

# The Cedilleum Language Specification

## Syntax, Typing, Reduction, and Elaboration

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## 1 Syntax

$id$	identifiers for definitions
$u$	term variables
$X$	type variables
$k$	kind variables
$x ::= id \mid u \mid X \mid k$	any variable

Figure 1: Identifiers

$uterm s ::= u$
$\lambda u. uterm$
$uterm uterm$

Figure 2: Untyped terms

<i>mod</i>	::=	<b>module</b> <i>id</i> . <i>imprt</i> * <i>cmd</i> *	module declarations
<i>imprt</i>	::=	<b>import</b> <i>id</i> .	module imports
<i>cmd</i>	::=	<i>defTermOrType</i> <i>defDataType</i> <i>defKind</i>	definitions
<i>defTermOrType</i>	::=	<i>id</i> <i>chkType</i> ? = <i>term</i> . <i>id</i> $\triangleleft$ <i>kind</i> = <i>type</i> .	term and type definitions
<i>defDataType</i>	::=	<b>data</b> <i>id</i> <i>param</i> * : <i>kind</i> = <i>constr</i> * .	datatype definitions
<i>defKind</i>	::=	<i>k</i> <i>params</i> * = <i>kind</i>	
<i>checkType</i>	::=	$\triangleleft$ <i>type</i>	annotation for term definition
<i>param</i>	::=	( <i>x</i> : <i>typeOrKind</i> )	
<i>typeOrKind</i>	::=	<i>type</i> <i>kind</i>	
<i>constr</i>	::=	<i>id</i> : <i>type</i>	

Figure 3: Modules and definitions

<i>kind</i>	::=	$\star$ $\Pi x : \text{typeOrKind} . \text{kind}$ $\text{kind} \rightarrow \text{kind}$ $\text{type} \rightarrow \text{kind}$ <i>k term</i> <i>k</i> $\cdot$ <i>type</i>	
<i>type</i>	::=	<i>X</i> $\Pi x : \text{typeOrKind} . \text{type}$ $\forall x : \text{typeOrKind} . \text{type}$ $\lambda x : \text{typeOrKind} . \text{type}$ $\text{type} \rightarrow \text{type}$ $\text{type} \Rightarrow \text{type}$ $\{ \text{uterm} \simeq \text{uterm} \}$	explicit product implicit product normal arrow type arrow with erased domain untyped equality

Figure 4: Kinds and types

$term$	$::=$	$x$	
		$\Lambda x\ class^? . term$	
		$\lambda x\ class^? . term$	
		$[ defTermOrType ] - term$	let
		$term\ term$	normal application
		$term - term$	application to erased argument
		$term \cdot type$	application to type
		$\beta < term > \{ term \}$	reflexivity of equality
		$\varsigma term$	symmetry of equality
		$\rho term\ guide^? - term$	
		$\delta type^? - term$	ex falso quodlibet
		$\phi term - term \{ term \}$	
$class$	$::=$	$: typeOrKind$	
$guide$	$::=$	$@ x. type$	

Figure 5: Annotated Terms