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Has its roots in Haskell, but PBT is not specific to functional programming.

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We don't use property-based testing very much in our codebase, so hopefully by the end of this, we'll be able to:

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- Get some familiarity with the `fast-check` API

## Example: algebraic properties

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- identity
- inverse
- associativity
- *(pseudo-)* commutativity

## Example: algebraic properties

Probably won't come up too often, but usually when defining type class instances for Semigroup, Monoid, Functor, Applicative, Monad, you might also want to test the corresponding type class laws.

(Or when defining optics, there are laws for those too!)

## Example: encoding and decoding

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`(src/catalog/attackDesigner/common/formatBytes.ts)`

In order to write custom

`arbFormattedBytes: Arbitrary<`<span style="color:#a00">string</span>`>`

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(units such as "B", "KB", "MB", etc.).

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(units such as "B", "KB", "MB", etc.).

I can combine a number and a `ByteUnit` to get a "formatted byte" by converting to string and using string concatenation, but how do I combine an `Arbitrary<number>` and an `Arbitrary<ByteUnit>`?

## Combining `Arbitrarys`

Normally we would use `sequenceT` and `map`

```
pipe(
  sequenceT(Arb.arbitrary)(fc.nat(), arbByteUnit()),
  Arb.map(([nat, byteUnit]) => `${nat} ${byteUnit}`)
)
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…but `Arbitrary` doesn't have an `Apply/Applicative` instance (so can't use with `sequenceT`) :sad-face:
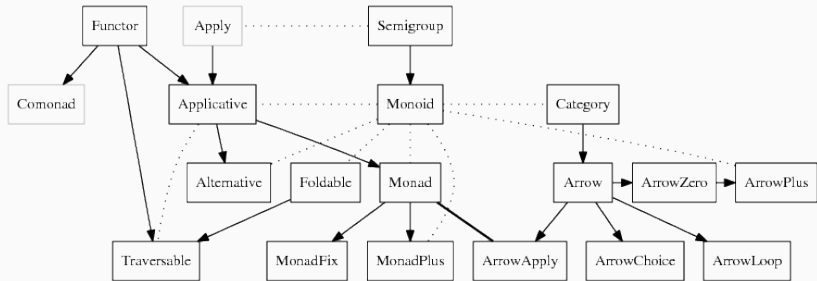
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…but `Arbitrary` doesn't have an `Apply`/`Applicative` instance
(so can't use with `sequenceT`) :sad-face:

…but there is a `chain`

**Figure 1:** Type classes

## Example: reference implementation

A more general `Array.prototype.every` that works on *all* Foldables

(packages/monorail/src/sharedHelpers/fp-ts-ext/__tests__/Foldable.jest.ts)

## In summary

Summary of common scenarios I've come across:

- Testing some thing with obvious algebraic properties

- Encoding/decoding (or parsing/formatting)

- Reference implementation (oracle)

More examples here:

- Choosing properties for property-based testing (Scott Wlaschin)

## GSM-7: A case study

Text encoding for SMS that packs a 7-bit character set into 8-bit bytes (so a 140-byte text message can contain 160 characters)

Wikipedia page: https://en.wikipedia.org/wiki/GSM_03.38

An encoding/decoding pair fails *rarely*, and there is no solution for it

## More resources

### Videos

- Code Checking Automation - Computerphile (with John Hughes, author of `QuickCheck`, and uses the GSM-7 encoding as an example)

- The Magic of Generative Testing: Fast-Check in JavaScript (lightning talk by Gabriel Lebec, more introductory material)

- Property-Based Testing for Better Code (Jessica Kerr)

### Articles

- Choosing properties for property-based testing (Scott Wlaschin)