Functional Programming

Ionut G. Stan - OpenAgile 2010

Functional Programming

- what
- why
- how

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- how

What is FP

- a programming style

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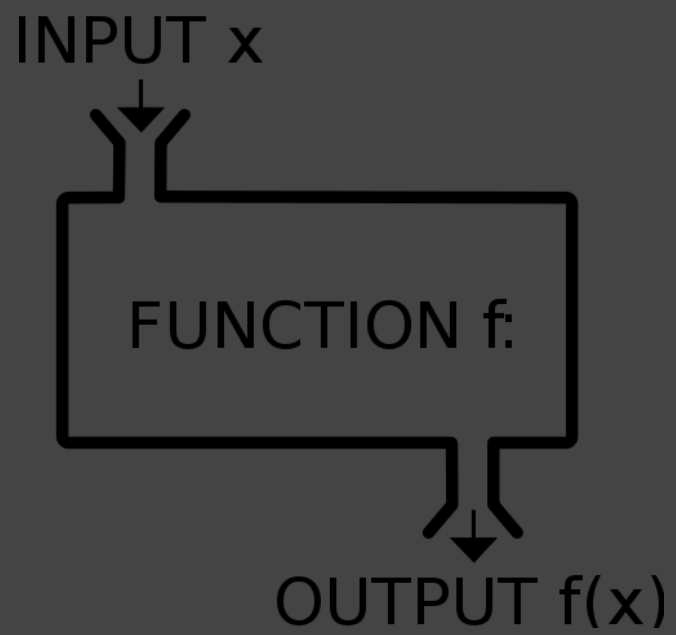
- math function: input completely determines the output



Imperative Programming

- programming: telling a computer what to do

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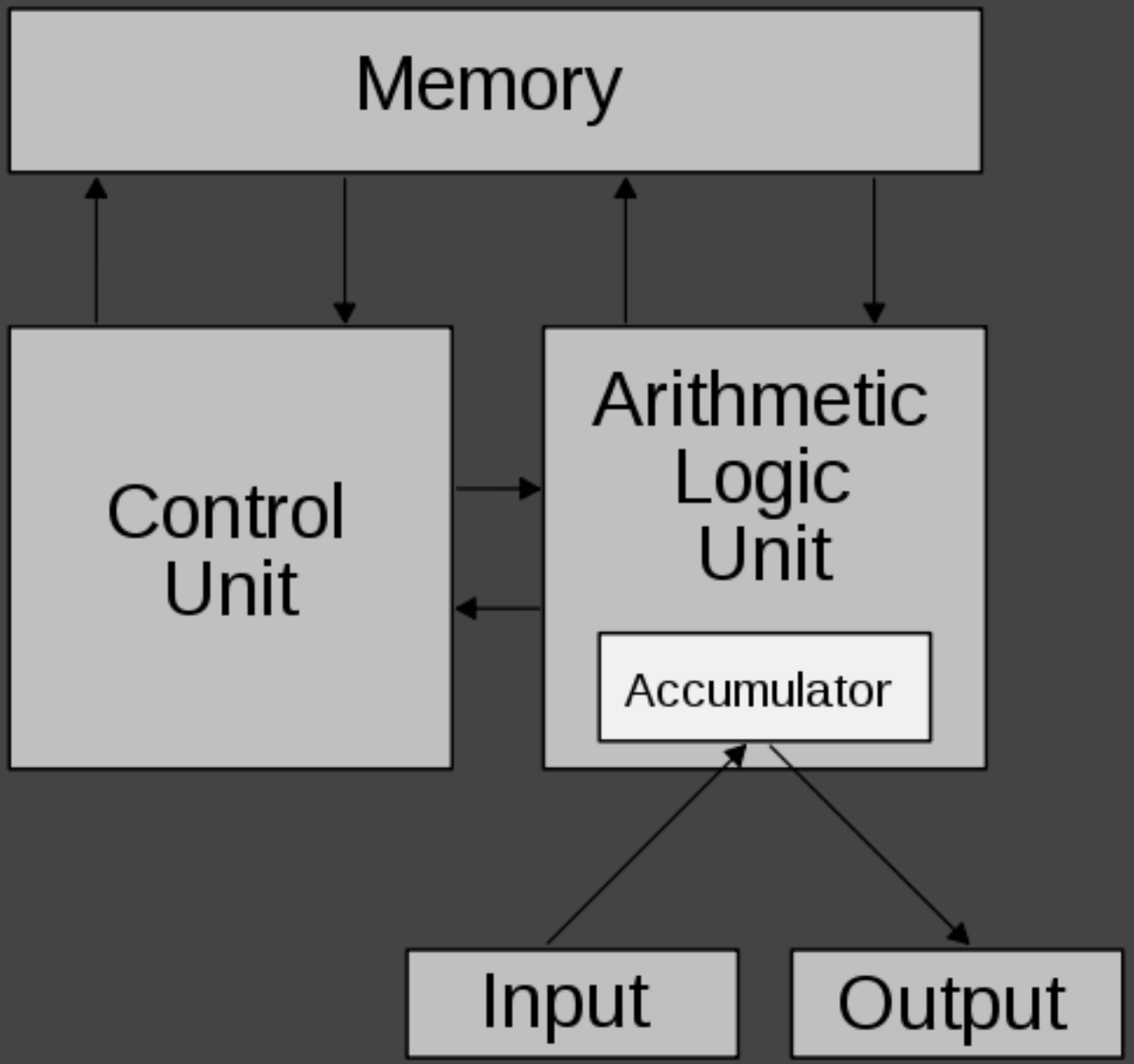
von Neumann architecture



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- von Neumann architecture is about modifying the state of the computer
- computation model in imperative languages reflects von Neumann architecture
- imperative programming: what and how to do

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- execution order is not guaranteed

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- heisenbugs
- race conditions
- off by one errors
- objects trashing another object's internal state

Why FP

- easier to reason about programs

```
// does this program terminate?
var n = 0;

while (--n) {
    n++;
}
```

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- program correctness proving

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- easier to parallelize
- program correctness proving
- composability results in greater and easier reuse

Just for fun - reuse in OO languages

"You wanted a banana but what you got was a gorilla holding the banana and the entire jungle."

Joe Armstrong, creator of Erlang

```
Jungle jungle = new Jungle();
Banana banana = jungle.getGorilla().getBanana();
```

Why FP

- easier to reason about programs
- easier to parallelize
- program correctness proving
- composability results in greater and easier reuse
- try out new perspectives

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- at least keep them as private as possible in OO
- treat variables as immutable (constants/final)
- return values (output) based on params (input) only
- play with a functional language

Functional Programming

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- example

Example

```
// imperative JavaScript
var sum = function (list) {
    var length = list.length;
    var total  = 0;

    while (length--) {
        total += list[length];
    }

    return total;
};
```

Example

```
// functional JavaScript
var sum = function (list) {
    return list.length === 0                    // base case
          ? 0
          : list[0] + sum( list.slice(1) ); // recursive rule
};
```

Example

```haskell
-- Haskell using pattern matching
sum :: [Int] -> Int
sum []           = 0                    -- base case
sum (first:rest) = first + sum rest -- recursive rule
```

"Conventional programming languages are growing ever more enormous, but not stronger. Inherent defects at the most basic level cause them to be both fat and weak: their primitive word-at-a-time style of programming inherited from their common ancestor -- the von Neumann computer, their close coupling of semantics to state transitions, their division of programming into a world of expressions and a world of statements, their inability to effectively use powerful combining forms for building new programs from existing ones, and their lack of useful mathematical properties for reasoning about programs."

John Backus, known for Fortran, Algol and BNF

Thank You

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Questions?

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