Zed Block Examples

Example 1 : Basic Variable Declarations

Use axdef for variable declarations with types:

$$[Person, Department]$$

$$assignment : Person \pfun Department$$
$$employees : \mathbb{F}\ Person$$
$$departments : \mathbb{F}\ Department$$

This groups related variable declarations in a single block (given types must be declared outside).

Example 2 : Abbreviations

$$N\_PLUS == \{ n : \mathbb{N} \mid n > 0 \}$$
$$N\_EVEN == \{ n : \mathbb{N} \mid n \bmod 2 = 0 \}$$
$$N\_ODD == \{ n : \mathbb{N} \mid n \bmod 2 = 1 \}$$

Abbreviations can be defined standalone (zed blocks for abbreviations may not be fully supported yet).

Example 3 : Type Parameters

$$[Company]$$

Declare given types using the given keyword.

Example 4 : Predicates elem Zed Block

$$x : \mathbb{N}$$
$$y : \mathbb{N}$$

$$x > 0$$
$$y > 0$$
$$x + y < 100$$

Multiple predicates can constrain variables defined in axdef.

Example 5 : Free Type Definitions

$$Color ::= red \mid green \mid blue$$
$$Size ::= small \mid medium \mid large$$

Product

$$color : Color$$
$$size : Size$$
$$price : \mathbb{N}$$

$$price > 0$$

Free types are defined standalone, then used in schemas.

Example 6 : Multiple Schemas

$[AccountZB, BalanceZB]$

BankAccountZB

$$accountNumber : \mathbb{N}$$
$$balance : \mathbb{Z}$$
$$balance \geq 0$$

TransactionZB

$$from : BankAccountZB$$
$$to : BankAccountZB$$
$$amount : \mathbb{N}$$
$$amount > 0$$
$$from.balance \geq amount$$

Multiple schemas can be defined separately, each with their own constraints.

Example 7 : Schema with External Variables

$[Student, Course]$

$$enrolled : Student \leftrightarrow Course$$
$$maxCourses : \mathbb{N}$$
$$maxStudents : \mathbb{N}$$
$$maxCourses = 7$$
$$maxStudents = 500$$

Enrollment

$$students : \mathbb{F}\ Student$$
$$courses : \mathbb{F}\ Course$$
$$students = \mathrm{dom}\ enrolled$$
$$courses = \mathrm{ran}\ enrolled$$
$$\#students \leq maxStudents$$
$$\#courses \leq maxCourses$$

Schemas can reference variables defined in axdef blocks.

Example 8 : Nested Schemas

$[Char]$

Address

$$street : \mathrm{seq}\ Char$$
$$city : \mathrm{seq}\ Char$$
$$zipCode : \mathbb{N}$$
$$zipCode \geq 10000 \land zipCode \leq 99999$$

PersonData

$$
\begin{array}{|l}
name : \text{seq } Char \\
address : Address \\
age : \mathbb{N} \\
\hline
age \geq 0 \land age \leq 150
\end{array}
$$

$$
\begin{array}{|l}
population : \mathbb{F}\ PersonData
\end{array}
$$

Schema Address is used within schema PersonData. Variables using schemas go in axdef.

Example 9 : Constants land Functions

$PI == 3$

$E == 2$

$$
\begin{array}{|l}
circumference : \mathbb{N} \longrightarrow \mathbb{N} \\
area : \mathbb{N} \longrightarrow \mathbb{N} \\
\hline
\forall\, r : \mathbb{N} \bullet circumference(r) = 2 * PI * r \\
\forall\, r : \mathbb{N} \bullet area(r) = PI * r * r
\end{array}
$$

Mathematical constants defined as abbreviations, functions in axdef.

Example 10 : Permission System Example

$[UserID, DocumentID]$

$PermissionType ::= read \mid write \mid admin$

User

$$
\begin{array}{|l}
userId : UserID \\
documents : \mathbb{P}\ DocumentID \\
permissions : DocumentID \pfun PermissionType \\
\hline
\text{dom } permissions \subseteq documents
\end{array}
$$

System

$$
\begin{array}{|l}
users : UserID \pfun User \\
allDocuments : \mathbb{F}\ DocumentID \\
\hline
allDocuments = \bigcup \{\, u : \text{ran } users \bullet u.documents \,\}
\end{array}
$$

$$
\begin{array}{|l}
users : UserID \pfun User
\end{array}
$$

A permission system specification using free types and schemas.

Example 11 : Best Practices

Use zed blocks for:

1. Type parameter declarations [X, Y]

2. Abbreviations (N_PLUS, N_EVEN, etc.)

3. Simple predicates without variable declarations

Use axdef for:

1. Variable declarations with types

2. Constraints on those variables

3. Function definitions

Use schema for:

1. State spaces with declarations

2. Operations on state

3. Reusable component specifications