# Annotated example programs

(Annotate as many of the standard constructs as possible, using arrows).

# List of keywords & their meanings

as – see Function definition.

abstract – see Inheritance

case – see switch…case

catch – see try … catch

class – see Class definition

constant – see Constant definition

constructor – see Constructor

curry – see Functional programming

default – see switch…case

else – see if…then…else

end – used (followed by another keyword) at the end of several programming constructs

enumeration – see Enumeration

for – see for…loop and for…in loop

function – see Function definition

if – see if…then…else

immutable – see Immutable class

in – see for…in loop

inherits – see Inheritance

lambda – see Function definition.

let – see Functional programming

main – see Main routine

new – see Instantiation

partial – see Functional programming

private – see Private members

procedure – Procedure definition

property – see Property

repeat – see repeat…until loop

return – see Function definition

self – see Object-oriented programming

step - see for…loop

switch – see switch…case

then – see if…then…else

throw – see Exceptions

to – see for…loop

try – see try … catch

until – see repeat…until loop

var – see Variable definition

while – see while loop

with – see Instantiation

# Project structure

## Single file program

Smaller Elan projects typically consist of a single file of code. The file name may be any valid Windows file name but to be recognised by the Elan compiler, it must end with the file extension .elan – for example program.elan

The first line of *every* Elan file *must* be a Comment – though it *may* be an empty comment line (i.e. just the # symbol). If you type other code on the first line, the Elan IDE will automatically correct this by inserting a new empty comment line at the top of the file.

To be an executable program the file *must* contain a single Main routine.

It *may* additionally contain other Top-level constructs.

## Working with multiple files

For larger projects the code may be split into multiple files. The filenames may be chosen by the programmer – the file names have no significance to the compiler, provided each ends with the file extension .elan.

Each code file may contain any mixture of the Top-level constructs, with the constraint that:

* Only one file in the project may contain a Main routine.
* Each top-level construct must be complete within a single file (you may not, for example, split a single procedure definition across multiple files).

Code in any file may reference constructs defined in another file within the project – without the need for an import or equivalent statement.

## Comment

A comment begins with # (the 'hash' symbol). This may be placed at the start of the line, or after other code, for example:

# This is a single line comment

# For a multi-line comment,  
# each line must begin with #

var count = 0 # Comment may follow other code

# Top-level constructs

## Main routine

For a program to be executable there must be a main routine - and only one. This is the first code that is called when the program is run.

The main routine is defined by :

* the main keyword on its own line
* a Statement block
* end main on its own line

## Procedure definition

A procedure is one of the two forms of Subroutine.

A procedure is defined by:

* the procedure keyword followed by:
  + The procedure's name, which must follow the rules of any identifier.
  + Round brackets, either empty or containing one or more parameter definitions
* end procedure on its own line

## Function definition

A function is one of the two forms of Subroutine.

A function is defined by:

* the function keyword followed by:
  + The functions name, which must follow the rules of any identifier.
  + (Round brackets, either empty or containing one or more parameter definitions
  + The keyword as followed by the Type of the value returned by the function
* a Statement block
* end function on its own line

Note that a function definition may alternatively be written using Expression syntax – the latter being more commonly adopted in the context of Functional programming. To differentiate the two, the form of function definition described above is sometimes referred to as a 'statement-bodied function'.

## Constant definition

A constant is a named value, where the value is fixed at compile time and may not be altered. Constants are top-level constructs and therefore 'global' - visible everywhere. (This in contrast to Variables, which are always scoped within the main routine or a subroutine.) A constant is defined by:

* The constant keyword followed by
  + The name, which must follow the same rules as for all Identifiers in Elan.
  + A literal value. This may be for any or the Standard value types or any of the Standard data structures *except for* Array (because an Array is *mutable).*

Note that the Standard Library defines a small number of constants, such as pi

## Class definition

## Enumeration definition

# Statement block

The statement block may include any of the following kinds of statement, with each such statement starting on a new line.

## Variables

### Variable definition

Examples:

var x = 1  
var message = "hello"

* A variable may only be defined within a Routine, and its scope is limited to that routine.
* The name defined for the variable must follow the same rules as for all Identifiers in Elan.
* The variable must be initialised with a value, which may be specified as a *literal*, or calculated from an Expression.
* Elan uses Static typing. The type of a variable is determined by the type for that variable.

### Assignment

* An assignment puts a new value into an *existing* variable, element in an array, or property of an object.
* The new value may be defined as a literal, or by an Expression.
* However, any new value assigned must be of the same type as the variable, i.e. of the same type as the value with which the variable was initialised.
* The new value may be defined by a literal or by an expression – the latter may make reference to other variables or constants in scope and/or to the *current* value of the variable.

Examples: cover all cases mentioned in first bullet

var x = 3 # definition  
x = 4 # assignment  
x = x + 1 # assigns to x a value one larger than its current value

## Control-flow statement

Elan supports six forms of control-flow statement, each of which runs over more than one line of code, and may incorporate one or more Statement blocks. The control flow statement determines either how many times a single block is executed, or which of more than one block is executed depending upon the value held by one or more variables.

### if…then…else

This is the most common form of 'selection' in procedural programming

### switch…case

### for…loop

### for…in loop

### while loop

### repeat…until loop

### try … catch

## Procedure call

* Because a procedure does not return a value, it *cannot be called within an expression*.
* A *freestanding* procedure call consists just of the name of the procedure always followed by round brackets. If the procedure defines parameters, then the call must include an argument (each defined as a literal value or an expression) corresponding to each required parameter. Arguments are placed within the round brackets and – if there is more than one – separated by commas. Examples:
* A proceduremay also be called using Dot-syntax. Examples:

## System call

* A system call is

## Exception

# Expressions

An expression is a single line of code (though it may be wrapped over more than one line on screen or paper) made up of multiple elements that, when evaluated, produces a value.

An expression may incorporate any or all of the following elements:

* Literal value
* Reference to a variable or constant
* Arithmetic operators and brackets
* Function call

Examples:

* 3 + 4
* 3 \* x ^ 2 – 2 \* x + k
* max(a, b) / min(c, d)
* firstName.ToUpper()+" " + lastName.ToUpper()

An expression may not contain procedure call or any system call

# List System Calls

## Input/Output

## Other System Calls

# Standard types

## Standard value types

## Standard data structures

### String

### List

### Array

### Tuple

### Dictionary

# Enumeration

# Object-oriented programming

## Class definition

### Constructor

### Property

### Method

### Private members

## Instantiation

## Inheritance

## Immutable class

# Functional programming

## Expression syntax

# Standard Library

(Includes functions, constants and some types)

# Definitions of terms

## Identifier

The term identifier in Elan refers to any of the following:

* Variable name
* Constant name
* Procedure name
* Parameter name
* Function name

All Elan identifiers must commence with a lower-case letter, which may be followed by any combination of lower-case or upper-case letters, numeric digits, and the underscore symbol \_. All identifiers visible within a given Scope must be unique.

Identifiers must not be identical to any Keyword– even if using different case. However, a keyword may be incorporated within a larger identifier.

Any identifier defined, or subsequently referenced, using the incorrect case will be auto-corrected by the Elan IDE.

## Type

The word *type* refers to any of the Standard types provided with the Elan language, or to any user-defined type, for which there will be a Class definition.

## Type name

Type names in Elan always start with an upper-case letter, followed by any combination of lower-case or upper-case letters, numeric digits, and the underscore symbol. This applies both to Standard types that come with the language and Classes. A recognised type name entered in the wrong case will be auto-corrected by the Elan IDE.

Examples:

## Scope

Scope refers to the extent of the code within which something may be referenced Subroutines are defined at top-level, so their scope is said to be *global*. A constant may be defined at top-level and hence have a *global* scope, or defined within a Routine, in which case its scope is limited to that Routine. A parameter or variable is always defined within a Routine and scoped to that routine – Elan does *not* permit 'global variables'.

Within a scope, each defined identifier must be distinct from all others in that scope. However, the same identifier may be defined in different scopes to refer to different things (for example the identifier x may be used as variable name within two different routines without creating any conflict or confusion).

## Routine

*Routine* refers to a Main routine, or Subroutine.

## Subroutine

*Subroutine* refers to either a Procedure or a Function.

## Dot-syntax

Any function, and any procedure that defines

## Instance

## Class

## Method

A method is a procedure or function that is defined on a class.

A method is *always* called using Dot-syntax, where the dot follows a reference to an object (the reference might be a variable holding that instance, or it might be an expression that returns an object instance).

A method has direct access to the Members of the instance on which it is called.

## Member

Refers to a Property or a Method defined on a class.

## Parameter

One or more parameters form part of every Function definition, and optionally as part of a Procedure definition.

## Delimiters

The delimiters of any code construct in Elan are the first and last lines of the code construct, typically these both involve keywords and sometimes other code elements. Many pairs of delimiters take the form of a keyword at the start, and end followed by the same keyword at the end, for example: if … end if, or procedure … end procedure.

## Signature

The signature of a subroutine in Elan consists of the name of the subroutine, the parameters (if any) that it defines, and – if the subroutine is a function, the type that it returns. All this information is contained within the first line of the subroutine definition. The signature defines all that you need to know in order to call that subroutine from within other code, and if that subroutine has been written by another part – for example those in the Standard Library– the signature may be the only information about the subroutine available to the programmer. Strictly speaking Main routine technically has a signature, but it is always the same, and is never called by other code, so it is not usually of interest.

## Body

The body of a subroutine in Elan consists of all the code between the Signature and the ending delimiter. A general principle in programming is that of 'separating the interface from the implementation'. In the case of a subroutine, the Signature defines the interface and the body defines the implementation.

## Keyword

[complete list]

## Static typing

## Parameter

A parameter defines a value to be passed into a Procedure or Function and for use within it.

## Argument

Programmers sometimes use the terms *parameter* and *argument* interchangeably, the two words really represent two different perspectives on the same thing.

When a Function, or Procedure that defines parameters, is called, the calling code must supply arguments: values to be passed in to the a Function, or Procedure with the call. When the code inside the a Function, or Procedure is executed, those values will have been associated with the parameter names defined in the a Function, or Procedure's signature.