

Assignment Project Exam Help



Software System Design and Implementation

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Effects and 10 Monad Practice

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The IO Type

A **procedure** that performs some side effects, returning a result of type `a` is written as

`IO a`

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World interpretation

`IO a` is an abstract type. But we can think of it as a function:

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`RealWorld -> (RealWorld, a)`

(that's how it's implemented in GHC)

`(>>=) :: IO a -> (a -> IO b) -> IO b`

`pure :: a -> IO a`

`getChar :: IO Char`

`readLine :: IO String`

`putStrLn :: String -> IO ()`

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Two-player Tic-Tac-Toe

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Example

Simple two-player Tic-Tac-Toe game

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State Monads

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```
newtype State s a = State (s -> (s, a))
```

State Monad

```
get  :: State s s  
put  :: s -> State s ()  
modify :: (s -> s) -> State s ()
```

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Here we use a monadic interface to simplify the passing of our state around, so that we don't need to manually plumb data around.

Tic-Tac-Toe A.I

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Example

Adding A.Is for Tic-Tac-Toe

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QuickChecking Monads

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QuickCheck lets us test IO (and ST) using this special **property monad** interface:

```
monadicIO :: PropertyM IO () -> Property
pre       :: Bool -> PropertyM IO ()
assert    :: Bool -> PropertyM IO ()
run       :: IO a -> PropertyM IO a
```

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Testing a Tic-Tac-Toe A.I

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Example

Testing A.I.s for Tic-Tac-Toe

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Homework

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- 1 Next week is flexibility week
- 2 Last week's quiz is due on Friday. Make sure you submit your answers.
- 3 The fourth programming exercise is due by the start of my next lecture (in 14 days).
- 4 This week's quiz is also up, it's due Friday week (in 16 days)

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Consultations

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- Poll on Piazza to register interest. Will not run if there are no votes.
- Tomorrow, 9am to 11am on Blackboard Collaborate.
- Link on course website & Piazza.
- Make sure to join the queue on Hopper. Be ready to share your screen with REPL (ghci or stack repl) and editor set up.

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