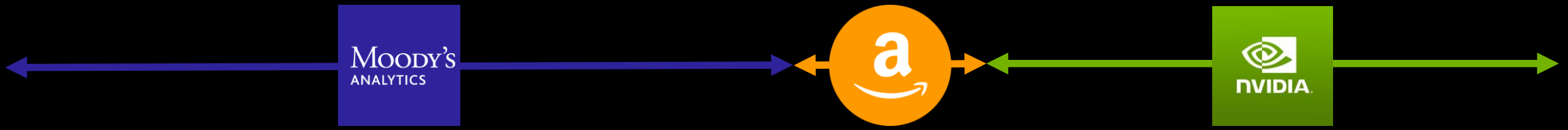
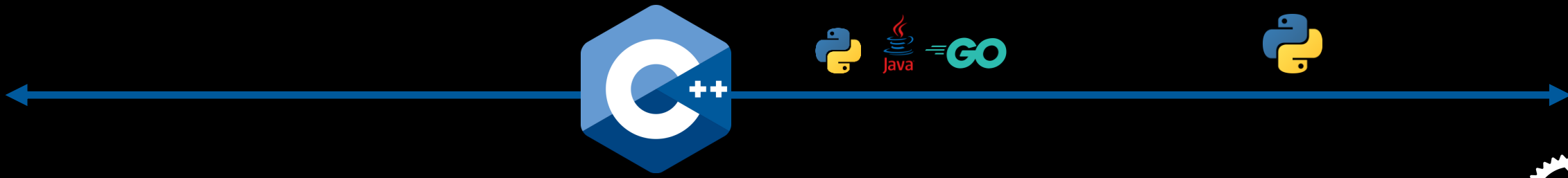
Beautiful Python Refactoring II

Conor Hoekstra

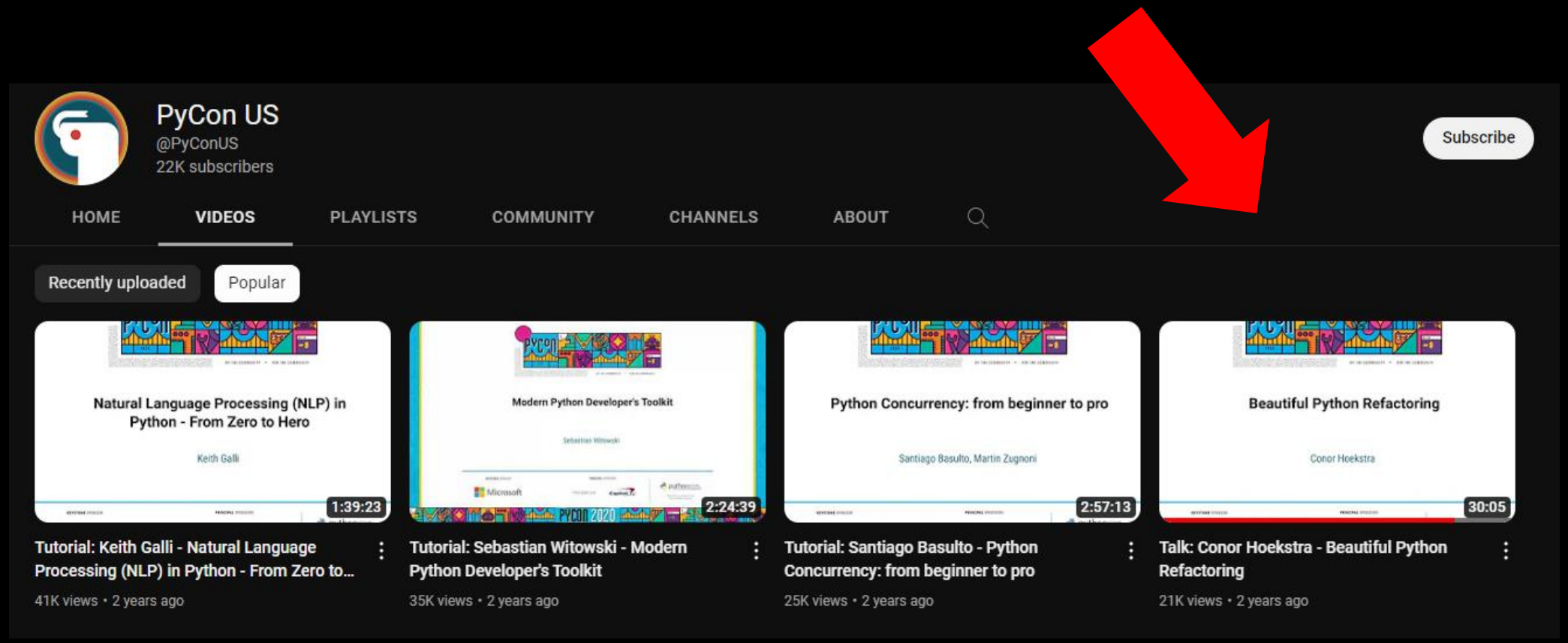
code_report



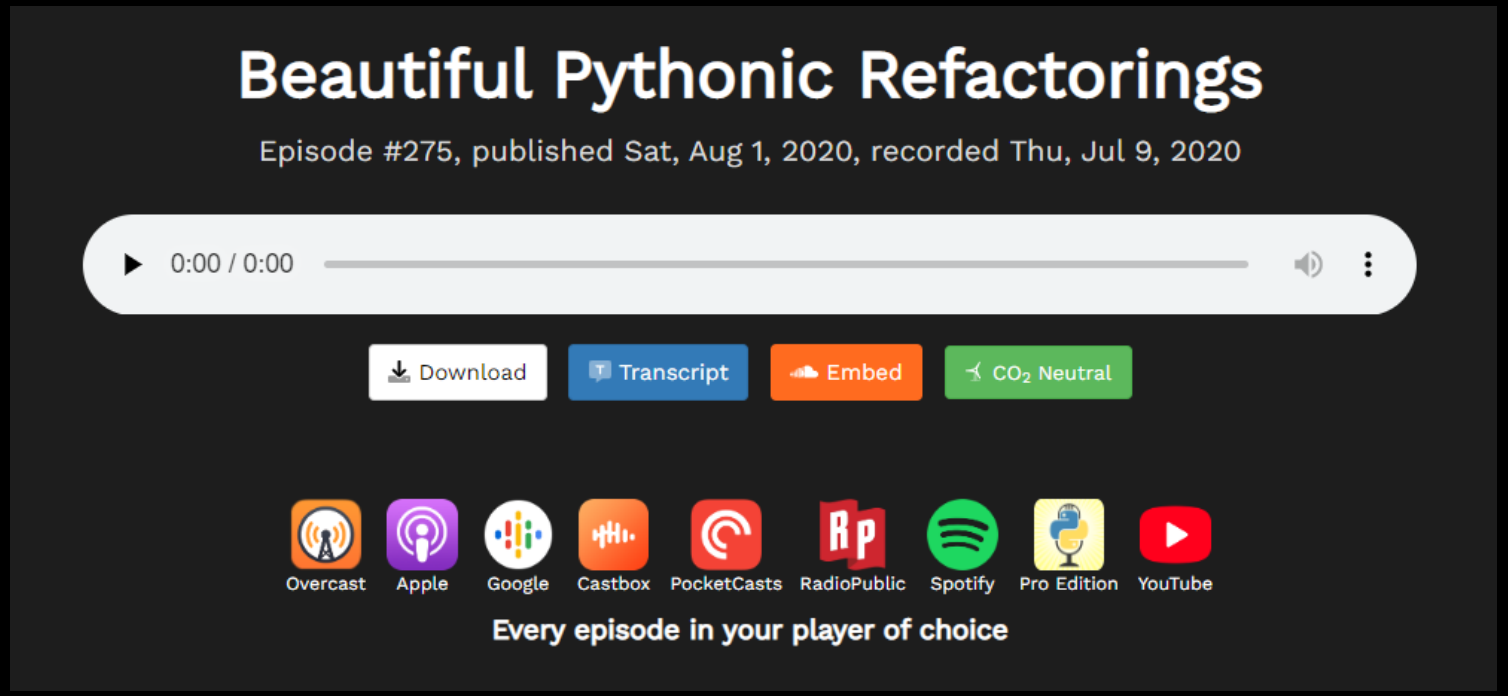


About Me

Conor Hoekstra / @code_report

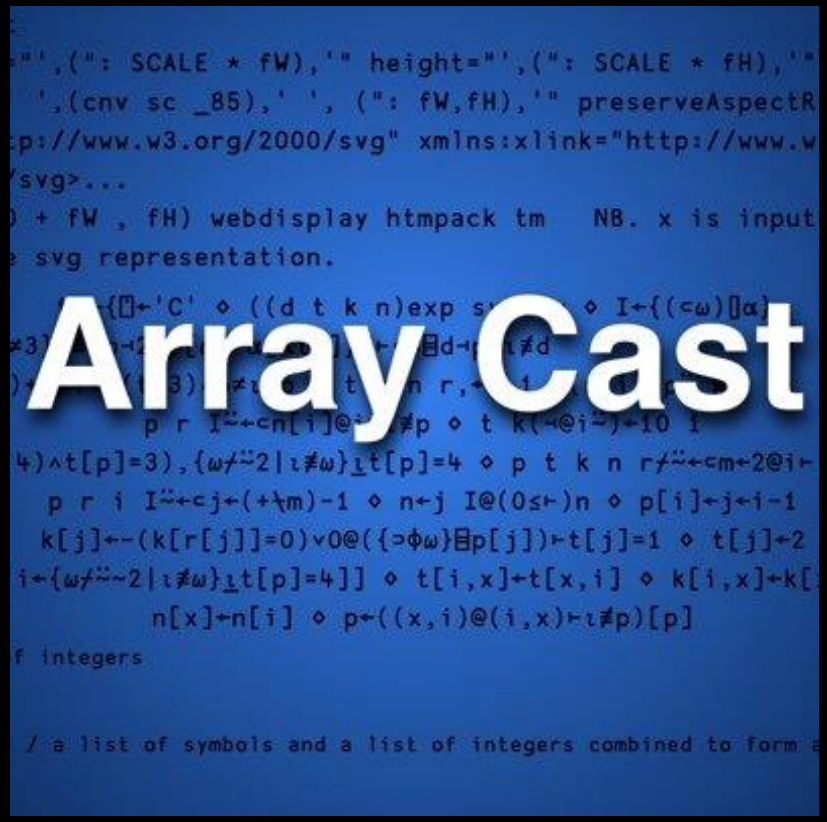


https://youtu.be/W-lZttZhsUY



https://talkpython.fm/episodes/show/275/beautiful-pythonic-refactorings

Algorithms + Data Structures = Programs



I refactored code from a

Blog Post

```
url = 'http://pokemondb.net/pokedex/all'

#Create a handle, page, to handle the contents of the website
page = requests.get(url)

#Store the contents of the website under doc
doc = lh.fromstring(page.content)

#Parse data that are stored between <tr>..</tr> of HTML
tr_elements = doc.xpath('//tr')

#Check the length of the first 12 rows
# [len(T) for T in tr_elements[:12]]

tr_elements = doc.xpath('//tr')

#Create empty list
col = []
i = 0

#For each row, store each first element (header) and an empty list
for t in tr_elements[0]:
    i += 1
    name = t.text_content()
    print('%d:"%s"'%(i, name))
    col.append((name, []))

#Since out first row is the header, data is stored on the second row onwards
for j in range(1, len(tr_elements)):
    #T is our j'th row
    T = tr_elements[j]

    #If row is not of size 10, the //tr data is not from our table
    if len(T) != 10:
        break

    #i is the index of our column
    i = 0

    #Iterate through each element of the row
    for t in T.iterchildren():
        data = t.text_content()
        #Check if row is empty
        if i > 0:
        #Convert any numerical value to integers
            try:
                data = int(data)
            except:
                pass
        #Append the data to the empty list of the i'th column
        col[i][1].append(data)
        #Increment i for the next column
        i += 1

# [len(C) for (title,C) in col]

Dict = {title:column for (title,column) in col}
df   = pd.DataFrame(Dict)

print(df.head())
```


```
url = 'http://pokemondb.net/pokedex/all'

#Create a handle, page, to handle the contents of the website
page = requests.get(url)

#Store the contents of the website under doc
doc = lh.fromstring(page.content)

#Parse data that are stored between <tr>..</tr> of HTML
tr_elements = doc.xpath('//tr')

col = [(t.text_content(), []) for t in tr_elements[0]]

for T in tr_elements[1:]:
    for i, t in enumerate(T.iterchildren()):
        data = t.text_content()
        col[i][1].append(int(data) if data.isnumeric() else data)

Dict = {title:column for (title,column) in col}
df   = pd.DataFrame(Dict)

print(df.head())
```


```python
url = 'http://pokemondb.net/pokedex/all'

page   = requests.get(url)                  # page handle
doc    = lh.fromstring(page.content)        # website contents
tr     = doc.xpath('//tr')                  # html <tr> data
titles = [t.text_content() for t in tr[0]] # column titles

fmt    = lambda data : int(data) if data.isnumeric() else data
cols   = zip(*[[fmt(t.text_content()) for t in T.iterchildren()]
                                      for T in tr[1:]])

Dict   = {title: column for title, column in zip(titles, cols)}
df     = pd.DataFrame(Dict)

print(df.head())
```


```
url = 'http://pokemondb.net/pokedex/all'

header = { "User-Agent": # ...
r      = requests.get(url, headers=header)
df     = pd.read_html(r.text)[0]

print(df.head())
```

enumerate()
list comprehensions
conditional expressions
slicing

I refactored code from a

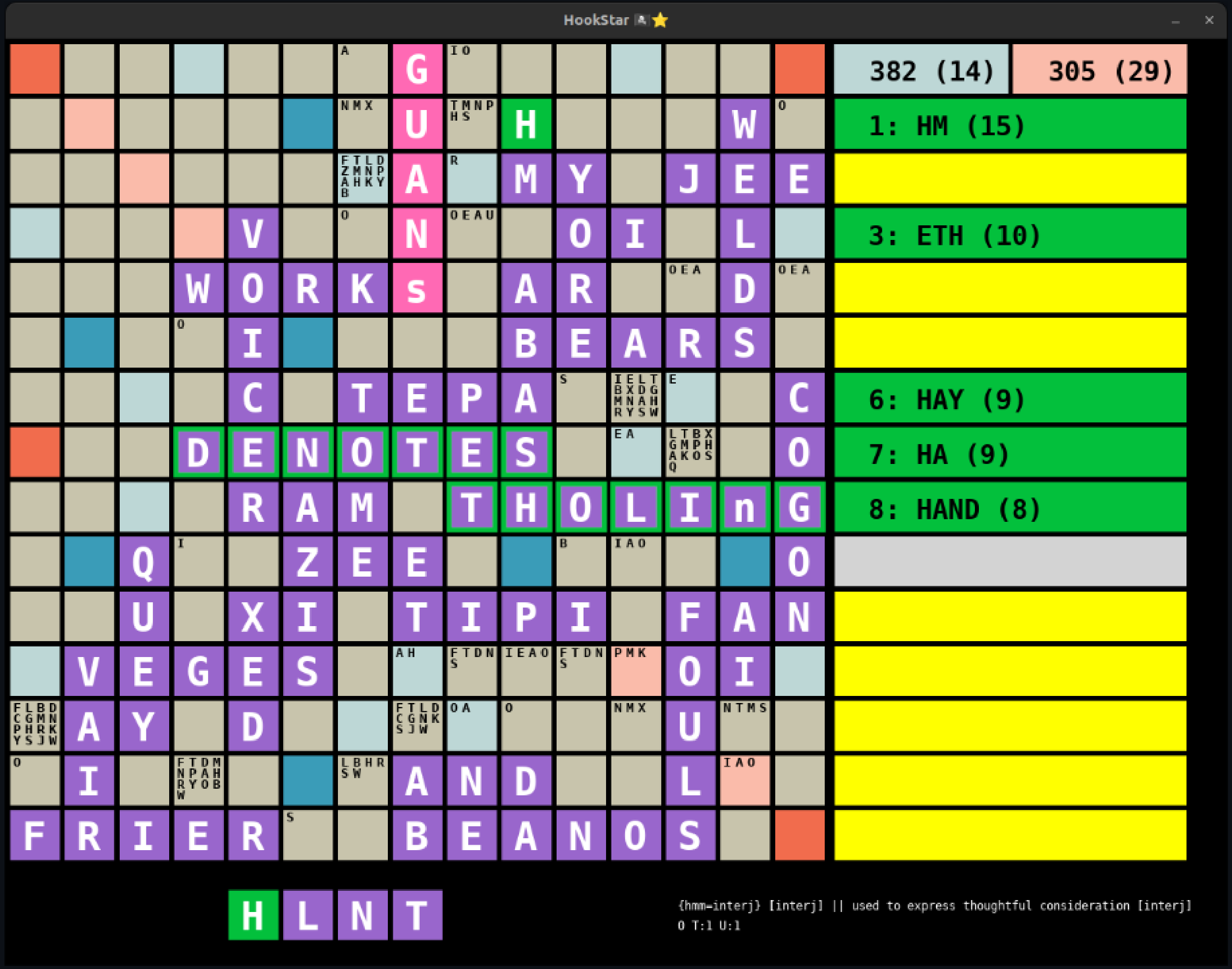
Blog Post

I refactored code from …

README.md

HookStar 🏴‍☠️ ⭐

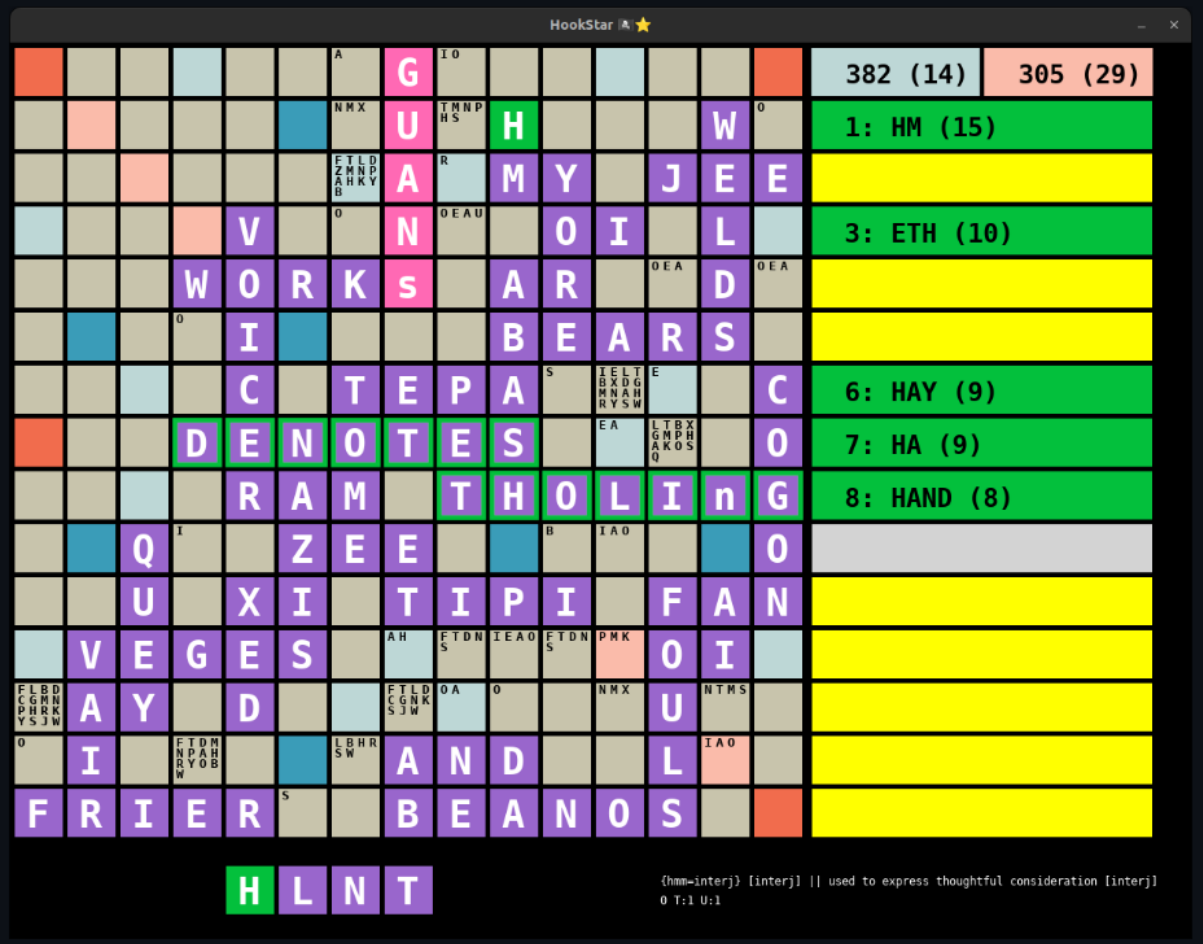
License MIT | Python 3 | Follow 1.3k | Star 4 | @code_report 5.6k



README.md

HookStar

License MIT | Python 3 | Follow 1.3k | Star 4 | @code_report 5.6k



https://github.com/codereport/scrabble


MB
MiltonBradley
Ages 8 to Adult
2 to 4 Players
4034
Deluxe Edition
SCRABBLE
BRAND
CROSSWORD GAME
FEATURES ROTATING GAMEBOARD
WITH TURNTABLE BASE
Deluxe Edition
SCRABBLE
GUIDE BOOKLET
SCRABBLE
CROSSWORD GAME
by Milton Bradley
OFFICIAL SCORE SHEET
PLAYERS
PLAYERS
UNPLAYED TILES*
+ OPPONENTS' TILES**
FINAL TOTAL

Live Demo

Time to Refactor!

https://github.com/codereport/scrabble

https://github.com/codereport/scrabble

https://github.com/codereport/scrabble/commits

https://github.com/codereport/scrabble/commits

Commits on Oct 7, 2022

Add tiles remaining to UI codereport committed on Oct 7	5884e67	<>
REFACTOR: remove duplication codereport committed on Oct 7	5b75f41	<>
REFACTOR: name the algorithm - [::-1].index() codereport committed on Oct 7	b7eb49b	<>
REFACTOR: Replace word_info with Play @DataClass codereport committed on Oct 7	44f91a4	<>
REFACTOR: replace two booleans with Phase enum codereport committed on Oct 7	67d6faa	<>
Move classes/enums around codereport committed on Oct 7	5f68abb	<>
REFACTOR: Position made @DataClass codereport committed on Oct 7	84e868c	<>
Bug fix: showing bingo outline codereport committed on Oct 7	95ebc61	<>
REFACTOR: combine (prefix|suffix)_tiles codereport committed on Oct 7	171db09	<>
REFACTOR: deltas function codereport committed on Oct 7	c8c4aa9	<>
REFACTOR: Make Cursor class codereport committed on Oct 7	37fb0da	<>

Refactor #1

`@dataclass`

84e868c

```python
class Position():
    def __init__(self, dir, row, col):
        self.row = row
        self.col = col
        self.dir = dir
```

```python
class Position():
    def __init__(self, dir, row, col):
        self.row = row
        self.col = col
        self.dir = dir
```

```python
class Position():
    def __init__(self, dir, row, col):
        self.row = row
        self.col = col
        self.dir = dir

    def __lt__(self, other):
        return self.row < other.row

    def __eq__(self, other):
        return self.row == other.row and \
               self.col == other.col and \
               self.dir == other.dir

    def __repr__(self):
        return str(self.tuple())

    def tuple(self):
        return (self.row, self.col, self.dir)
```

```python
@dataclass(frozen=True, order=True)
class Position():
    dir: Direction
    row: int
    col: int
```

```
91
92  - # TODO make immutable
93    class Position():
94  -     def __init__(self, dir, row, col):
95  -         self.row = row
96  -         self.col = col
97  -         self.dir = dir
98  -
99  -     def __lt__(self, other):
100 -         return self.row < other.row
101 -
102 -     def __eq__(self, other):
103 -         return self.row == other.row and \
104 -                self.col == other.col and \
105 -                self.dir == other.dir
106 -
107 -     def __repr__(self):
108 -         return str(self.tuple())
109 -
110 -     def tuple(self):
111 -         return (self.row, self.col, self.dir)
112
```

```
92
93  + @dataclass(frozen=True, order=True)
94    class Position():
95  +     dir: Direction
96  +     row: int
97  +     col: int
98
```

@dataclass in  3.7

Refactor #2

f-strings

d8b1203


HookStar
382 (14)
305 (29)
1: HM (15)
3: ETH (10)
6: HAY (9)
7: HA (9)
8: HAND (8)
H L N T
{hmm=interj} [interj] || used to express thoughtful consideration [interj]
0 T:1 U:1

```
str(render_row) + ": " + play.word + " (" + str(play.score) + ")"
```

```
f"{render_row}: {play.word} ({play.score})"
```

```
f"{render_row}: {play.word} ({play.score})"
```

```
str(render_row) + ": " + play.word + " (" + str(play.score) + ")"
f"{render_row}: {play.word} ({play.score})"
```

```
tiles = ' '.join(a + ':' + str(b) for a, b in ...)
```

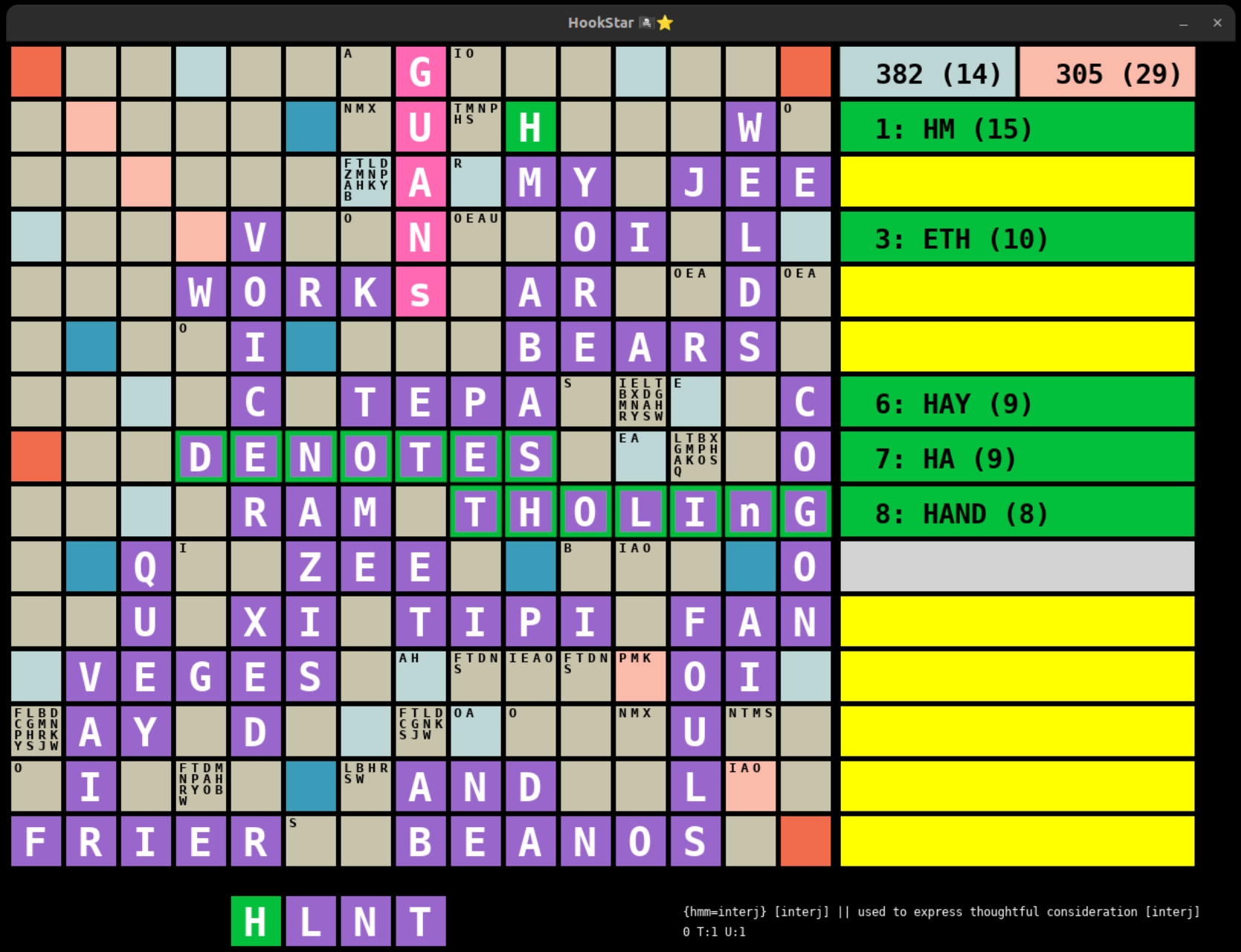
```
tiles = ' '.join(f"{a}:{b}" for a, b in ...)
```

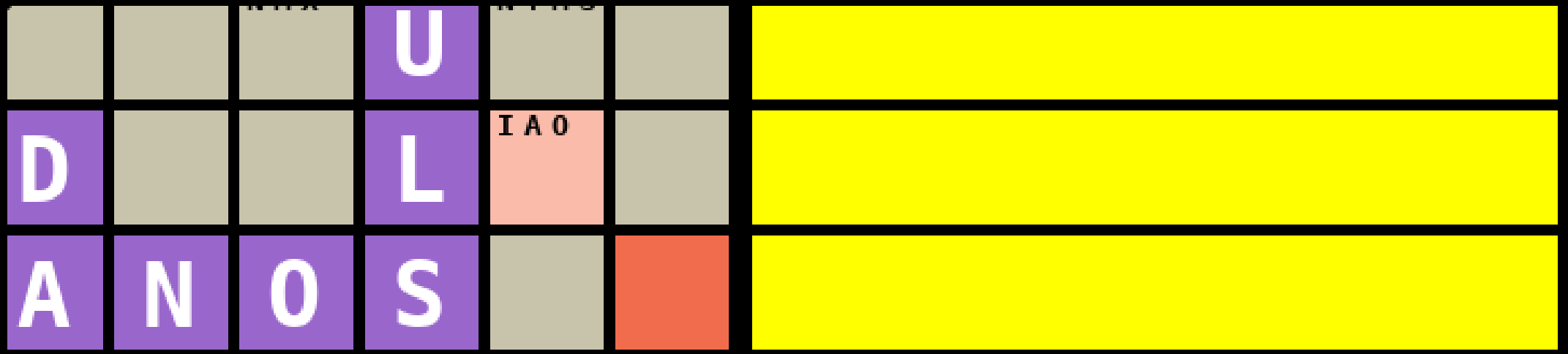
[[digression]]

```
tiles = ' '.join(f"{a}:{b}" for a, b in ...)
```

```
tiles = ' '.join(f"{a}:{b}" for a, b in sorted(Counter(tile_bag[self.tile_bag_index:]).items()))
```

```
tiles = ' '.join(f"{a}:{b}"
    for a, b in
    sorted(
        Counter(tile_bag[self.tile_bag_index:]).items()))
```


HookStar
382 (14)
305 (29)
1: HM (15)
3: ETH (10)
6: HAY (9)
7: HA (9)
8: HAND (8)
H L N T
{hmm=interj} [interj] || used to express thoughtful consideration [interj]
0 T:1 U:1



{hmm=interj} [interj] || used to express thoughtful consideration [interj]

0 T:1 U:1

```
tiles = ' '.join(f"{a}:{b}"
    for a, b in
    sorted(
        Counter(tile_bag[self.tile_bag_index:]).items()))
```

`' '.join`	method on string
`f"{a}:{b}"`	f-string formatting
`for a, b in`	list comprehension
`sorted()`	built-in function
`Counter()`	collection
`tile_bag[self.tile_bag_index:]`	slicing

`tile_bag[self.tile_bag_index:]`	slicing
`Counter()`	collection
`sorted()`	built-in function
`for a, b in`	list comprehension
`f"{a}:{b}"`	f-string formatting
`' '.join`	method on string

```
let tiles = tile_bag
    .iter()
    .skip(tile_bag_index)
    .counts()
    .iter()
    .sorted()
    .map(|(a, b)| format!("{a}:{b}"))
    .collect::<Vec<_>>()
    .join(" ");
```

Counter

list comprehension

slicing

sorted()

f-strings

join

https://play.rust-lang.org/?version=stable&mode=debug&edition=2021&gist=7b9582706c99ea749a7950e754bfaf7e

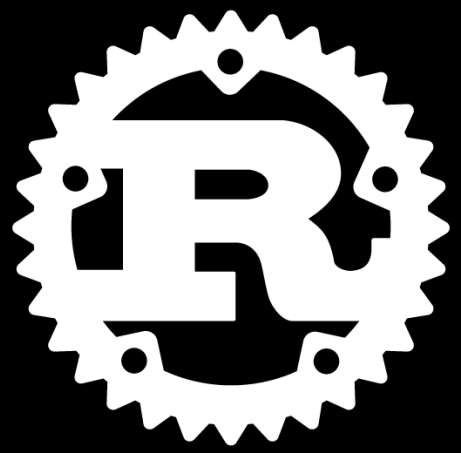
Hoogle Translate

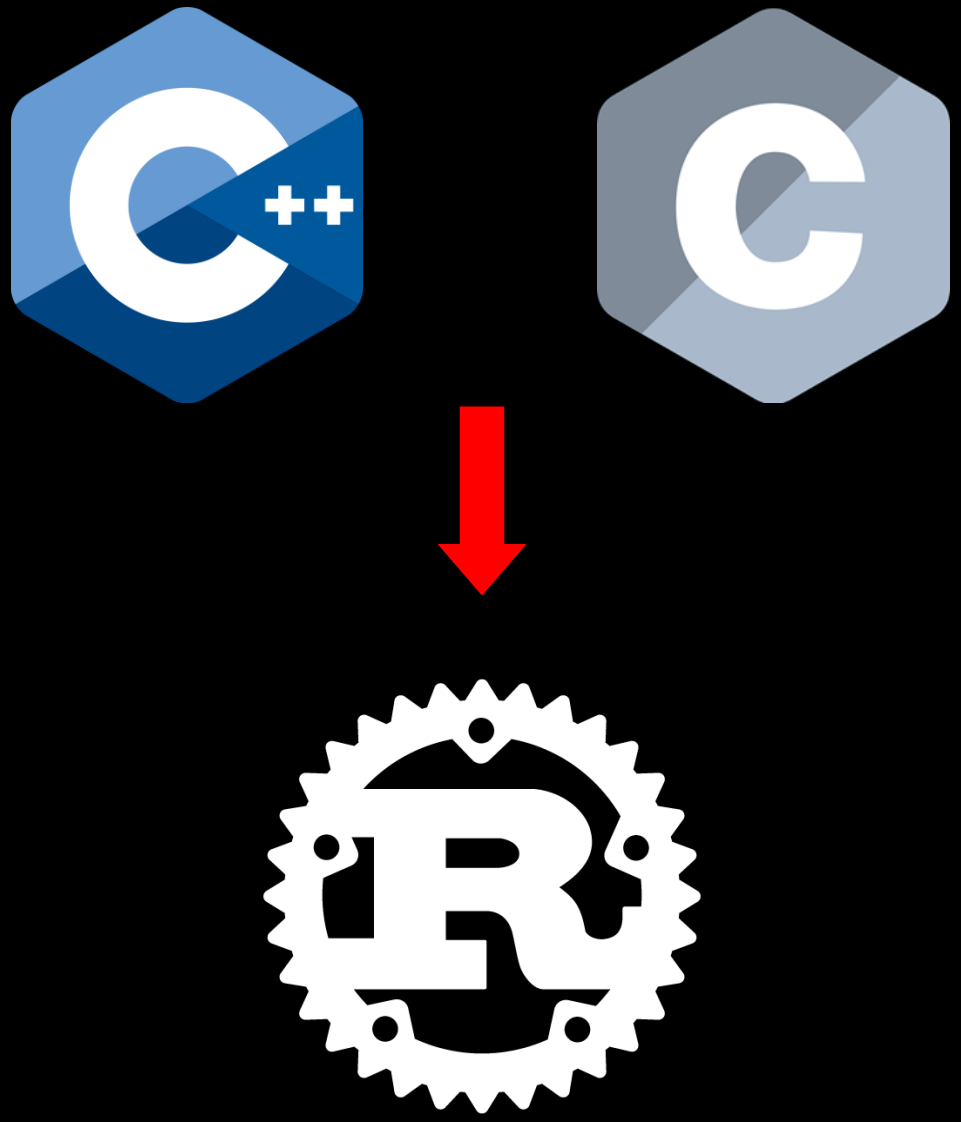
counts

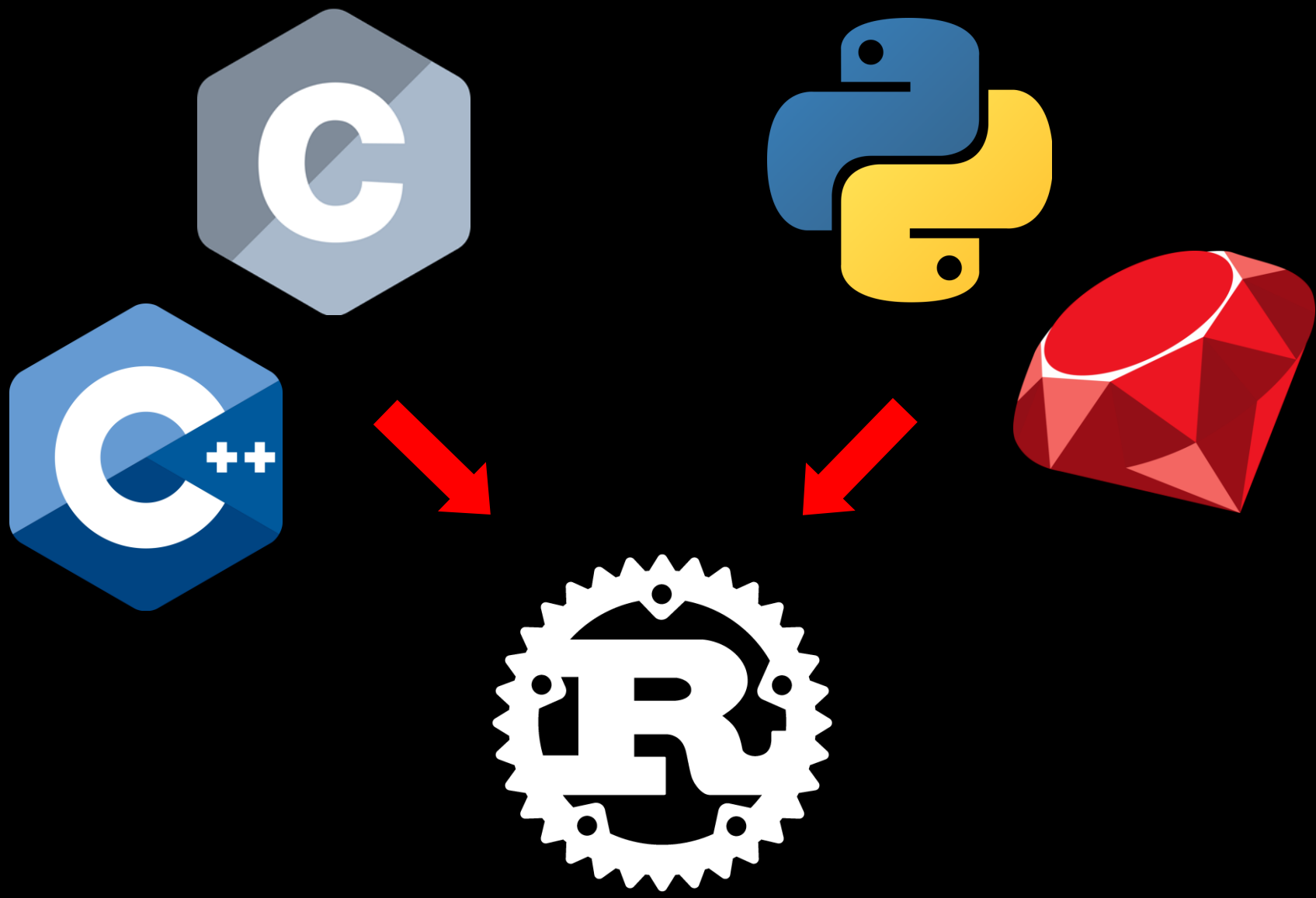
Clojure	**frequencies**	core	Doc
Racket	**frequencies**	list-utils	Doc
pandas	**value_counts**	Series	Doc
Python	**Counter***	collections	Doc
Haskell	**count**	Data.List.Unique	Doc
Rust	**counts**	Itertools	Doc

```rust
let tiles = tile_bag
    .iter()
    .skip(tile_bag_index)
    .counts()
    .iter()
    .sorted()
    .map(|(a, b)| format!("{a}:{b}"))
    .collect::<Vec<_>>()
    .join(" ");
```

https://play.rust-lang.org/?version=stable&mode=debug&edition=2021&gist=7b9582706c99ea749a7950e754bfaf7e




C++
C


C
C++

[[end of digression]]

f-strings in  3.6

Refactor #3

Enum

Refactor #3a

Enum vs 2 Booleans

67d6faa

```
self.pause_for_analysis = False
self.players_turn       = True
```

	self.players_turn	self.pause_for_analysis
PLAYERS_TURN	True	
COMPUTERS_TURN	False	

	self.players_turn	self.pause_for_analysis
PLAYERS_TURN	True	False
PAUSE_FOR_ANALYSIS	False	True
COMPUTERS_TURN	False	False

PLAYERS_TURN

PAUSE_FOR_ANALYSIS

COMPUTERS_TURN

```
class Phase(Enum):
    PLAYERS_TURN         = 1
    PAUSE_FOR_ANALYSIS = 2
    COMPUTERS_TURN      = 3
```

```
328 -       self.pause_for_analysis      = False
329         self.pause_for_analysis_rank = None
330 -       self.players_turn            = True
```

```
333 +       self.phase                   = Phase.PLAYERS_TURN
334         self.pause_for_analysis_rank = None
```

```python
if (not self.players_turn and not self.pause_for_analysis):
```

```python
if self.phase == Phase.COMPUTERS_TURN:
```

```
self.players_turn        = False
self.pause_for_analysis = True
```

```
self.phase = Phase.PAUSE_FOR_ANALYSIS
```

Refactor #3b

Use Enums

acd6d66

```
# TODO convert to Enum
NO = 1
DL = 2
DW = 3
TL = 4
TW = 5
```

```python
class Tile(Enum):
    NO = 1
    DL = 2
    DW = 3
    TL = 4
    TW = 5
```

```
class Tile(Enum):
    NO = 1
    DL = 2
    DW = 3
    TL = 4
    TW = 5
```

```
class Tile(Enum):
    NO = 1
    DL = 2
    DW = 3
    TL = 4
    TW = 5

class Hooks(Enum):
    OFF     = 0
    ALL     = 1
    ON_RACK = 2
```

```
class Extension(Enum):
    PREFIX = 1
    SUFFIX = 2

class Phase(Enum):
    PLAYERS_TURN        = 1
    PAUSE_FOR_ANALYSIS = 2
    COMPUTERS_TURN      = 3

class Direction(IntEnum):
    ACROSS = 1
    DOWN   = 2
```

Enum in  3.4

Refactor #1: `@dataclass` (3.7)
Refactor #2: `f-strings` (3.6)
Refactor #3: `Enum` (3.4)

Refactor #4

_____ ?

```python
self.cursor = 0 # 0 = off, 1 = across, 2 = down
```

```
self.cursor = 0 # 0 = off, 1 = across, 2 = down
```

```
self.cursor = Optional.empty()
```

```
self.cursor = Optional.empty()

class Direction(IntEnum):
    ACROSS = 1
    DOWN   = 2
```

Refactor #4

Optional

9a378bf

[[digression]]

Category Theory for Programmers: Chapter 6 - Simple Algebraic Data Types

3.3K views • 1 year ago

code_report

PL Virtual Meetup: https://www.meetup.com/Programming-Languages-Toronto-Meetup/ CtFP Textbook: ...

Introduction | Table of Contents | Product Types | Records | Duality | Algebraic Types | Exercise 1... 8 chapters

Option	Some	None
Maybe	Just	Nothing
optional	.value()	nullopt
Optional	some	none

12:15




Option Some None



Maybe Just Nothing

optional .value() nullopt

Optional some none

Option Some None

Maybe Just Nothing

optional .value() nullopt

Optional some none

Optional .of() .empty()

[[end of digression]]

Before	After
`self.cursor`	`self.cursor.is_present()`
`self.cursor == 0`	`self.cursor.is_empty()`
`self.cursor == 1`	`self.cursor.get() == Direction.ACROSS`
`self.cursor == 2`	`self.cursor.get() == Direction.DOWN`
`self.cursor = 0`	`Optional.empty()`
`self.cursor = 1`	`self.cursor = Optional.of(Direction.ACROSS)`
`self.cursor = 2`	`self.cursor = Optional.of(Direction.DOWN)`

Optional >=  2.7

https://pypi.org/project/optional.py

Refactor #5

Name the Algorithm

b7eb49b

```
rank = 1
while play != self.player_plays[-rank]:
    rank += 1
```

ITM

Initialize
Then
Modify

```
rank = 1
while play != self.player_plays[-rank]:
    rank += 1
```

```
int rank = 1;
while (play != player_plays[player_plays.size() - rank]) {
    rank += 1;
}
```

```
auto const rank = std::distance(
    std::find(
        player_plays.rbegin(),
        player_plays.rend(),
        play),
    player_plays.rend());
```

https://godbolt.org/z/4forbdGvM

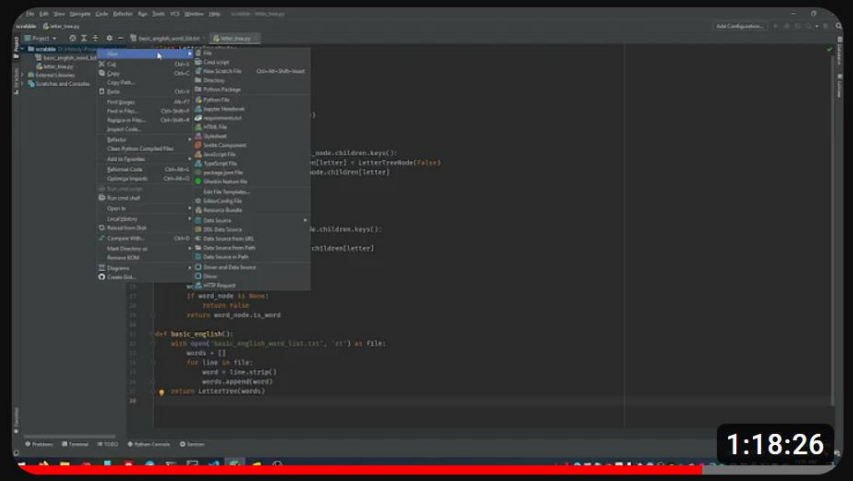
```
rank = 1
while play != self.player_plays[-rank]:
    rank += 1
```

```
rank = self.player_plays[::-1].index(play) + 1
```

Refactor #6

Avoid ITM

17c2657



"The World's Fastest Scrabble Program" (1988) from the Ground Up

1.3K views • 1 year ago

boringcactus

original paper: https://www.cs.cmu.edu/afs/cs/academic/class/15451-s06/www/lectures/**scrabble**.pdf code: ...

Programming Techniques and Data Structures

Daniel Sleator Editor

The World's Fastest Scrabble Program

ANDREW W. APPEL AND GUY J. JACOBSON

ABSTRACT: An efficient backtracking algorithm makes possible a very fast program to play the SCRABBLE® Brand Crossword Game. The efficiency is achieved by creating data structures before the backtracking search begins that serve both to focus the search and to make each step of the search fast.

1. INTRODUCTION

The SCRABBLE® Brand Crossword Game[1] (hereafter referred to as "Scrabble") is ill-suited to the adversary search techniques typically used by computer game-players. The elements of chance and limited information play a major role. This, together with the large number of moves available at each turn, makes subjunctive reasoning of little value. In fact, an efficient generator of legal moves is in itself non-trivial to program, and would be useful as the tactical backbone of a computer crossword-game player.

The algorithm described here is merely that: a fast move generator. In practice, combining this algorithm with a large dictionary and the heuristic of selecting the move with the highest score at each turn makes a very fast program that is rarely beaten by humans. The program makes no use of any strategic concepts, but its brute-force one-ply search is usually sufficient to overwhelm its opponent.

2. COMPUTER SCRABBLE-PLAYERS IN THE LITERATURE

A number of computer programs have been written to play SCRABBLE®. The best publicized is a commercial product named MONTY®[2], which is available for various microcomputers and as a hand-held device the size of a giant calculator. According to *Scrabble Players News*, it uses both strategic and tactical concepts [2]. The human SCRABBLE experts who reviewed MONTY beat it consistently, but said that it was a fairly challenging opponent.

Peter Turcan of the University of Reading in England has written a SCRABBLE-player [8, 9] for some unspecified micro-computer. It appears that he generates moves by iterating over the words in his lexicon in reverse order of length. He somehow decides for each word whether and where it can be played on the current board with the current rack. His program doesn't attempt any adversary search, but it does use an evaluation function more sophisticated than the score of the prospective move. It takes the score and conditionally adds terms depending on simple strategic features of the new position and tiles left in the rack.

[1] As used in this paper, the mark SCRABBLE refers to one of the crossword-game products of Selchow and Richter Company.

This research was sponsored in part by a grant from the Amoco Foundation, in part by an NSF Graduate Student Fellowship, in part by NSF grant MCS-830805, in part by Presidential Young Investigator grant DCR-8352081, and in part by the Defense Advanced Research Projects Agency (DOD), ARPA Order No. 3597, monitored by the Air Force Avionics Laboratory Under Contract F33615-81-K-1539.

The views and conclusions in this document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the Defense Advanced Research Projects Agency or the US Government.

SCRABBLE is a registered trademark of Selchow and Richter Company for its line of wordgames and entertainment services.

[2] Registered trademark of Ritam Corporation.

```python
class Board:
    def __init__(self, size):
        self.size = size
        self._tiles = []
        for _ in range(size):
            row = []
            for _ in range(size):
                row.append('.')
            self._tiles.append(row)

    def all_positions(self):
        result = []
        for row in range(self.size):
            for col in range(self.size):
                result.append((row, col))
        return result

    def copy(self):
        result = Board(self.size)
        for pos in self.all_positions():
            result.set_tile(pos, self.get_tile(pos))
        return result

    # ...
```

```
class Board:
    def __init__(self, size):
        self.size = size
        self._tiles = []
        for _ in range(size):
            row = []
            for _ in range(size):
                row.append('.')
            self._tiles.append(row)
```

```
class Board:
    def __init__(self):
        self.size = 15
        self._tiles = []
        for _ in range(size):
            row = []
            for _ in range(size):
                row.append('.')
            self._tiles.append(row)
```

```python
class Board:
    def __init__(self):
        self.size = 15
        self._tiles = []
        for _ in range(size):
            row = ['.'] * self.size
            self._tiles.append(row)
```

```
class Board:
    def __init__(self):
        self.size = 15
        self._tiles =
            [['.'] * self.size for _ in range(self.size)]
```

```python
class Board:
    def __init__(self):
        self.size = 15
        self._tiles =
            [['.'] * self.size for _ in range(self.size)]

    def all_positions(self):
        result = []
        for row in range(self.size):
            for col in range(self.size):
                result.append((row, col))
        return result
```

```python
import itertools as it

class Board:
    def __init__(self):
        self.size = 15
        self._tiles =
            [['.'] * self.size for _ in range(self.size)]

    def all_positions(self):
        return it.product(range(0, 15), range(0,15))
```

Hoogle Translate

product

Rust	**cartesian_product**	trait.itertools	Doc
D	**cartesianProduct**	std.algorithm.setops	Doc
Racket	**cartesian-product**	base	Doc
C++	**cartesian_product**	range-v3	Doc
Julia	**product**	IterTools	Doc
Python	**product**	itertools	Doc
Ruby	**product**	Array	Doc
APL	**,⍤.,**		Doc
q	**cross**	-	Doc
F#	**allPairs**	List	Doc

```python
import itertools as it

class Board:
    def __init__(self):
        self.size = 15
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            [['.'] * self.size for _ in range(self.size)]

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```

```python
import itertools as it

class Board:
    def __init__(self):
        self.size = 15
        self._tiles =
            [['.'] * self.size for _ in range(self.size)]

    def all_positions(self):
        return it.product(range(0, 15), range(0,15))

    def copy(self):
        result = Board(self.size)
        for pos in self.all_positions():
            result.set_tile(pos, self.get_tile(pos))
        return result
```

```
import copy
import itertools as it

class Board:
    def __init__(self):
        self.size = 15
        self._tiles =
            [['.'] * self.size for _ in range(self.size)]

    def all_positions(self):
        return it.product(range(0, 15), range(0,15))

    def copy(self):
       return copy.deepcopy(self)
```

```python
class Board:
    def __init__(self, size):
        self.size = size
        self._tiles = []
        for _ in range(size):
            row = []
            for _ in range(size):
                row.append('.')
            self._tiles.append(row)

    def all_positions(self):
        result = []
        for row in range(self.size):
            for col in range(self.size):
                result.append((row, col))
        return result

    def copy(self):
        result = Board(self.size)
        for pos in self.all_positions():
            result.set_tile(pos, self.get_tile(pos))
        return result

    # ...
```

```
import copy
import itertools as it

class Board:
    def __init__(self):
        self.size = 15
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        return it.product(range(0, 15), range(0,15))

    def copy(self):
       return copy.deepcopy(self)
```

Refactor #1: @dataclass (3.7)
Refactor #2: f-strings (3.6)
Refactor #3: Enum (3.4)
Refactor #4: Optional
Refactor #5: Use Algorithms
Refactor #6: Avoid ITM

https://github.com/codereport/scrabble/commits

Thank You

https://github.com/codereport/Content/Talks

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Questions?

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