

SP2023 Week 12 • 2023-04-13

Esolangs

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Announcements

- PlaidCTF is tomorrow!!!!
 - We will be in-person tomorrow at 7PM



ctf.sigpwny.com

sigpwny{malbolge_supremacy}

I'VE DEVELOPED A
NEW PROGRAMMING
LANGUAGE!

DIDN'T A JUDGE
ORDER YOU TO
STOP DOING THAT?



HIGHER COURT THREW
OUT THE RULING!
I'M BACK, SUCKERS!

DAMMIT.



BUT I PROMISE IT'S
GOOD THIS TIME!
JUST NORMAL CODE.
GOOD CLEAN SYNTAX.
NOTHING WEIRD.

OKAY...



EXCEPT THE ONLY VARIABLE NAME
IS "X." TO REFER TO DIFFERENT
VARIABLES YOU HAVE TO WRITE
"X" IN DIFFERENT FONTS.

I'M CALLING
THE COURT.

MAYBE WE
CAN APPEAL.



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EsoLang



What is an Esolang?

- People thought it would be funny to make a programming language as a joke
 - Have too much time on their hands
- **esolang** : a computer programming language designed to experiment with weird ideas, to be hard to program in, or as a joke, rather than for practical use – esolangs.org



Classic Esolang History

```
DO FORGET expression
ABSTAIN (don't execute the referenc
DO ABSTAIN FROM (label)
or DO ABSTAIN FROM something + some
(as in DO ABSTAIN FROM CALCULATING)
REINSTATE (cancel out an ABSTAIN or
DO REINSTATE (label)
or DO REINSTATE something + somethi
IGNORE (make a variable read-only,
DO IGNORE variable + variable +
REMEMBER (cancel out an IGNORE)
DO REMEMBER variable + variable
```

```
Code: Pseudo code:
>> Move the pointer to cell2
[-] Set cell2 to 0
<< Move the pointer back to cell0
[ While cell0 is not 0
- Subtract 1 from cell0
>> Move the pointer to cell2
+ Add 1 to cell2
<< Move the pointer back to cell0
] End while
```

Number Guessing Game (from 1 to 3)

```
>>v
v1?2v
3
> > >: v
|-&<
$
>"!tcerroC">:v
|,<
@
```

First Esolang: **INTERCAL**

(Compiler Language With No Pronounceable Acronym)

Most Well-Known Esolang: **Brainf*ck**

- Simple plus/minus/move operations

2D Esolang: **Befunge**

- Follow the arrows for control flow
- If statements change the direction of the instruction pointer

There are a *Lot* of Esolangs

- We will be covering the important ones, like AMONGUSISABIGSUSSYBAKAHAHAHAHA
- View a complete list at esolangs.org
- Are not guaranteed to be turing complete

Arch is the best! is a joke language that prints "Arch is the best!" regardless of the program. It has no syntax. It is a joke about the "Arch is the best" project. I use Arch BTW.

- ALPACA
- AIPhAbEt
- AlphaBeta
- Alphabet Stew
- Alphabetti spaghetti
- Alphaprint
- Alphon
- ALPL
- ALT-4
- /æmbi:ɛf/
- Amelia
- AMiaBF'!?
- Among Us
- AMONGUSISABIGSUSSYBAKAHAHAH
- Amycus
- Amycus Severus
- AnalLang
- Analogia
- Analytical Engine Programming Cards
- And
- Andrei Machine 9000
- Andromeda
- Anemone
- ANGL
- Anguish
- Animosian
- ANItka
- AnnieFlow
- Annihilator
- brainbool
- Braincells
- BrainClub
- Braincopter
- BrainCurry
- BrainCurses
- Brainedumbed
- Brainfact
- brainfault
- BrainfishHQ9+
- Brain-Flak
- Brainflop
- Brainfoctal
- Brainfork
- brainfuckconsole74
- brainfuck
- Brainfuck++
- Brainfuck+10
- Brainfuck+3
- Brainfuck--
- brainfuck 4 humans
- Brainfuck Assembly Language
- Brainfuck But With Buffer
- Brainfuck Encoded Concatenative Calculus
- BrainFuckFart
- Brainfuckn't
- Brainfuck Substitutor
- BrainfuckXT
- Brainfuck/w/index.php?title=Talk:Brainfuck/in
- BrainFuck+
- BrainFuck++
- brainfunc
- brainfunct
- BrainFunge2
- Braingolf

Two major types

Stack-Based

- very simple to implement, most esolangs are stack-based
- uses a stack of values, and performs operations on the values

Procedural languages

- more general category of programming languages, typically has variables, loop control, and more
- e.g. C is a procedural language

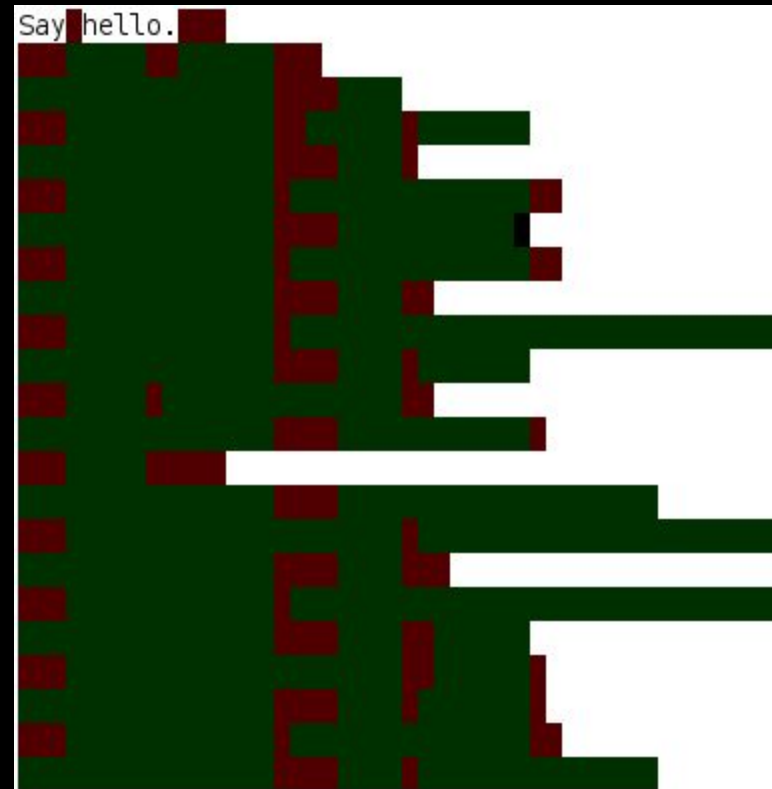


EsoLang Examples



Whitespace

- Each whitespace character is a different operator
- Common CTF language
- Stack-Based



Malbolge

- Designed to be impossible (or at least very hard) to program
- First program written by **brute-forcing** a set of constraints
 - Read this [article](#)
- After each instruction, runs the “Crazy operation”
 - Completely changes the instruction set based on what instruction was just ran

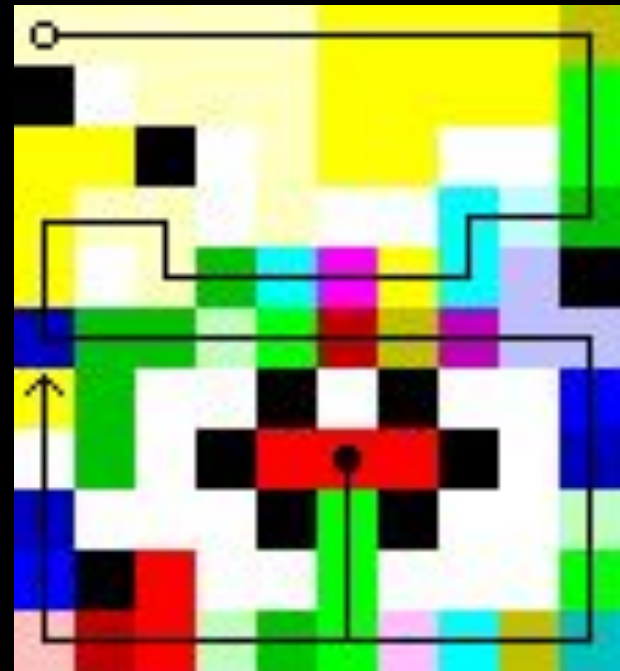
Hello, World! [[edit](#)]

This program displays "[Hello, World.](#)".^[9]

```
(=<`#9]~6ZY327Uv4-QsqpMn&+Ij" 'E%e{Ab~w=_:]Kw%o44Uqp0/Q?xNvL:`H#c#DD2^WV>gY;dts76qKJImZkj
```

Piet

- 2D stack-based programming language
- Pixel difference correlates to which operation is run
- Ran a challenge for UIUCTF 2022 in Piet
 - Challenge: automate reverse-engineering piet programs
 - [Solution](#): trace execution, and reverse program from execution



Shakespeare Programming Language

- Shakespeare ... but you are programming
- **Act / Scene** are GOTO labels
- [...] acts as control flow/operations
- Constants represented by series of words
 - “Positive and neutral nouns have a value of 1 and negative nouns have a value of -1. Any adjective multiplies a noun by 2”

```
A New Beginning.
```

```
Hamlet, a literary/storage device.
```

```
Juliet, an orator.
```

```
Act I: The Only Act.
```

```
Scene I: The Prince's Speech.
```

```
[Enter Hamlet and Juliet]
```

```
Juliet: Thou art the sum of an amazing healthy honest noble peaceful  
fine Lord and a lovely sweet golden summer's day. Speak your  
mind!
```

```
[A pause]
```

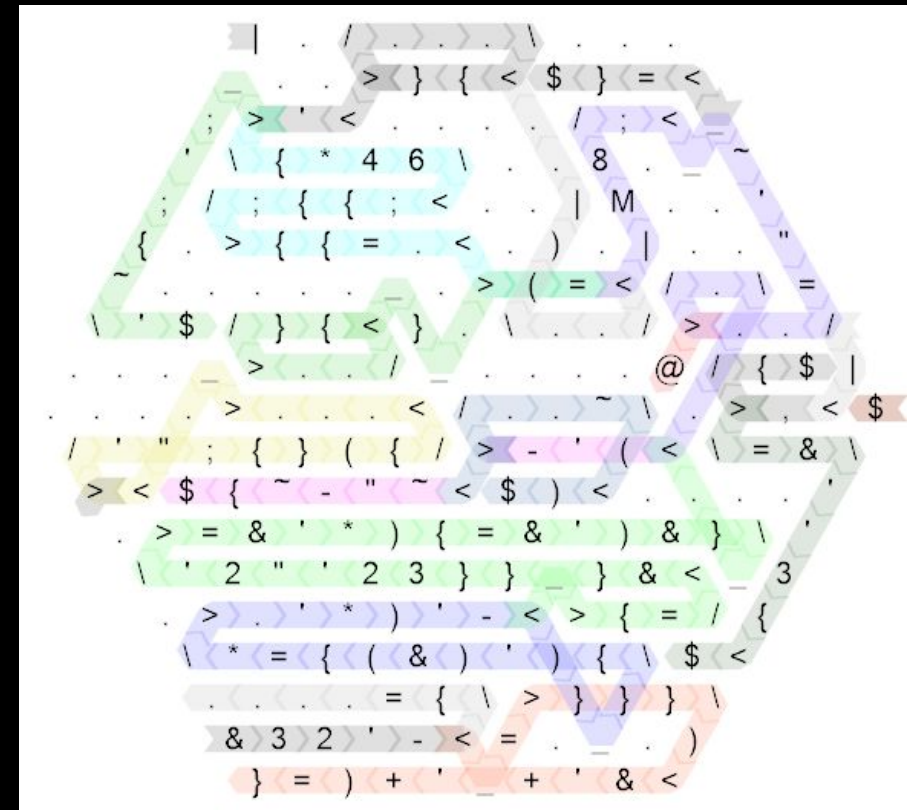
```
Juliet: Thou art the sum of thyself and a King. Speak your mind!
```

```
Thou art the sum of an amazing healthy honest hamster and a golden  
chihuahua. Speak your mind!
```

```
[Exeunt]
```

Hexagony

- 2d grid esolang
- [code golfing writeup](#)
- [HexagonyColorer](#)
- [Online interpreter](#)
- Look at these visuals!



Additional Information

Tips & Usage in CTF



How to identify an esolang

- ... Pretty hard!
- Google-fu for series of operations in the code + “esolang”
- Use lists of esolangs online
- Use the list of popular languages on esolangs.org, or the esolangs.org IRC chat



Meeting Challenge - Identify This

```
HAI 1.3
O HAI IM pile
  I HAS A length ITZ 0
  I HAS A max ITZ -1

HOW IZ I pushin YR item
  DIFFRINT ME'Z max AN BIGGR OF ME'Z max AN ME'Z length, O RLY?
    YA RLY, ME HAS A SRS ME'Z length ITZ item, ME'Z max R SUM OF ME'Z max AN 1
    NO WAI, ME'Z SRS ME'Z length R item

  OIC
  ME'Z length R SUM OF ME'Z length AN 1
IF U SAY SO

HOW IZ I popin
  DIFFRINT ME'Z length AN 0, O RLY?
  YA RLY
    ME'Z length R DIFF OF ME'Z length AN 1
    I HAS A item ITZ ME'Z SRS ME'Z length
    ME'Z SRS ME'Z length R NOOB
    FOUND YR item

  OIC
IF U SAY SO

HOW IZ I gettinLen
  FOUND YR ME'Z length
IF U SAY SO

KTHX
```





https://www.youtube.com/watch?v=CcFv7Nb_51c

- regex language



Next Meetings

2023-04-14 - Tomorrow

- PlaidCTF 2023 starts
- We will be competing in-person, starting at 7PM! (room TBD)

2023-04-16 - This Sunday

- No meeting!
- We'll be finishing PlaidCTF!

2023-04-20 - Next Thursday

- Block Ciphers (AES encryption) with Sagnik!



```
sigpwny{malbolge_supremacy}
```



SIGPwny