

workshop

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computation

compute *putare*

- ▶ to cleanse, to trim
- ▶ to settle, to value, to judge, to think

program *πρόγραμμα*

- ▶ edict, decree, commandment

function *functio*

- ▶ performance, execution

what type of functions is a computer program?

machines

μαθηματικός

-- *euclid's algorithm*

`gcd` $a \ 0 = a$

`gcd` $a \ b = \text{gcd } b \ (\text{mod } a \ b)$

turing machine

- ▶ turing tarpit

lambda calculus

- ▶ alonzo church
- ▶ alan turing
- ▶ haskell curry

imperative

- ▶ von neumann architecture

mess of complexity

- ▶ mutable states (combinatorics)
- ▶ concurrency, resource management (space)
- ▶ asynchronous interaction (time)
- ▶ code base (human)

solution

- ▶ lambda the ultimate¹

¹<http://lambda-the-ultimate.org/papers>

lisp

born in 1958

- ▶ scheme, topos, fibred category (alexander grothendieck)
- ▶ monad (roger godement)
- ▶ adjoint functor, limit (daniel kan)
- ▶ lisp (john mccarthy)

mccarthy 1960²

- ▶ recursive functions
- ▶ symbolic expressions
- ▶ symbolic representation for recursive functions
- ▶ recursive evaluation of symbolic expressions

²<http://jmc.stanford.edu/articles/recursive.html>

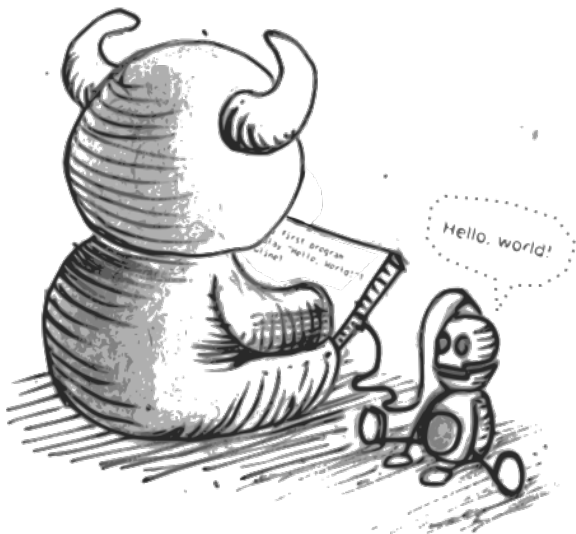
lisp family³

- ▶ 1975 scheme
- ▶ 1984 common lisp
- ▶ 2007 clojure

1980s ai winter

- ▶ the fall of lisp machines
- ▶ the free software foundation, the gnu project, gnu emacs, emacs lisp (richard stallman)

³https://en.wikipedia.org/wiki/List_of_Lisp-family_programming_languages



⁴<https://www.gnu.org/software/guile/>

clojure

- ▶ creator and bdf: rich hickey

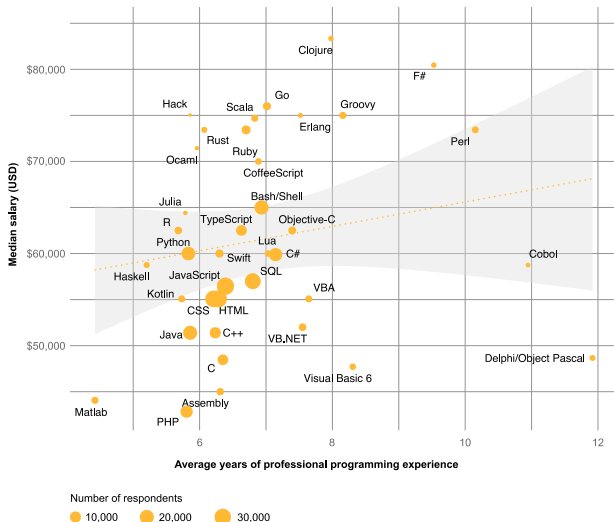
hosts

- ▶ `clojure`: jvm
- ▶ `clojurescript`: javascript
- ▶ `(clojureclj: clj)`

build tools

- ▶ leiningen
- ▶ boot

2018 survey⁵



⁵<https://insights.stackoverflow.com/survey/2018>

clojure ide

- ▶ emacs ([cider](#))

miscellaneous

- ▶ vim ([fireplace](#))
- ▶ intellij ([cursive](#))
- ▶ visual studio code ([clojurevscode](#), [calva](#))
- ▶ atom ([proto repl](#))
- ▶ sublime text ([sublimerepl](#))
- ▶ eclipse ([counterclockwise](#))
- ▶ [light table](#) (written in clojurescript)
- ▶ [nightcode](#) (written in clojure)

closure intro

process philosophy

heraclitus, plato, ... , alfred whitehead

- ▶ λόγος word
- ▶ πάντα ῥεῖ everthing flows
- ▶ ὁδὸς ἄνω κάτω the way up and down
- ▶ πυρὸς τροπαὶ the turnings of fire
- ▶ δίκη ἔρις strife is justice

that which always was and is and will be everlasting fire
... all is exchanged for fire and fire for all

summary

functional programming

- ▶ sets you free by giving you control over the turnings of fire
- ▶ solves complexity by compositionality

computational trinitarianism

- ▶ logic (proof theory)
- ▶ lambda calculus (type theory)
- ▶ category theory

the second coming — william butler yeats

*turning and turning in the widening gyre
the falcon cannot hear the falconer;
things fall apart; the centre cannot hold;
mere anarchy is loosed upon the world,
the blood-dimmed tide is loosed, and everywhere
the ceremony of innocence is drowned;
the best lack all conviction, while the worst
are full of passionate intensity.*

the second coming — william butler yeats

*surely some revelation is at hand;
surely the second coming is at hand.
the second coming! hardly are those words out
when a vast image out of spiritus mundi
troubles my sight: somewhere in sands of the desert
a shape with lion body and the head of a man,
a gaze blank and pitiless as the sun,
is moving its slow thighs, while all about it
reel shadows of the indignant desert birds.
the darkness drops again; but now i know
that twenty centuries of stony sleep
were vexed to nightmare by a rocking cradle,
and what rough beast, its hour come round at last,
slouches towards bethlehem to be born?*