Stak Scheme

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Overview

- Stak Scheme
  - There is a typo. (no "c")
  - https://github.com/raviqqe/stak
- Scheme runs on a machine stack.
  - No `std` and no `alloc`
- Compiler written in Scheme + VM written in Rust
- Based on Ribbit Scheme
  - Stak VM does not pursue portability.
  - The VM is specialized for implementation in system programming languages.

Virtual Machine (VM)

- Stack machine
- Von Neumann architecture (?)
  - All bytecodes, stack, heap objects are on VM heap.
- Written in Rust
- No `unsafe` so far

Virtual Machine (VM)

State

- Program counter
  - Points to bytecodes running currently
- Stack
  - Represented as a list
- Symbols
  - Represented as a list of pairs
- Heap (as an unboxed array)
  - If someone wants to run a VM on actual heap, they can simply box it with, for example, `Box::new()`.

Bytecodes

- Mostly borrowed from Ribbit Scheme
- Represented as lists
- Core instructions
  - `call`: Procedure calls
  - `set`: Set global/local variables
  - `get`: Get global/local variables
  - `constant`: Push constants
  - `if`: Branch based on condition values
- Primitives: `rib`, `cons`, `close`, ...

Compiler

Main routine

```
(write-target (encode (compile (expand (read-source)))))
```

- `read-source` reads S-expressions from stdin.
- `expand` expands syntax sugar (e.g. `let`, `letrec`, etc.)
- `compile` compiles S-expressions into bytecodes.
- `encode` encodes bytecodes on memory into bytes.
- `write-target` writes encoded bytecodes into stdout.

What's implemented so far

Syntax

- Function/variable definitions
- Closures
- Binding expressions
  - e.g. `let`, `let*`, `letrec`, ...
- Conditional expressions
  - e.g. `if`, `cond`, `when`, ...
- `begin` block

What's implemented so far

Built-ins

- Arithmetic operations
- Comparison operations
- Boolean operations
- List operations (`car`, `cdr`, `cons`, `map`, `length` ...)
- Continuation (`call/cc`)
- `error`

What's implemented so far

Types

- Signed 63-bit integer
- Boolean
- Pair / Null
- Symbol
- Character
- String
- Vector / Bytevector (as list)
- Procedure

What's implemented so far from the last missed meetup

- `define-syntax`, `let-syntax`, `letrec-syntax`
- Non-hygienic `syntax-rules`
- Efficient representation of argument counts at call sites

Next tasks...

- Hygienic `syntax-rules`
- Quasi-quotation
- Record type
- `write` and `display`
- `read`
- `cond-expand`

Summary

- Building Scheme is fun.

References

- Ribbit Scheme
- R7RS