CIS 5520
Advanced Programming

Fall 2024

Introduce yourself to your new homework partner

Today: Monday, Oct 2nd

- HW #3 available, due Thursday, Oct 17th
  - SAT / Queue – start now   (depends on QuickCheck module)
  - AVL – after Oct 9th (depends on video/RedBlack module)
- You are responsible for every part of the assignment
- Fall Break Oct 3rd-6th
  - No class Wednesday Oct 2nd
  - Watch video before class Monday Oct 7th --- in class exercise!

QuickCheck discussion

- Quickcheck library overview
- Quiz questions:
  - prop_insert_ordered
  - genMaybe

[5 min break]

- Generating trees: genTree variants
- Open Q&A

QuickCheck and the Testable Typeclass

quickCheck :: Testable prop => prop -> IO ()

- – to quickCheck (f :: **a -> Bool**) generate 100 random "a"s
- – check if each "f a" returns true or false
- – if ever false, shrink counterexample
- – print smallest failing value

Testable Bool

(Arbitrary a, Show a, Testable prop) => **Testable** (a -> prop)

QuickCheck and the Arbitrary Typeclass

```
class Arbitrary a where

    arbitrary :: Gen a      -- generator for arbitrary elements of a
    shrink :: a -> [a]      -- produce "smaller" variants of argument


type Gen a                          -- generator type
sample' :: Gen a -> IO [a]    -- generate some random values
instance Functor Gen           -- fmap :: (a -> b) -> Gen a -> Gen b
instance Monad Gen            -- return :: a -> Gen a
                              -- (>>=) :: Gen a -> (a -> Gen b) -> Gen b
```

Property type: controlling QuickCheck

Abstract type: "Property"

    -- | can turn any testable type into a property

    property :: Testable prop => prop -> Property

    -- | can test with any Property

    instance Testable Property

Property combinators

    (==>) :: Testable prop => Bool -> prop -> Property

    label :: String -> Property -> Property

    (and others!)