
Extra
01
CST8152
Compilers

Algonquin College

Computer Engineering Technology

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Fall, 2023

Extra 01

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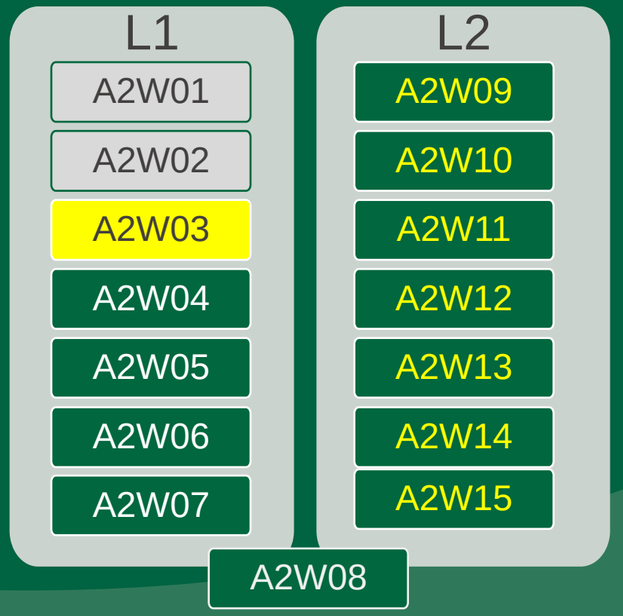
A11-A12: New languages

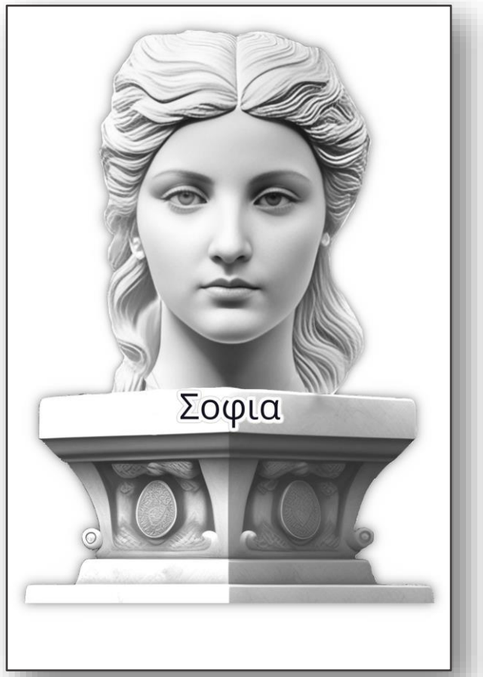
New Compiler Specification



Ex1: Sofia Language

In the Lecture Notes:

- **Appendixes 1-4:**
  - **Appendix 1: Go/DSL** examples
    - Tip: Check similarities and differences with original Python language.
  - **Appendix 2: Sofia** initial models (to be used in A21)
  - **Appendix 3: Sofia** ILS: Informal language spec.
    - Tip: Check how basic elements are defined in the language.
  - **Appendix 3: Sofia** BNF (to be used in A31).



Ex1: Sofia Language

Learning by Example

- **Show your examples:** Anyone (including you) can learn by examples:

```
# Sofia Hello #
  main& {
      data { }
      code {
             print&('Hello World!');
       }
}
```

```
# Sofia Example (Volume of a sphere) #
main& {
      data {
            real PI%, r%, Vol%;
      }
      code {
            PI% = 3.14;
            input&(r%);
            Vol% = 4.0 / 3.0 * PI% * (r% * r% * r%);
            print&(Vol%);
      }
}
```

Compilers – Week 3

Additional Examples

Ex2: “Brazil” language

- Basic datatype:
  * Integers:
    - Using hexadecimal signed values
    - Ex: LITERAL / CONSTANTS (2 bytes):

      $(0000)_{16}$ $(0)_{10}$ ... $(FFFF)_{16}$ $(65535)_{10}$.

    - *Remember: Hex: 0=0... , A=10, ... F=15*
- Variables (only using 16 Registers):
    - R0...RF (Registers: R_n, n=0...F)
    - Note: They use the prefix ‘@’ $(0040)_{16}$

Ex2: “Brazil” language

- Comments (single line):
    * Starts with # = $(0023)_{16}$
- Basic operations:
    * Input / Output:
        * SC (CodOp = 1): Scan: keyboard (to a register)
        * DP (CodOp = 2): Display: screen
    * Memory manipulation:
        * LD (CodOp = 3): Load (register / constant)
        * ST (CodOp = 4): Store (register)

Ex2: “Brazil” language

* Operations:
    * Arithmetic:
        * AD (CodOp = 5): Integer Addition
        * SU (CodOp = 6): Integer Subtration
        * MU (CodOp = 7): Integer Multiplication
        * DI (CodOp = 8): Integer Division
    * Logical:
        * AN (CodOp = 9): And operator
        * OR (CodOp = A): Or operator
        * NT (CodOp = B): Not operator

Ex2: “Brazil” language

* Functions:
    * BF: (CodOp = C): Beginning of Function
    * EF: (CodOp = D): End Function with return value (0000 = NULL)
    * Syntax:
        * Names: using ‘_’ for function names: $(005F)_{16}$
        * Scope: Using “:” $(003A)_{16}$ and finishing with EF.
        * Template:

```
BF _FUNCNAME_ PARAM_LIST:
    #COMMANDS
EF REG
```

Ex2: “Brazil” language

* Extra commands (controls):
    * ST: (CodOp = 0): Start Operation (beginning of program)
    * LF: (CodOp = E): Load function (returning value to a specific reg)
        - Syntax: **LF** RET _FUNCNAME_ PARAM_LIST
    * HT: (CodOp = F): Halt (end of execution).

NOTE:
In this hypothetical language, functions have indexes to label their names (until 15). The main program (not named) uses the index 0.

Ex2: “Brazil” language

- Examples:

  * Attribution:

```
LD R0
ST 0001
```

Intermed. rep.:

```
3 @0
4 0001
```

Binary:

```
01101000
1000001
```

  * Functions samples (note the indexes):

```
BF _ADD_ R0 R1:
LD R0
AD R1
ST R2
EF R2
```

Intermed. rep.:

```
# Func Index
1: _ADD_
# Representation:
C 1 @0 @1
3 @0
5 @1
4 @2
D @2
```

Ex2: “Brazil” language

- Examples:

  * Functions samples:

```
BF _MULTBYTWO_ R1:
LD R1
MU 0002
ST R1
EF R1
```

  # Intermed. repres:

```
# Func Index
2: _MULTBYTWO_
# Representation:
C 2 @1
7 0002
5 @1
4 @1
D @1
```

Ex2: “Brazil” language

- More fictional examples:

* Hello World:

```
# Func 3
BF _HELLO_:
DP 48 # Letter H
DP 45 # Letter E
DP 4C # Letter L
DP 4C # Letter L
DP 4F # Letter O
EF 00
```

* Invoking function:

```
ST
LF 00 _HELLO_
HT
```

Ex2: “Brazil” language

- Invoking functions:

* Sphere Volume:

```
# Func 4
BF _VOLUME_ R0:
LD R0
MU R0
MU R0
MU 0004
MU 7AAB # 31400
DI 7530    # 30000
ST R0
EF R0
```

* Invoking:

```
ST
SC R2
LF R3 _VOLUME_ R2
DP R3
HT
```

Open questions…

Any questions, let me know…

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Compilers – Week 3

Thank you for your attention!