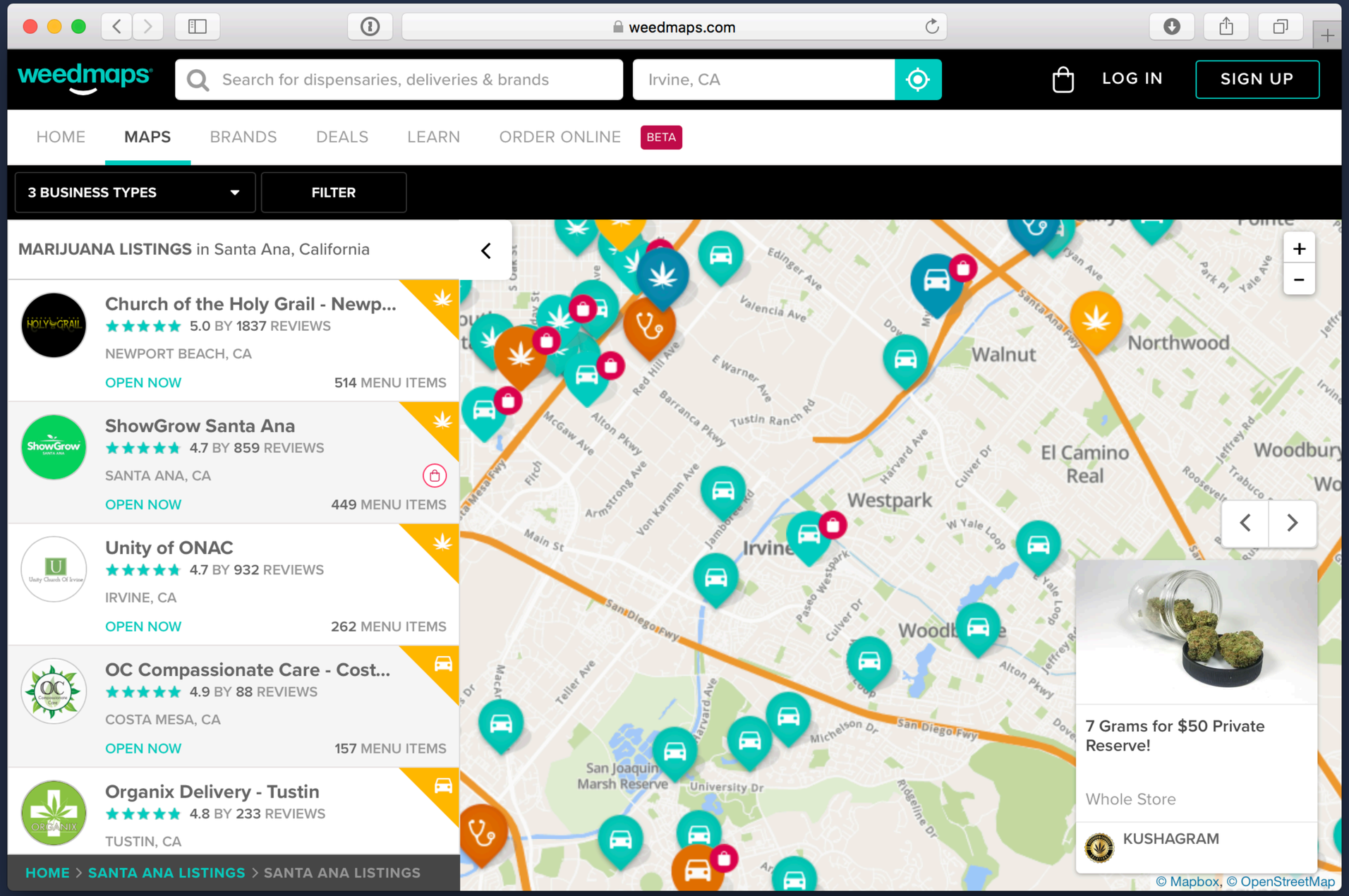

PROPERTY-BASED TESTING
IS A MINDSET

@whatyouhide


weedmaps®


weedmaps.com
weedmaps
Search for dispensaries, deliveries & brands
Irvine, CA
LOG IN
SIGN UP
HOME
MAPS
BRANDS
DEALS
LEARN
ORDER ONLINE
BETA
3 BUSINESS TYPES
FILTER
MARIJUANA LISTINGS in Santa Ana, California
Church of the Holy Grail - Newp...
5.0 BY 1837 REVIEWS
NEWPORT BEACH, CA
OPEN NOW
514 MENU ITEMS
ShowGrow Santa Ana
4.7 BY 859 REVIEWS
SANTA ANA, CA
OPEN NOW
449 MENU ITEMS
Unity of ONAC
4.7 BY 932 REVIEWS
IRVINE, CA
OPEN NOW
262 MENU ITEMS
OC Compassionate Care - Cost...
4.9 BY 88 REVIEWS
COSTA MESA, CA
OPEN NOW
157 MENU ITEMS
Organix Delivery - Tustin
4.8 BY 233 REVIEWS
TUSTIN, CA
HOME > SANTA ANA LISTINGS > SANTA ANA LISTINGS
Walnut
Northwood
El Camino Real
Westpark
Irvine
Woodbury
Edinger Ave
Valencia Ave
Red Hill Ave
E Warner Ave
Barranca Pkwy
Tustin Ranch Rd
McGaw Ave
Alton Pkwy
Armstrong Ave
Von Karman Ave
Jamboree Rd
Harvard Ave
Culver Dr
W Yale Loop
Main St
San Diego Fwy
Paseo Westpark
Teller Ave
Michelson Dr
University Dr
San Joaquin Marsh Reserve
Ridgeline Dr
Santa Ana Fwy
7 Grams for $50 Private Reserve!
Whole Store
KUSHAGRAM
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https://weedmaps.com/careers


T E S T I N G

why do we test?

why do we test?

no tests 😟

why do we test?

no tests 😟

yes tests 😔

unit tests

```
test "sorting" do
  assert sort([]) == []
  assert sort([1, 2, 3]) == [1, 2, 3]
  assert sort([2, 1, 3]) == [1, 2, 3]
end
```

```
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  assert sort([1, 2, 3]) == [1, 2, 3]
  assert sort([2, 1, 3]) == [1, 2, 3]
end
```

example-based

Input	Output
`[]`	`[]`
`[1, 2, 3]`	`[1, 2, 3]`
`[2, 1, 3]`	`[1, 2, 3]`

table-based

unit tests

unit tests

unit tests

🙂, but also 😢


PROPERTIES

hard to write 😟, but...

valid **inputs**

valid **inputs**
properties of **output**


valid **inputs**
properties of **output**
testing framework

Elixir

+

github.com/whatyouhide/**stream_data**

example time:

sorting lists

```
test "sorting" do
  assert sort([]) == []
  assert sort([1, 2, 3]) == [1, 2, 3]
  assert sort([2, 1, 3]) == [1, 2, 3]
end
```

lists of **integers**

it's a list

it's a list

has the same elements

it's a list

has the same elements

it's ordered

```
check all list <- list_of(int()) do
  sorted = sort(list)

  assert is_list(sorted)
  assert same_elements?(list, sorted)
  assert ordered?(sorted)
end
```

```
check all list <- list_of(int()) do
  sorted = sort(list)

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  sorted = sort(list)

  assert is_list(sorted)
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end
```
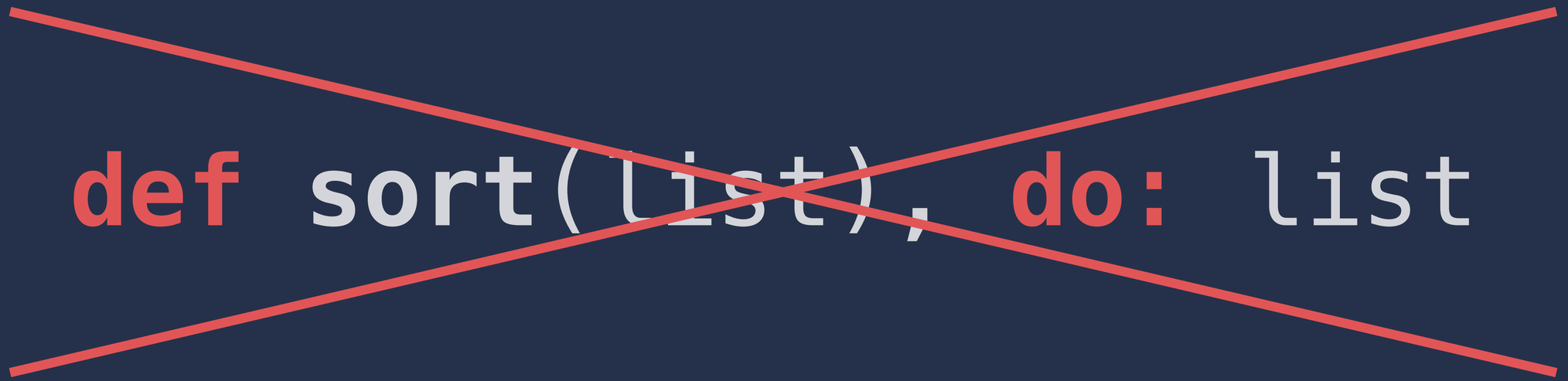

```
def sort(list), do: list
```


def sort(list), do: list

```
[32, 2, 44, -12]
```

[32, 2, 44, -12]

[1, 0]


G E N E R A T O R S

```
iex> Enum.take(integer(), 4)
[1, 0, -3, 1]
```

Composability

```
number = one_of([integer(), float()])
```

```
StreamData.map(integer(), &abs/1)
```

Example

```
def string(:ascii) do
  integer(?\s..?~)
  |> list_of()
  |> map(&List.to_string/1)
end
```


PATTERNS

circular code

```
decode(encode(term)) == term
```

JSON encoding

```
property "unicode escaping" do
  check all string <- string(:printable) do
    encoded = encode(string, escape: :unicode)
    assert decode(encoded) == string
  end
end
```

oracle model

```
my_code() == oracle_code()
```

older system

less performant implementation

```
property "gives same results as Erlang impl" do
  check all bin <- binary() do
    assert Huffman.encode(bin) ==
             :huffman.encode(bin)
  end
end
```

smoke tests

https://www.youtube.com/watch?v=jvwfDdgg93E

API: 200, 201, 400, 404

https://www.youtube.com/watch?v=jvwfDdgg93E

```
property "only expected codes are returned" do
  check all request <- request() do
    response = HTTP.perform(request)
    assert response.status in [200, 201, 400, 404]
  end
end
```

https://www.youtube.com/watch?v=jvwfDdgg93E

locally  , **CI** 

```elixir
if ci?() do
  config :stream_data, max_runs: 500
else
  config :stream_data, max_runs: 25
end
```

unit + properties

```
property "String.contains?/2" do
  check all left <- string(),
            right <- string() do
    assert String.contains?(left <> right, left)
    assert String.contains?(left <> right, right)
  end
end
```

```elixir
property "String.contains?/2" do
  check all left <- string(),
            right <- string() do
    assert String.contains?(left <> right, left)
    assert String.contains?(left <> right, right)
  end
end
```



```elixir
test "String.contains?/2" do
  assert String.contains?("foobar", "foo")
  assert String.contains?("foobar", "bar")
  assert String.contains?("foobar", "ob")
end
```


STATEFUL
TESTING

model

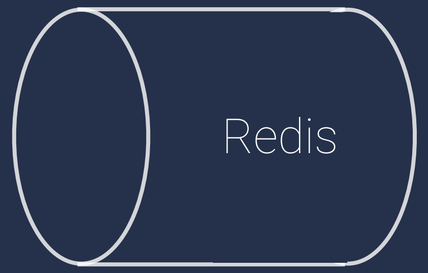
valid commands

model: state + state transformations

commands: calls + preconditions

getting/setting keys
in Redis

system



model

%{}

commands

- `get(key)`
- `set(key, value)`

```
def get(model, key),
  do: Map.get(model, key)


def set(model, key, value),
  do: Map.put(model, key, value)
```

```
keys = Map.keys(model)

one_of([
  command(:get, [one_of(keys)]),
  command(:set, [binary(), binary()]),
  command(:set, [one_of(keys), binary()])
])
```

get

```
{:ok, result} = Redix.command!(conn, ["GET", key])
assert Map.fetch(model, key) == {:ok, result}
```

set_existing

```
Redix.command!(conn, ["SET", key, value])
Map.replace!(model, key, value)
```

LevelDB

17 (seventeen) calls

17 (seventeen) calls

33 (thirty three) calls


R E S E A R C H

stream_data

+

dialyzer

stream_data

+

dialyzer

Dialyzer

```
@type my_type() :: integer()

@spec my_fun(integer()) :: my_type()
```

Generators from type

```
@type timeout() :: :infinity | non_neg_integer()
```

```
from_type(timeout())
```

```
from_type(timeout())
```

one_of([:infinity, map(integer(), &abs/1)])

Automatic property checking of specs

```
@spec my_fun(timeout()) :: :ok | :error
```

```elixir
@spec my_fun(timeout()) :: :ok | :error
```

```elixir
check all timeout <- from_type(timeout()) do
  assert my_fun(timeout) in [:ok, :error]
end
```


C O N C L U S I O N

find obscure bugs

find obscure bugs

reduce to minimal failing input

find obscure bugs

reduce to minimal failing input

find specification errors

find obscure bugs

reduce to minimal failing input

find specification errors

cover vast input space


v1.7

use property-based testing


@whatyouhide
github.com/whatyouhide/stream_data