

# CScript: Implementing C in JavaScript

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CScript is ...

- An educational tool for learning programming in C
- A *mostly* specification compliant implementation of C in JavaScript
- An interesting project in compiler/interpreter design

# Why?

Learning to program online:

- [tryruby.org](http://tryruby.org)
- [codecademy.com](http://codecademy.com)
- Nothing for learning C interactively

I need to teach high school students a C based language.

Available options:

- Deal with platform differences
- Learn an IDE first
- Build an interactive tool

# Implementing C: The Toolbox

- Parser generators
  - CFG vs. PEG
  - Jison vs PEG.js
- Continuations
  - Continuation Passing Style
  - Compiling with continuations
  - CESK machine
- Compiler vs. Interpreter

## Context Free Grammars

- Bison/Yacc/Jison
- Happy

## Parsing Expression Grammars

- PEG.js
- Pappy

# Parser Generator Syntax

## Context Free Grammars

```
add_expr
  : cast_expr
  | add_expr + mult_expr
  | add_expr - mult_expr
```

## Parsing Expression Grammars

```
add_expr
  = cast_expr ("+" mult_expr)*
  / cast_expr ("- " mult_expr)*
```

## Context Free Grammars

- Bottom up parsing
- LR, LALR algorithms
- Ambiguity
- Usually require pre-lexed input

## Parsing Expression Grammars

- Top down parsing
- Linear time
- *Unambiguous*
- No need for a lexer
- Problems with left recursion

# PEG: The Good

- Ordered choice eliminates ambiguity
- Left recursion can be eliminated
- Linear time parsing
- The C grammar is easy to adapt to a PEG



# PEG: The Bad

- Rule order matters
  - **do** vs. **double**
- Left recursion elimination can be tricky
  - Can change associativity
- Space use proportional to input
  - The downside to linear time parsing

# Continuations

# Compiler vs. Interpreter

## Compile to JavaScript

- CoffeeScript
- Elm
- Fay

## Interpret in JavaScript

- Various Schemes
- O'Browser: OCaml bytecode interpreter in JavaScript

# Challenges

## Paradigm shift

- C is imperative
- JavaScript is Object-oriented, Imperative, Functional

# The Future

- Finishing the parser
- Building the interpreter/compiler
- Fill in the missing pieces

# Contributing

- CScript is open source and all code is available at [GitHub.com/dfeltey/CScript](https://github.com/dfeltey/CScript)
- I'm very open to suggestions/opinions/contributions
- I hope that CScript could become a valuable learning/teaching tool

# References