The Official
Medaware Anterogradia™
Language Reference

For ANTG v1.1.1

by Haas, Clarissa
Patak, Rastislav
Sam, Elias
Wyrwas, Piotr

Contents

1 Standard Library Functions

v1.0.0 **about**

It is mandatory for all Anterogradia libraries to implement an *about* function. The standard library is no exception to this rule. The standard implementation provides basic information about the lib at hand.

```
about ()
```

v1.0.0 **sequence**

The **variadic** *sequence* function evaluates every parameter expression and returns a string made up of all individual results.

```
sequence {
    "Hello, "
    "World!"
}
    => "Hello, World!"
```

v1.0.0 **progn**

Just like in Common Lisp, the **variadic** *progn* function evaluates all parameters in sequence and returns the last value.

```
progn {
    "Hello, "
    "World!"
}
    => "World!"
```

v1.0.0 **nothing**

Returns an empty string (a string with length 0).

```
nothing ()
    => ""
```

v1.0.0 **repeat**

Repeats the expression *str* for *count* times, each iteration separated by an optional *separator*, otherwise unseparated.

```
repeat (count = 3, str = "Hello")
    => "HelloHelloHello"

repeat (count = 3, str = "Hello",
        separator = " ")
    => "Hello Hello Hello"
```

v1.0.0 **random**

The **variadic** function *repeat* randomly evaluates a single expression.

```
random {
    "Foo"
    "Bar"
    "Baz"
}
    (1) => "Bar"
    (2) => "Baz"
    (2) => "Baz"
    (3) => "Bar"
    (4) => "Foo"
    ...
```

v1.0.0 **_if**

The *_if* function implements conditional control flow. If *cond* is `"true"`, the *then* expression will be evaluated and returned as the result of the function. Otherwise, the function evaluates and returns the *else* expression.

```
_if (cond = 1 > 2,
     then = "1 is bigger than 2!",
     else = "Math still works!")

    => "Math still works!"
```

v1.0.0 **equal**

The *equal* function compares the expressions *left* and *right*. If both have the same value, the function returns `"true"`, otherwise it returns `"false"`

```
equal (left = "123", right = "321")
    => "false"
```

v1.0.0 **param**

Anterogradia may be started with custom startup parameters from within the Kotlin API. This function is used to retrieve said parameters, with *key* being the key of a given startup parameter entry.

```
param (key = "binaryPath")
```

v1.0.0 **set**

This function together with *get* implement the backbone of Anterogradia's memory features. This function creates or modifies a variable identified by a *key* with a given *value*. This function always returns an empty string.

```
set (key = "message", value = "Hello, World!")
    => ""
```

v1.0.0 **get**

The *get* function retrieves a variable *key* and returns the value.

```
get (key = "message")
    => "Hello, World!"
```

v1.0.0 **compile**

Thsi function is used to dynamically invoke the Anterogradia interpreter while re-using the current runtime object. Thus, all libraries, functions and variables present in the host script are going to be usable in the code passed to the *source* parameter.

```
progn {
    set (key = "msg", value = "Hi!")
    compile (
        source = "&`msg"
    )
}
    => "Hi!"
```

v1.0.0 **lgt**

The *lgt* function compares the expressions *left* and *right* and returns `"true"` if the former is greater than the latter; otherwise `"false"` Depending on the value of both expressions, the comparison will either be numeric or lexicographic.

```
lgt (left = "123", right = "321")
    => "false"
```

v1.0.0 **rgt**

Same as *lgt*, but `(right > left) ? "true" : "false"`

```
rgt (left = "123", right = "321")
    => "true"
```

v1.0.0 **len**

Returns the length of the *expr* string.

```
len (expr = "Hello!")
    => "6"
```

v1.0.0 **astd**

Generates valid Anterogradia source code from the parser result of the passed *expr*.

```
astd (expr = get(key = "abc"))
    => "get(key="abc")"
```

v1.0.0 **_fun**

This function stores the *expr* expression as *id*. It is worth mentioning that, unlike variables, what gets stored is not the result of evaluating the given expression, but rather the AST nodes making up said expression. Thus, evaluating such stored expressions **might** yield different values on each iteration.

```
_fun (id = "greet", expr = &`abc)
```

v1.0.0 **_eval**

The **_eval** function is closely related with the **_fun** function. Its purpose is to retrieve the expression *id* stored via the former function and evaluate it at a given point in time.

```
sequence {
    set(key = "abc", value = "Hi!")
    _eval (id = "greet")
    " "
    set(key = "abc", value = "Hello!")
    _eval (id = "greet")
}
    => "Hi! Hello!"
```

v1.0.0 **__require_prop**

This function checks for the existence of the variable *id* and causes the interpreter to throw an `AntgRuntimeException` with the *err* message whenever it cannot find the required variable. Note that the existence of a variable is determined by the value of its length being `> 0`

```
__require_prop(
    id = "abc",
    err = "Variable not found!")

(This causes the runtime to throw the
aforementioned exception, since the
variable is not present in this context.
This also means that the execution of
the script will be interrupted at
this exact point.)
```

It is worth mentioning, that this function is a utility designed to implement reliable function calls and was originally meant to be generated exclusively by the **function definition syntax binding**. It is not recommended to use it manually.

v1.0.0 **add**

Evaluates to the result of adding the *left* and *right* operands together.

```
add (left = "10", right = "2")
    => "12"
```

v1.0.0 **sub**

Evaluates to the result of subtracting the *right* operand from the *left* operand.

```
sub (left = "10", right = "2")
    => "8"
```

v1.0.0 **mul**

Evaluates to the result of multiplying the *left* and *right* operands together.

```
mul (left = "10", right = "2")
    => "20"
```

v1.0.0 **div**

Evaluates to the result of dividing the *left* operand by the *right* operand.

```
div (left = "10", right = "2")
    => "5"
```

v1.0.0 **mod**

Evaluates to the result of retrieving the division remainder of *left* / *right*.

```
mod (left = "10", right = "2")
    => "0"
```

v1.0.0 **signflp**

Evaluates to *expr* with a flipped sign.

```
signflp (expr = "123")
    => "-123"
```

v1.0.0 **vsignflp**

Performs a sign-flip on the variable *id* and stores the result in the source variable.

```
progn {
    set (key = "a", value = "12")
    vsignflp (key = "a")
    &`a
}
    => "-12"
```

v1.0.0 **increment**

Increments the value of the variable *id* and stores the result in the source variable.

```
progn {
    set (key = "a", value = "10")
    increment (id = "a")
    &`a
}
    => "11"
```

v1.0.0 **decrement**

Decrements the value of the variable *id* and stores the result in the source variable.

```
progn {
    set (key = "a", value = "10")
    decrement (id = "a")
    &`a
}
    => "9"
```

v1.1.0 **_while**

Evaluates *expr* as long as *cond* is `"true"` and returns the value of the *expr* from the final iteration.

```
progn {
    `i := 5.0
    _while (cond = &`i > 1,
           expr = decrement(id = `i))
}
    => 1.0
```

v1.1.0 **not**

Negates the boolean value, i.e. returns `"false"` if *cond* is `"true"`, else returns `"true"`

```
not(cond = "true")
    => "false"

not(cond = "false")
    => "true"

not(cond = "Lorem ipsum")
    => "true"
```

v1.1.0 **_debug**

User the interpreter's logger to display *str* as an info message.

```
_debug(str = "Hello, World!")
    => ""
```

v1.1.0 **trunc**

Truncates the number *expr* to an integer

```
trunc(expr = 1.234)
    => "1"
```

v1.1.0 **sqrt**

Returns the square root of *expr*.

```
sqrt(expr = 4)
    => "2.0"
```

v1.1.1 **omit**

Evaluates all expressions sequentially and returns an empty string

```
omit {
    "Hello, World!"
}
    => ""
```

2 String Manipulation Library

The following documentation assumes this library was imported as *str*:

```
@library "org.medaware.anterogradia.libs.Strings" as str
```

v1.1.0 **contains**

Returns "true" if *str* contains *substr*, otherwise returns "false"

```
str.contains(str = "Hello, World!",
             substr = "Hello")

    => "true"

str.contains(str = "Hello, World!",
             substr = "Ketamine")

    => "false"
```

v1.1.0 **at**

If called only with *str* and *index*, returns the character found at *index* of *str*. When the *insert* parameter is also provided, inserts *insert* at *index* and returns the new string.

```
str.at(str = "Hello, World!", index = 12)
    => "!"

str.at(str = "Hello, World!",
       index = 7,
       insert = "wonderful ")

    => "Hello, wonderful World!"
```

v1.1.0 **upper**

Returns *str* in upper case letters.

```
str.upper(str = "Hello")
    => "HELLO"
```

v1.1.0 **lower**

Returns *str* in lower case letters.

```
str.lower(str = "hElLo")
    => "hello"
```

v1.1.0 **matches**

Returns "true" if *str* matches *regex*, otherwise returns "false"

```
str.matches(str = "Hello",
            regex = "[a-zA-Z]*")

    => "true"

str.matches(str = "Hello, World!",
            regex = "[a-zA-Z]*")

    => "false"
```

v1.1.0 **replace**

Replaces occurrences of *regex* in *org* with *str*. By default, this replaces all occurrences. This can be overridden with the *mode* parameter set to "all" for the default behavior, or "first" to only replace the first occurrence.

```
str.replace(org = "Hello, Weed!",
            regex = "Weed",
            str = "World")

    => "Hello, World!"

str.replace (
    org = "I smoke weed in my weed den",
    regex = "weed",
    str = "cigars",
    mode = "first"
)

    => "I smoke cigars in my weed den"
```

v1.1.0 **trim**

Removes leading and trailing white spaces from *str*

```
str.trim(str = "  Hello!  ")
    => "Hello!"
```

v1.1.0 **capture**

Runs a RegEx matcher against *str* with *regex* and returns the value of capture group *group*.

```
str.capture(str = "Lorem 123",
            regex = "[a-zA-Z ]+([0-9]+)",
            group = 1)

    => "123"
```

v1.1.0 **substr**

Returns the substring of *str* between *start* and *end*. If *end* is not provided, the section ends at the end of the original string.

```
str.substr(str = "Hello, World!",
           start = 7)

    => "World!"

str.substr(str = "Hello, World!",
           start = 0,
           end = 5)

    => "Hello"
```

3 Linear Algebra Library

The following documentation assumes this library was imported as *la*:

```
@library "org.medaware.anterogradia.libs.LinearAlgebra" as la
```

v2.0.0 **validate**

Checks whether *str* is a valid vector object. Returns "true" or "false" respectively.

```
la.validate(str = "1|2")
    => true

la.validate(str = "Lorem ipsum")
    => false
```

v2.0.0 **v**

Creates a vector object from the given dimensions. This function has variadic parameters.

```
la.v { 1 0 2 }
    => 1.0|0.0|2.0

la.v { 2 4 }
    => 2.0|4.0
```

v2.0.0 **sum**

A variadic function that returns the sum of the given vectors. All vectors are required to be of the same dimensions.

```
la.sum { la.v { 1 1 } la.v { 2 3 } }
    => 3.0|4.0
```

v2.0.0 **sub**

A variadic function that returns the result of subtracting the given vectors left to right. All vectors are required to be of the same dimensions.

```
la.sub { la.v { 1 1 } la.v { 2 3 } }
    => -1.0|-2.0
```

v2.0.0 **mul**

Multiplies the vector *v* by a scalar factor *fac*.

```
la.mul(v = la.v { 1 0 }, fac = 5)
    => 5.0|0.0
```

v2.0.0 **div**

Divides the vector *v* by a scalar divisor *div*.

```
la.div(v = la.v {10 5}, div = 2)
    => 5.0|2.5
```

v2.0.0 **normalize**

Normalizes the vector *v* by dividing each component by the vector magnitude.

```
la.normalize(v = la.v { 4 3 })
    => 0.8|0.6
```

v2.0.0 **len**

Computes the magnitude (Euclidean norm) of the vector *v*.

```
la.len(v = la.v { 4 3 })
    => 5.0
```

v2.0.0 **x**

Retrieves the X dimension (the 0^{th} dimension) from the vector *v*

```
la.x(v = la.v { 1 2 3 })
    => 1.0
```

v2.0.0 **y**

Retrieves the Y dimension (the 1^{st} dimension) from the vector *v*

```
la.y(v = la.v { 1 2 3 })
    => 2.0
```

v2.0.0 **z**

Retrieves the Z dimension (the 2^{nd} dimension) from the vector *v*

```
la.z(v = la.v { 1 2 3 })
    => 3.0
```

v2.0.0 **n**

Retrieves the n^{th} dimension from the vector *v*

```
la.n(v = la.v { 1 2 3 4 }, n = 3)
    => 4.0
```

v2.0.0 **dot**

Computes the dot product ("scalar product") between the vectors *a* and *b*

```
la.dot(a = la.v { 1 2 }, b = la.v { 4 3 })
    => 10.0
```

4 Visual Integration Suite

The *Medaware Design Kit* is a part of *AVIS* and must be implemented as follows:

```
@library "org.medaware.avis.MedawareDesignKit" as avis
```

AVIS v2.0 **header**

Emits an HTML "header" comment. Use case not yet defined.

AVIS v2.0 **root**

Emits a `div` that wraps the *body* of an article.

AVIS v2.0 **heading**

Emits a `p` element with the appropriate classes for an article heading. The heading text is determined by *value*.

AVIS v2.0 **img**

Emits an `img` element with the given *src* address.

AVIS v2.0 **subheading**

Emits a `p` element styled as a sub-heading (smaller title) through appropriate classes. The value of the subheading is determined by *value*

AVIS v2.0 **text**

Emits a `p` element styled as regular text. Content defined by *text*

AVIS v2.0 **blank**

Emits a `div` styled as a visually distinguishable placeholder.

AVIS v2.0 **id_wrap**

Emits a `div` which does not apply any styling, but is used by the editor to highlight selected elements.

5 Syntax Bindings

5.1 General Overview

Since every expression in Anterogradia must either be a string literal or a function call, **syntax bindings** were introduced in order to solve the readability and practicality issues. Syntax bindings are nothing more than fancy syntactical entities that are directly translated into standard library function calls by the parser. Take a look at the following piece of code as an example:

```
progn {
    fun sayHi {
        "Hello, World!"
    }
    eval sayHi
}
```

This code is simple enough to be able to almost immediately notice the two obvious primitive expressions:

1. The **variadic function** call of *progn*
2. The string literal `"Hello, World!"`

However, here, `fun` and `eval` don't match the established syntax for any ANTG primitive. Thus, you'd be correct to conclude that they are in fact syntax bindings. With the help of the *astd* (AST Dump) function we can take a peek behind what's going in the program above:

```
astd(expr = progn { ...
```

Yields:

```
progn {
    _fun(
        expr = progn {
            "Hello, World!"
        },
        id = "sayHi"
    ),
    _eval(id = "sayHi")
}
```

Here you can see that the `fun` entity has been translated to a `_fun` call with a `progn` call as its return value. The function identifier is now also provided as a discrete parameter. As for the `eval` entity, it was also changed a bit by turning into an `_eval` call with the function id as its parameter. The difference is not particularly striking in this example, but it's enough to establish what this technique is all about. Syntax bindings really start to shine when your code samples slightly grow in complexity, as illustrated by the following example:

Here, the original code ...

```
progn {
  fun sayHi <to> {
    sequence { "Hello, " &`to "!" }
  }
  eval sayHi(to = "World")
}
```

... expands to ...

```
progn {
  _fun(
    expr = progn {
      __require_prop(
        err = "Required prop not present",
        id = "to"
      ),
      progn {
        sequence {
          "Hello, ",
          get(key = "to"),
          "!"
        }
      }
    },
    id = "sayHi"
  ),
  progn {
    set(value = "World", key = "to"),
    _eval(id = "sayHi")
  }
}
```

To briefly summarize what the parser has done, the most noticeable change is the transformation of would-be discrete function parameters to variable declarations prior to evaluating the stored function. The parser also generates safeguards at the beginning of the function body to ensure that all required variables are in fact present; this is achieved via the `__require_prop` function, which checks for the existence of a variable *id* and causes the runtime to throw an `AntgRuntimeException` with the error message *err* whenever it fails to locate said variable. It is also worth mentioning that since the parser has no notion of functions and variables (after all, this functionality is implemented in the standard library) there is no way for it to check the validity of the parameters passed to the `eval` entity, and thus it will transform any discrete parameters into variable declarations, regardless of whether they're actually required by the callee.

5.2 Standard Library Bindings

5.2.1 Magnitude operator

```
len(expr = "Lorem ipsum") ↔ |"Lorem ipsum"|
```

5.2.2 Conditional expression

```
_if(cond = .., then = "Lorem", else = "Ipsum") ↔
if (...) { "Lorem" } else { "Ipsum" }
```

5.2.3 Function definition without parameters

```
_fun(id = "foo", expr = "Hello, World")    ↔
fun foo { "Hello" }
```

5.2.4 Function definition with required property checks

```
fun foo <a, b, ..,> { "Hello" }
```

5.2.5 Function call without properties

```
_eval(id = "foo") ↔ eval foo
```

5.2.6 Function call with required property assignments

```
eval foo (a = .., b = ..,)
```

5.2.7 Lexical atom to string conversion

```
"123" ↔ `123
"foo" ↔ `foo
"(" ↔ `(
```

5.2.8 Variable assignment

```
set(key = "i", value = "Bar") ↔ `i := "Bar"
```

5.2.9 Variable retrieval

```
get(key = "i") ↔ &`i
```

5.2.10 Equality check

```
equal(left = 10, right = 20) ↔ 10 = 20
```

5.2.11 Left greater check

```
lgt(left = 10, right = 20) ↔ 10 > 20
```

5.2.12 Right greater check

```
rgt(left = 10, right = 20) ↔ 10 < 20
```