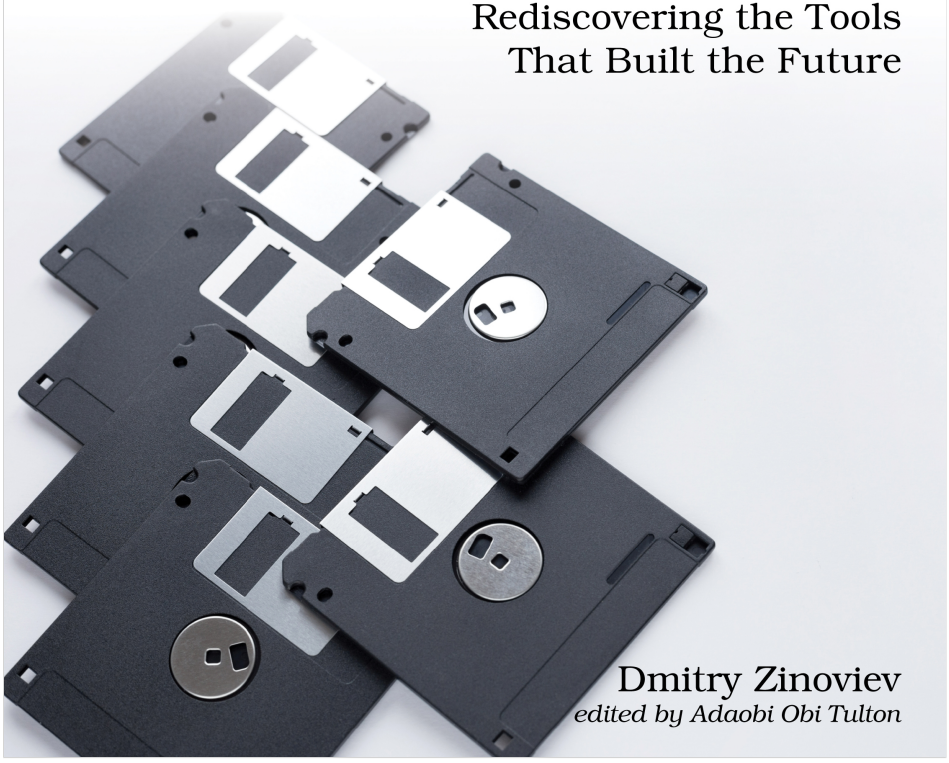
The Pragmatic Programmers

Seven Obscure Languages in Seven Weeks

Rediscovering the Tools That Built the Future



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This chapter offers you a gift. Instead of one obscure language, it gives you two: Simula and ALGOL, because Simula is ALGOL in disguise (specifically, Simula-67 is a superset of ALGOL-60). Beyond OOP, Simula's origins in simulation will introduce you to coroutines and discrete event modeling, enabling you to simulate complex systems—a skill increasingly crucial in data-driven decision-making.

But do not get too excited yet: ALGOL had a massive influence on computing in general and specifically on programming languages, but, forgotten for any practical purpose, it is remarkably boring.

ALGOL is the second oldest programming language, designed in 1958 as a direct successor to FORTRAN. Its antiquated features are a clear reminder of its roots in the early days of computing. ALGOL is characterized by its heavy syntax, reliance on `GOTO` statements, a clear divide between functions and procedures, lack of dynamic memory allocation, and compatibility with punch cards rather than files.

Such shortcomings, among others, must have prompted the emergence of Simula between 1962 and 1967. Simula stepped in to supplant ALGOL, absorbing its core components while enhancing its capabilities. Developed initially for CD 3300, it was soon ported to CD 3600, CD 6600, UNIVAC 1108, IBM 360/370, and other computer systems.

It's ALGOL!

Boring or not, ALGOL is Simula, and you cannot learn one without learning the other. Let's start with the traditional "Hello, world!" chant to illustrate using comments and compound statements.

simula/hello.sim

```
% A comment
! Another comment ;
BEGIN
   OutText("Hello World!");
   COMMENT One more comment ; Outimage;
END of Program
```

An unterminated comment begins with `%` and extends to the end of the line. Terminated comments begin with `!` or `COMMENT` and extend to the first semicolon because both are statements, and statements must always conclude with a semicolon. Everything after the `END` clause to the end of the line is ignored, too.

A *compound statement* is a sequence of single or other compound statements wrapped in `BEGIN` and `END` clauses. It can be utilized in any situation where a

single statement would be expected. A Simula program is typically one compound statement.

Compound Statements

Simula compound statements correspond to the C/C++/Java compound statements enclosed in curly braces {} or Python blocks indented by the same amount.

ALGOL-60 and Simula are case-insensitive languages. As a convention, consider typing keywords in uppercase letters and identifiers in mixed-case letters for better readability and consistency.

Glancing at Variables, Data Types, and Operators

A variable must be declared at the beginning of the statement in which it is used before any executable statement (such executable statements are called "sentences"). A declaration (or a "qualification," as it is known in the original Simula documentation) includes the name and the data type.

The set of primitive data types in Simula is almost "standard" for its time. It has `INTEGER` numbers (`26`, `-12`), `REAL` numbers (`3.14159`, `2E-8`), `BOOLEAN` constants (`TRUE` and `FALSE`), and EBCDIC `CHARACTER` (`'*'`). Explicit type conversion is not supported.

Operators in Simula generally behave as you would expect. Many operators come in two forms: "classical" ALGOL-60 (with non-EBCDIC characters) and "modern" (only with EBCDIC/ASCII characters). The arithmetic operations include addition (+), subtraction (-), multiplication (× or *), division (/), integer division (÷ or //), and exponentiation (↑ or **).

Logical operators encompass the following: greater than (>), less than (<), less than or equal to (≤ or <=), greater than or equal to (≥ or >=), inequality (≠, ¬=, or <>; compares values), reference inequality (=/=; compares references), equality (=; compares values), and reference equality (==; compares references).

The language also includes the following relational operators: negation (¬ or `NOT`), conjunction (∧ or `AND`), disjunction (∨ or `OR`), implication (⊃ or `IMP`, this is interpreted as "B follows from A" or "NOT A OR B"), and equivalence (≡ or `EQV`, which is the same as NXOR).

Comparison

Operators = and <> correspond to Python language operators == and !=. Operators == and =/= correspond to Python language operators `is` and `is not`.

Characters

Simula characters are enclosed in single quotes. A few procedures are provided to convert them to and from integer character codes and to test their associations with character classes.

- rank(c): Returns the integer character code (*cf.* ord(c) in Python).
- char(n): Returns the character that corresponds to the code n (*cf.* chr(n) in Python).
- digit(c): Returns TRUE if c is a decimal digit.
- letter(c): Returns TRUE if c is a letter (according to the local definition of letters).

Text Objects and Operations

Simula offers two additional data types specific to its structure: REF and TEXT. The REF type is a reference to an object, denoted as NONE if no object is referenced. The TEXT type is used for text strings—for example, "Hello, world!". When not initialized, its value is NOTEXT.

A Simula reference is an alternate identifier for an existing object. An instance of the TEXT type is a reference to a compound object—a *text descriptor*.

Unlike the languages we remember, Simula treats text not as a character array but as a memory file. The text descriptor contains information about the text area (text buffer), including its memory address, size, and current position within the text (it starts at 1). Typically, this position points to the first uninitialized character, but you can reposition it as desired. If T is a text, then Integer T.Pos returns its current position, T.SetPos(n) sets the current position to n, Integer T.Length returns the text area size, and Boolean T.More checks if the position is at the end of the text area.

In Simula, there are two methods to create a text object:

- By allocating a blank space-initialized text area of size n with the procedure Blanks(n) and then initializing by assigning a literal string, or
- By copying a literal string s with the procedure Copy(s).

Note that Simula has two assignment operators: ":=" is used for value assignment, and ":-" is used for reference assignment.

```
TEXT t1, t2;
t1 :- Blanks(10);     ! Reference assignment ;
t1 := "Hello,";       ! Value assignment ;
```

```
t2 :- Copy("World!"); ! Reference assignment ;
```

Several procedures can be utilized to manipulate texts in Simula, including:

- T.GetChar: Returns the current character and advances the current position.
- T.PutChar(c): Inserts the character c at the current position and advances the current position.
- T.Sub(p,n): Creates a subtext of length n, starting at the position p.
- T.Strip: Eliminates white spaces (blanks) at the end of text area.
- T.GetInt: Interprets the text as an integer number.
- T.GetReal: Interprets the text as a real number.
- T.PutInt(n): Appends an integer number n.
- T.PutFix(n,w): Appends an integer number n of a fixed width w.
- T.PutReal(n,w): Appends a real number n of a fixed width w.

As an example, the following code fragment greets the author. It allocates a 64-character text area, copies the greeting, appends the author's initials, removes unused characters, and displays the results.

simula/greet.sim

```
BEGIN
   TEXT txt;
   txt :- Blanks(64);
   txt := "Hello, ";
   txt.SetPos(8); ! Skip over the greeting! ;
   txt.PutChar('D');
   txt.PutChar('Z');
   txt :- txt.Strip; ! Remove the trailing blanks ;
   OutText(txt);
   OutText("!");
END;
```

If cim is installed on your system, you can compile and run the program as follows:

```
/home/dzseven> cim greet.sim
Compiling greet.sim:
gcc -g -O2 -c greet.c
gcc -g -O2 -o greet greet.o -L/usr/local/lib -lcim
/home/dzseven> greet
Hello, DZ!
```

Arrays

Simula arrays are static and optionally multidimensional. The type, size, index ranges, and number of dimensions of an array must be declared at the time of programming. Indices can start from any value, not limited to 0 or 1. Array elements can be accessed and modified using parentheses notation.

```
INTEGER ARRAY age, weight(0:16); ! A vector of length 17 ;
CHARACTER ARRAY chess(1:8,1:8); ! A 2D array 8×8 ;
age(0) := 16;
chess(1,1) := 'Q';
```

Simula performs a runtime index check and will terminate your program if an index is out of bounds.

Arrays

Simula arrays are comparable to Fortran arrays and statically declared C arrays.