EXPLORATION OF PATTERNS FOR USE IN CLASS

1. Fundamental Patterns

2. Definitions

(1) Singleton: A set with one value.
(2) Set: A mathematical set. Ex. An undirected graph is a set of edge descriptions.
(3) Sequence: A mathematical sequence. Ex. A digraph is a sequence of edge descriptions.

3. Functor Pattern

A pattern that allows a generic function to apply a specific function without changing or modifying the generic function.

4. Fold Pattern:set or sequence to singleton

For function f, set or sequence S, and singleton a,

$$fold(f, S, a) = \begin{cases} a & \text{if } S = \varnothing \\ fold(f, S, f(x : x \in S, a)) & \text{otherwise} \end{cases}$$

5. Unfold Pattern:singleton to set or sequence

For function f, and singleton d

$$unfold(f, d) = \begin{cases} \varnothing & \text{if } f(d) = \varnothing \\ f(d) \cup unfold(f, f(d)) & \text{otherwise} \end{cases}$$

6. Derived Patterns

6.1. **Hylomorphism Pattern.** For functions f and g, singleton d, and singleton a,

$$hylo(f, g, d, a) = fold(f, unfold(g, d), a)$$

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6.2. **Map Pattern.** For set or sequence $A = \varnothing$, set or sequence S, and function f, where $f(s : s \in S, A)$ performs some transformation t as well as $\{t(s)\} \cup A$,

$$map(f, S) = fold(f, S, A)$$

6.3. **Filter Pattern.** For set or sequence $A = \varnothing$, set or sequence S, and function f, where $f(s : s \in S, A)$ performs some comparison c and $\{t(s)\} \cup A$ when $c(s) = true$,

$$filter(f, S) = fold(f, S, A)$$

6.4. **Monad Pattern.**

6.5. **Sream Pattern.** unfold pattern derivative (Stream is the same as Lazy Evaluation)