$\Xi ZcgaState$

$schemaText : \mathbb{P}\ LINES$

$schemaText = \{\} \lor$

$schemaText = definitions \cup expressions$