DS-210: PROGRAMMING FOR DATA SCIENCE

LECTURE 28

1. EXTERNAL CRATE EXAMPLE: `csv` (READING CSV)

2. BASIC COLLECTIONS: STACK AND QUEUE

3. GRAPH EXPLORATION: BREADTH-FIRST SEARCH (BFS)

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CRATE `csv` (AND `serde`): READING A CSV FILE

See:

- https://crates.io/crates/csv
- https://crates.io/crates/serde

- Create a new project
- Add to `Cargo.toml`:

```
csv = "1.1.6"
serde = "1.0.136"
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Doesn't work!!!!!

- Search for solution online!

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Solution: modify `Cargo.toml` for `serde`

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serde = { version = "1.0.136", features = ["derive"] }
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#[allow(dead_code,non_snake_case)]
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Bottom line:

- parameters other than the version number possible in `Cargo.toml`

RELYING ON EXTERNAL PROJECTS

Things to consider about external libraries:

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Things to consider about external libraries:

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- do you really need it?

Many things best left to professionals:

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Implementing your own things can be a great educational experience!

EXTREME EXAMPLE

theregister.com/2016/03/23/npm_left_pad_chaos/

The Register

fell over during development and deployment. Thousands, worldwide. Left-pad was fetched 2,486,696 times in just the last month, according to NPM. It was that popular.

```
module.exports = leftpad;

function leftpad (str, len, ch) {
  str = String(str);

  var i = -1;

  if (!ch && ch !== 0) ch = ' ';

  len = len - str.length;

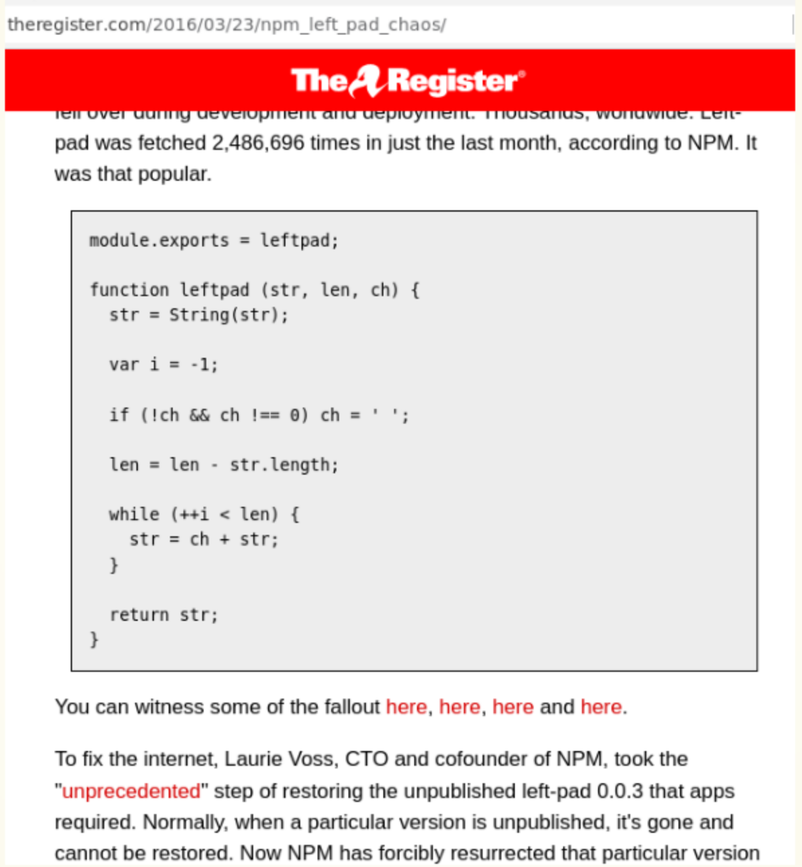
  while (++i < len) {
    str = ch + str;
  }

  return str;
}
```

You can witness some of the fallout here, here, here and here.

To fix the internet, Laurie Voss, CTO and cofounder of NPM, took the "unprecedented" step of restoring the unpublished left-pad 0.0.3 that apps required. Normally, when a particular version is unpublished, it's gone and cannot be restored. Now NPM has forcibly resurrected that particular version

EXTREME EXAMPLE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Rust and `cargo`: can't delete libraries that were published

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BASIC DATA STRUCTURES: STACK AND QUEUE

Stack (same name as in "stack vs. heap"):

- FILO: first in last out / LIFO: last in first out
- put items on the top
- get items from the top
- can use `Vec` for this: methods `push` and `pop`

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Queue:

- FIFO: first in last out
- add items at the end
- get items from the front

RUST: `std::collections::VecDeque<T>`

- generalization of queue and stack
- accessing front: methods `push_front(x)` and `pop_front()`
- accessing back: methods `push_back(x)` and `pop_back()`
- `pop_front` and `pop_back` return `Option<T>`

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In [2]:
```
use std::collections::VecDeque;

// using as a stack: push_back & pop_back
let mut stack = VecDeque::new();

stack.push_back(1);
stack.push_back(2);
stack.push_back(3);

println!("{:?}",stack.pop_back());
println!("{:?}",stack.pop_back());

stack.push_back(4);
stack.push_back(5);

println!("{:?}",stack.pop_back());
```

```
Some(3)
Some(2)
Some(5)
```

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IMPLEMENTATION OF `VecDeque`

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- use an array allocated on the heap
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Out of space?

- double the size
- good complexity due to amortization

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  - next lecture
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- depth–first search (DFS)
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  - uses a stack
- random walks
  - example: PageRank (see HW 10)