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-- Week 2, Activity 5:
-- Change the program to also accept hexadecimal numbers, in the format usually
-- used by other programming languages. Make sure to accept both upper and
-- lower-case letters, both for the initial "X" and for the hex digits (Once you
-- match the numeral, you can use the Lua function tonumber directly on it).
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local lpeg = require "lpeg"
local pt = require "pt"
local loc = lpeg.locale()
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-- FRONTEND: PARSER
-- Our frontend is a parser that gets a source code as input and produces an
-- intermediate representation of the program in an AST
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-- Initial patterns:
local spc = loc.space^0
local vazio = -lpeg.P(1)
local sinal = lpeg.S("+^-")^-1
local hexdig = lpeg.R("AF", "af", "09")
local hexpre = lpeg.P("0") * lpeg.S("Xx")
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-- Function that get's a number and return a node of AST
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function node(numero)
    return {
        tag = "numero",
        val = numero
    }
end
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-- What is a number? Note that an AST node is returned
local decnum = ((sinal * loc.digit^1) / tonumber) / node * spc
local hexnum = ((hexpre * hexdig^1) / tonumber) / node * spc
local numero = spc * (hexnum + decnum) * spc
```

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-- The parser per si:
local function parse(input)
    return numero:match(input)
end
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-- BACKEND: CODE GENERATOR
-- Our backend is a code generator that get's an AST and generate the final
-- output of the compiler
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-- The compiler per si:
local function compile(ast)
    if ast.tag == "numero" then
        return {"push", ast.val}
    end
end
```

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-- INTERPRETER
-- Receives the intermediate code produced by the compiler and empty stack and,
-- when finished, leaves the result of the expression on the top of the stack.
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-- The interpreter:
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local function run(code, stack)
    local pc = 1                -- program counter
    local top = 0               -- top of stack
    while pc <= #code do
        if code[pc] == "push" then
            pc = pc + 1
            top = top + 1
            stack[top] = code[pc]
        else
            error("unknown instruction")
        end
        pc = pc + 1
    end
end

-- Tests:
-- Get's the source code (only a number for now):
local input = io.read("a")

-- The frontend (parser) generates as AST:
local ast = parse(input)
print(pt.pt(ast))

-- The backend (code generator) compiles AST to intermediate code:
local code = compile(ast)
print(pt.pt(code))

-- We run the interpreter passing as arguments the intermediate code and AST:
local stack = {}
run(code, stack)
print(stack[1])
```