

# The Programming Language EGA Reference Manual Version 12

Written by Katayama Hirofumi MZ.

Copyright (C) 2020-2023 Katayama Hirofumi MZ.

## What is EGA?

EGA is a small programming language of a simple grammar, written in C++11. It is very tiny (< 500 KiB). You can extend its functions easily.

The source code of EGA will be found at <https://github.com/katahiromz/EGA> .

## How to use

Please start up EGA. The following text will be displayed:

```
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@ EGA Version 10 by katahiromz                                     @
@ Type 'exit' to exit. Type 'help' to see help. @
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@

EGA>
```

Enter an EGA expression (for example, `print(+(1, 2));`) and press Enter key. 3 will be shown.

```
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@ EGA Version 10 by katahiromz                                     @
@ Type 'exit' to exit. Type 'help' to see help. @
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@

EGA> print(+(1, 2));
3
EGA>
```

To quit EGA, please enter "exit".

The syntax of the EGA is similar to one or more function call(s) of C language. But, every operator in EGA is a function.

Enter "help" to see all the EGA functions:

```
EGA> help;
EGA has the following functions:
!
!=
%
&
&&
...
and
array
...

EGA>
```

To see brief usage of print function, enter "help print".

```
EGA> help print;
EGA function 'print':
  arity: 0..32767
  usage: print(value, ...)

EGA>
```

The detailed descriptions of the EGA functions will be described later.

## What's New

Change in Version 10:

- Added RES\_str\_get function.
- Added RES\_str\_set function.

Change in Version 9:

- Improved binary function.
- Added RES\_set\_binary function.
- Added RES\_const function.

Change in Version 8:

- Improved or function in evaluation way.
- Improved and function in evaluation way.

## Comments

The comment of EGA begins with the first atmark (@) of a line, and ends with newline. The comments are ignored in execution of EGA program.

For example:

```
@ This is a comment.
```

## Values

The EGA values are integers, strings, and/or arrays.

An EGA integer literal is a sequence of digit(s) (0, ..., 9).

An EGA string literal is a string wrapped by double quotations (" ").

If the string value contains a double quotation, it will be doubled in the string literal.

The EGA array literal is a list of the EGA values it contains, separated by commas (,), and wrapped by braces ({ and }).

## Variables

You can set a value into a variable by using the set special function.

For example, `set(A, 123);` will create a variable named A whose value is 123.

The define special function can store the unevaluated expression into a variable.

## Integers

Expression `+(1, 2)` is the sum of two integers 1 and 2.

Expression `*(3, 4)` is the multiplication of two integers 3 and 4.

You can compare two integers by `==`, `!=`, `<`, `<=`, `>`, `>=` functions.

To specify a negative value, use minus (-) function: `-(123)`.

## Strings

Expression `"This is a string."` is a string literal of length 17.

Expression `"This is a \"string\"."` is a string literal of length 19.

You can compare two strings by `==`, `!=`, `<`, `<=`, `>`, `>=` functions.

See also `left`, `len`, `mid`, `right`, `replace`, `remove` and `str` functions.

## Binarys

In EGA, a binary data is a string. See `binary` function.

## Arrays

Expression `{1, 2, "string"}` is an array literal of length 3.

Expression `set(ary, {1, 2, "string"})`; can store the array to the ary variable.

To get the 2nd element of ary, use `at(ary, 1)`.

To set 999 to the 2nd element of ary, use `at(ary, 1, 999)`.

See also `left`, `len`, `mid`, `right`, `replace`, `remove` and `array` functions.

## Booleans

In EGA, the boolean value is an integer value. Zero means false. Non-zero means true.

See not, and, or functions.

## Conditional execution

The special function `if` can switch the execution by condition.

For example:

```
if(==(+(1, 1), 2), println("1 + 1 == 2"), println("1 + 1 != 2"))
```

## Loops

The special functions `for`, `foreach` and `while` can make an execution loop.

The `break` special function can break the loop.

For example:

```
for(i, 1, 10, println(i));
```

## Normal Functions vs. Special Functions

In a call of the normal function, the parameters will be evaluated in the order of parameters. The special functions can change the order of expression evaluations and can ignore some parameters.

## Input and output

The `input` function prompts the user for a string and waits for input.

If input is done, the function returns a string.

The `print`, `println`, `dump` and `dumpln` functions shows text of the specified values to the user.

Unlike `print` and `println`, the `dump` and `dumpln` functions add quotes and commas to the string values. `println` and `dumpln` add a newline at the end of the output text.

## Samples

### Sample `break.ega`

```
for(i, 1, 10000, (println(i), if(>=(i, 10), break())));
```

This EGA program will outputs 0-to-10. Output:

```
1
2
3
4
5
6
7
8
9
10
```

The break special function cut the for loop.

### Sample fact.ega

```
define(fact, do(set(prod, 1), for(i, 2, n, set(prod, *(prod, i)))));

for(k, 1, 12, (
    set(n, k),
    fact,
    println("n = ", n, ": fact == ", prod)
)
)
```

This EGA program will outputs the factorial numbers of 1-to-12. Output:

```
n = 1: fact == 1
n = 2: fact == 2
n = 3: fact == 6
n = 4: fact == 24
n = 5: fact == 120
n = 6: fact == 720
n = 7: fact == 5040
n = 8: fact == 40320
n = 9: fact == 362880
n = 10: fact == 3628800
n = 11: fact == 39916800
n = 12: fact == 479001600
```

The define special function defines a macro variable. This program is same as:

```
for(k, 1, 12, (
    set(n, k),
    do(set(prod, 1), for(i, 2, n, set(prod, *(prod, i)))),
    println("n = ", n, ": fact == ", prod)
)
)
```

### Sample input.ega

```
set(s, input("Type a string"));
for(i, 1, +(len(s), 4), print("#"));
println();
println(cat("# ", s, " #"));
for(i, 1, +(len(s), 4), print("#"));
println();
```

This program wraps the input string by #. Output:

```
Type a string? This is a test.
#####
# This is a test. #
#####
```

The input function prompts user input.

The cat function concatenates strings.

## Sample plus.ega

```
set(A, input("A="));
set(B, input("B="));
set(C, +(int(A), int(B)));
println(C);
```

This program calculates the sum of input A and B. Output:

```
A=? 3
B=? 5
8
```

## The EGA Functions

The following sections are a list of the EGA functions.

### EGA and Function

```
EGA function 'and':
  arity: 2
  usage: and(value1, value2)
```

Calculates logical AND of two integers. Returns an integer.

Same as &&.

### EGA array Function

```
EGA function 'array':
  arity: 0..32767
  usage: array(value1[, ...])
```

Creates an array from specified parameters. Returns an array.

### EGA at Function

```
EGA function 'at':  
  arity: 2..3  
  usage: at(ary_or_str, index[, value])
```

Gets or sets the item at the specified index.

ary\_or\_str must be an array or a string.

If the value is not specified, the function gets the value at the position of the specified index.

If the value is specified, the function sets the value at the position of the specified index.

Returns the value.

Same as [].

## EGA binary Function

```
EGA function 'binary':  
  arity: 0..32767  
  usage: binary(string_or_byte[, ...])
```

Creates a binary string of the specified parameters.

Each parameter is an integer or a string.

Returns a binary string.

## EGA bitand Function

```
EGA function 'bitand':  
  arity: 2  
  usage: bitand(value1, value2)
```

Calculates bitwise AND of two integers. Returns an integer.

Same as &.

## EGA bitor Function

```
EGA function 'bitor':  
  arity: 2  
  usage: bitor(value1, value2)
```

Calculates bitwise OR of two integers. Returns an integer.

Same as |.

## EGA break Function

```
EGA function 'break':  
  arity: 0  
  usage: break()
```

Goes out of an EGA loop.

## EGA cat Function

```
EGA function 'cat':  
  arity: 1..32767  
  usage: cat(ary_or_str_1, ary_or_str_2, ...)
```

Concatnates the specified arrays and/or strings. Returns an array or a string.

## EGA compare Function

```
EGA function 'compare':  
  arity: 2  
  usage: compare(value1, value2)
```

Compares two values. Returns 0 if value1 and value2 are equal, -1 if value1 was less, or 1 if value1 was greater.

## EGA compl Function

```
EGA function 'compl':  
  arity: 1  
  usage: compl(value)
```

Calculates bitwise NOT. Returns an integer.

Same as ~.

## EGA define Function

```
EGA function 'define':  
  arity: 1..2  
  usage: define(var[, expr])
```

Defines an EGA macro variable. var is a variable.  
Unlike the set function, the expr argument will be not evaluated.  
If expr is omitted, var will be reset.  
Returns expr.

Same as :=.

## EGA div Function

```
EGA function 'div':  
  arity: 2  
  usage: div(int1, int2)
```

Divides an integer value int1 by another integer value int2.  
Returns an integer.

Same as /.

## EGA do Function

```
EGA function 'do':  
  arity: 0..32767  
  usage: do(expr, ...)
```



Does loop while expr is non-zero.  
The arguments will be evaluated in order.  
Returns the last argument.  
You can break the execution by break function.

## EGA dump Function

```
EGA function 'dump':  
  arity: 0..32767  
  usage: dump(value, ...)
```

Outputs the values with quotations and commas if necessary.  
No return value.

## EGA dumpln Function

```
EGA function 'dumpln':  
  arity: 0..32767  
  usage: dumpln(value, ...)
```

Same as dump except dumpln adds a newline.

Same as ?.

## EGA equal Function

```
EGA function 'equal':  
  arity: 2  
  usage: equal(value1, value2)
```

Compares two values. Returns 1 if two values are equal. zero if not equal.

Same as ==.

## EGA exit Function

```
EGA function 'exit':  
  arity: 0..1  
  usage: exit([value])
```

Ends the program with a value.

## EGA find Function

```
EGA function 'find':  
  arity: 2  
  usage: find(ary_or_str, target)
```

Finds a target value from an array or a string.  
Returns the zero-based offset of the found target. Returns -1 if not found.

## EGA for Function

```
EGA function 'for':  
  arity: 4  
  usage: for(var, min, max, expr)
```

Does loop from min and max.

The expr argument will be evaluated repeatedly.

The min and max values must be integers.

The var is the name of a loop variable.

1. At first, min will be stored into the var variable.
2. Then, expr will be evaluated.
3. var will be incremented upto max.
4. If var is less than max, then back to 2.

You can break the loop by break function.

## EGA foreach Function

```
EGA function 'foreach':  
  arity: 3  
  usage: foreach(var, ary, expr)
```

Does loop using an array.

ary is an array.

The item in the ary array will be evaluated and stored into variable var repeatedly.

You can break the loop by break function.

## EGA greater Function

```
EGA function 'greater':  
  arity: 2  
  usage: greater(value1, value2)
```

Compares two values. Returns 1 if value1 was greater than value2. zero if not greater.

Same as >.

## EGA greater\_equal Function

```
EGA function 'greater_equal':  
  arity: 2  
  usage: greater_equal(value1, value2)
```

Compares two values. Returns 1 if value1 was greater than value2 or equal. Otherwise returns zero.

Same as >=.

## EGA hex Function

```
EGA function 'hex':  
  arity: 1  
  usage: hex(value)
```

Converts an integer value to a hexidemical string.  
Returns a string.

## EGA if Function

```
EGA function 'if':  
  arity: 2..3  
  usage: if(cond, true_case[, false_case])
```

Chooses the execution by the condition.

If the integer value cond was non-zero, then true\_case will be evaluated.  
If cond was zero, then false\_case will be evaluated if any.  
Returns the evaluated value of true\_case or false\_case.

## EGA input Function

```
EGA function 'input':  
  arity: 0..1  
  usage: input([message])
```

Gets a text string as input from EGA console.  
message will be shown if any.  
Returns the text string.

## EGA int Function

```
EGA function 'int':  
  arity: 1  
  usage: int(value)
```

Converts a value to an integer value.  
Returns an integer.

## EGA left Function

```
EGA function 'left':  
  arity: 2  
  usage: left(ary_or_str, count)
```

Returns an array or a string of count items at the left side of an array or a string.

## EGA len Function

```
EGA function 'len':  
  arity: 1  
  usage: len(ary_or_str)
```

Returns the length of an array or a string.

## EGA less Function

```
EGA function 'less':  
  arity: 2  
  usage: less(value1, value2)
```

Compares two values. Returns 1 if value1 was less than value2. zero if not less.

Same as <.

## EGA less\_equal Function

```
EGA function 'less':  
  arity: 2  
  usage: less_equal(value1, value2)
```

Compares two values. Returns 1 if value1 was less than value2 or equal. Otherwise returns zero.

Same as <=.

## EGA mid Function

```
EGA function 'mid':  
  arity: 3..4  
  usage: mid(ary_or_str, index, count[, value])
```

Returns the sequence of the specified range of an array or a string.

ary\_or\_str must be an array or a string.

The range starts from offset index.

The length of the range is count.

If value is specified, the range will be replaced with a value of value.

## EGA minus Function

```
EGA function 'minus':  
  arity: 1..2  
  usage: minus(int1[, int2])
```

Negates or subtract.

int1 and int2 must be integers.

Returns an integer.

Same as -.

## EGA mod Function

```
EGA function 'mod':  
  arity: 2  
  usage: mod(int1, int2)
```

Calculates the remainder of division of two integers.

int2 must be non-zero.

Returns an integer.

Same as %.

## EGA mul Function

```
EGA function 'mul':  
  arity: 2  
  usage: mul(int1, int2)
```

Calculates multiplication of two integers.  
Returns an integer.

Same as \*.

## EGA not Function

```
EGA function 'not':  
  arity: 1  
  usage: not(value)
```

Calculates logical NOT of the value.  
Returns an integer.  
Same as !.

## EGA not\_equal Function

```
EGA function 'not_equal':  
  arity: 2  
  usage: not_equal(value1, value2)
```

Compares two values. Returns 1 if value1 was different from value2. Otherwise returns zero.  
Same as !=.

## EGA or Function

```
EGA function 'or':  
  arity: 2  
  usage: or(value1, value2)
```

Calculates logical OR of two values.  
Returns an integer.

Same as ||.

## EGA plus Function

```
EGA function 'plus':  
  arity: 2  
  usage: plus(int1, int2)
```

Calculates sum of two integer values.  
Returns an integer.

Same as +.

## EGA print Function

```
EGA function 'print':  
  arity: 0..32767  
  usage: print(value, ...)
```

Outputs the values without quotation.  
No return value.

## EGA println Function

```
EGA function 'println':  
  arity: 0..32767  
  usage: println(value, ...)
```

Outputs the values without quotation with a newline.  
No return value.

## EGA remove Function

```
EGA function 'remove':  
  arity: 2  
  usage: remove(ary_or_str, target)
```

Returns an array or a string, whose parts are removed.

If ary\_or\_str is an array, the items with the same value as target are removed.

If ary\_or\_str is a string, the substrings target are removed.

Returns the array or the string of the results.

This function doesn't change ary\_or\_str.

## EGA replace Function

```
EGA function 'replace':  
  arity: 3  
  usage: replace(ary_or_str, from, to)
```

If ary\_or\_str is an array, every item with the same value as the from value are replaced with the to value.

If ary\_or\_str is a string, the substrings from are replaced with the to string.

Returns the array or the string of the results.

This function doesn't change ary\_or\_str.

## EGA right Function

```
EGA function 'right':  
  arity: 2  
  usage: right(ary_or_str, count)
```

Returns an array or a string of count items at the right side of an array or a string.

## EGA set Function

```
EGA function 'set':  
  arity: 1..2  
  usage: set(var[, value])
```

Creates a variable whose value is value.  
If value is not specified, the variable is cleared.  
Returns the value.

Same as =.

## EGA str Function

```
EGA function 'str':  
  arity: 1  
  usage: str(value)
```

Converts the value to a string.  
Returns a string.

## EGA typeid Function

```
EGA function 'typeid':  
  arity: 1  
  usage: typeid(value)
```

Returns the type ID of the value.

If the value is NULL, then returns -1.  
If the value is an integer, then returns zero.  
If the value is a string, then returns 1.  
If the value is an array, then returns 2.

## EGA u8fromu16 Function

```
EGA function 'u8fromu16':  
  arity: 1  
  usage: u8fromu16(utf16str)
```

Converts a UTF-16 string to a UTF-8 string.

NOTE: The EGA standard string is UTF-8.  
You can convert a UTF-8 string into a UTF-16 binary string by this function.

## EGA u16fromu8 Function

```
EGA function 'u16fromu8':  
  arity: 1  
  usage: u16fromu8(utf8str)
```

Converts a UTF-8 string to a UTF-16 string.

## EGA while Function

```
EGA function 'while':  
  arity: 2  
  usage: while(cond, expr)
```

Does loop while the specified condition is non-zero.  
The expr argument will be evaluated repeatedly.  
The cond is the condition.

1. At first cond will be evaluated. If it was zero, then loop will be ended.
2. expr will be evaluated. Back to 1.

You can break the loop by break function.

## EGA xor Function

```
EGA function 'xor':  
  arity: 2  
  usage: xor(value1, value2)
```

Calculates bitwise XOR of two integers. Returns an integer.

Same as ^.

## RisohEditor EGA extension

RisohEditor EGA has the following functions as EGA extension:

- RES\_load
- RES\_save
- RES\_clone\_by\_lang
- RES\_clone\_by\_name
- RES\_const
- RES\_delete
- RES\_get\_binary
- RES\_search
- RES\_select
- RES\_set\_binary
- RES\_unload\_res
- RES\_str\_get
- RES\_str\_set

## EGA RES\_load Function

```
EGA function 'RES_load':  
  arity: 1..2  
  usage: RES_load(filename[, options])
```

RES\_load loads the resource file.

options is an empty string or "(no-load-res-h)";

## EGA RES\_save Function



```
EGA function 'RES_load':  
  arity: 1..2  
  usage: RES_save(filename[, options])
```

RES\_save saves the resource file.

options is an empty string or the combinations of the following strings.

- "(idc-static)"
- "(compress)"
- "(sep-lang)"
- "(no-res-folder)"
- "(lang-macro)"
- "(less-comments)"
- "(wrap-manifest)"
- "(begin-end)"
- "(utf-16)"
- "(backup)"
- "(ms-msgtbl)"

For example: RES\_save("C:\Users\katahiromz\Desktop\a.res", "(sep-lang) (compress)");

## EGA RES\_clone\_by\_lang Function

```
EGA function 'RES_clone_by_lang':  
  arity: 4  
  usage: RES_clone_by_name(type, name, src_lang, dest_lang)
```

RES\_clone\_by\_name clones the resource data as another resource language.

type must be an integer or a string of a resource type. If type is zero, then search all resource types.

name must be an integer or a string of a resource name. If name is zero, then search all resource names.

src\_lang must be an integer that specifies the source language ID. If lang is -1, then search all resource languages.

dest\_lang must be an integer that specifies the destination language ID.

Returns 1 if cloned. Otherwise returns zero.

## EGA RES\_clone\_by\_name Function

```
EGA function 'RES_clone_by_name':  
  arity: 3  
  usage: RES_clone_by_name(type, src_name, dest_name)
```

RES\_clone\_by\_name clones the resource data as another resource name.

type must be an integer or a string of a resource type. If type is zero, then search all resource types.

src\_name must be an integer or a string of a resource name. If src\_name is zero, then search all resource names.

dest\_name must be an integer or a string of a new resource name.

Returns 1 if cloned. Otherwise returns zero.

## EGA RES\_const Function

```
EGA function 'RES_const':  
  arity: 1  
  usage: RES_const(name)
```

The RES\_const function queries the database for the value of a constant.

name must be a constant name. Returns the value if successful, otherwise zero.

## EGA RES\_delete Function

```
EGA function 'RES_delete':  
  arity: 0..3  
  usage: RES_delete([type[, name[, lang]])
```

RES\_delete deletes the resource items.

type must be an integer or a string of a resource type. If type is zero or omitted, then search all resource types.

name must be an integer or a string of a resource name. If name is zero or omitted, then search all resource names.

lang must be an integer that specifies the language ID. If lang is -1 or omitted, then search all resource languages.

Returns 1 if deleted. Otherwise returns zero.

## EGA RES\_get\_binary Function

```
EGA function 'RES_get_binary':  
  arity: 0..3  
  usage: RES_get_binary([type[, name[, lang]])
```

RES\_get\_binary gets the binary data of the specified resource data.

Returns the binary string.

## EGA RES\_search Function

```
EGA function 'RES_search':  
  arity: 0..3  
  usage: RES_search([type[, name[, lang]])
```

RES\_search returns an array of the resource items.

type must be an integer or a string of a resource type. If type is zero or omitted, then search all resource types.

name must be an integer or a string of a resource name. If name is zero or omitted, then search all resource names.

lang must be an integer that specifies the language ID. If lang is -1 or omitted, then search all resource languages.

## EGA RES\_select Function

```
EGA function 'RES_select':  
  arity: 0..3  
  usage: RES_select([type[, name[, lang]])
```

RES\_select selects an item on the RisohEditor treeview.  
Returns 1 if successful, zero if failed.

## EGA RES\_set\_binary Function

```
EGA function 'RES_set_binary':  
  arity: 4  
  usage: RES_set_binary(type, name, lang, binary)
```

RES\_set\_binary sets the binary data as the specified resource type, resource name, and language.  
Returns 1 if successful, zero if failed.

## EGA RES\_unload\_res Function

```
EGA function 'RES_unload_res':  
  arity: 0  
  usage: RES_unload_res()
```

RES\_unload\_res unloads the "resource.h" file.  
Always returns 1.

## EGA RES\_str\_get Function

```
EGA function 'RES_str_get':  
  arity: 1..2  
  usage: RES_str_get(lang[, str_id])
```

RES\_str\_get reads the resource string table.  
If str\_id specified, then returns a UTF-8 string.  
If str\_id not specified, then returns an array of pairs of string ID and text.  
If failed, returns an empty string or an empty array.

## EGA RES\_str\_set Function

```
EGA function 'RES_str_set':  
  arity: 2..3  
  usage: RES_str_set(lang, str_id, str) or RES_str_set(lang, ary)
```

RES\_str\_set writes the resource string table.  
If str\_id specified, then write a UTF-8 string to the string table.  
If the string was empty, then the resource string will be cleared.  
If str\_id not specified, then set an array of pairs of string ID and text to the string table.  
Returns one if successful.  
Returns zero if failed.

## How can I extend EGA?

1. Import libega.

2. Include `ega.hpp`.
3. Call the following EGA C++ functions: `EGA_init`, `EGA_set_input_fn` and `EGA_set_print_fn`.
4. Add your EGA functions by `EGA_add_fn` C++ function.

## Special thanks

- <https://www.aconvert.com/pdf/md-to-pdf/>