

# CIS 552

# Advanced Programming

Fall 2021



## Today: Wed Sep 29

- HW #3 available, due Thursday, Oct 7<sup>th</sup>
- Read QuickCheck before Monday & complete Canvas quiz
- In-class exercise (with partners): MonoidFoldable  
git pull in 03-classes repo to access file

# Semigroup/Monoid

```
class Semigroup a where                                -- associative binary operator
    (<>) :: a -> a -> a                                -- a <> (b <> c) == (a <> b) <> c
instance Semigroup [a] where
    (<>) = (++)
class Semigroup a => Monoid a where                  -- with identity element
    mempty :: a                                        -- a <> mempty == a
instance Monoid [a] where                            -- mempty <> a == a
    mempty = []
```

# Foldable

**class** Foldable t **where**

foldMap :: Monoid m => (a -> m) -> t a -> m

...

**instance** Foldable [] **where**

foldMap :: Monoid m => (a -> m) -> [a] -> m

foldMap f = List.foldr (\x acc -> f x <> acc) mempty

**toList** :: Foldable t => t a -> [a] -- this is an iterator