CS4450/7450: Introduction

Professor William L. Harrison

September 10, 2018

CS4450/7450: Principles of Programming Languages

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  - Programming language Design

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  - Texts
- Course Webpage
  - TBD

Grading

- Midterm (Friday, 10/5): 25%
- Written Homeworks + Programming: 40%
- Final: 35%

(Regrade Policy)

Requests for re-grades must be made in writing within 7 days of receiving graded HW/test. There will be absolutely no exceptions.

Personnel

- Instructor: Professor William L. Harrison
  Office: 318 EBN
  Office hours: *By appointment; email me first*
- Teaching Assistants:
  - Trevor Bajkowski
  - Matthew Deardorff

Textbooks

Both texts are online:

- *Learn You a Haskell for Good* by Miran Lipovaca
  Highly amusing and informative; available online.
- *Anatomy of Programming Languages* by William Cook.
- Slides, of course.

The following are good but not required.

- *Programming in Haskell* by Graham Hutton
- *Thinking Functionally with Haskell*, Richard Bird, Cambridge University Press.

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- You really want to know how computers work.
    - Often interpreters and compilers look like magic. And you shouldn't be comfortable with that magic.
    - You want to demystify the process of building an interpreter and a compiler, understand how they work, and get in control of things.

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    - You want to demystify the process of building an interpreter and a compiler, understand how they work, and get in control of things.
- You want to create your own programming language or domain specific language.
    - If you create one, you will also need to create either an interpreter or a compiler for it.
    - Recently, there has been a resurgence of interest in new languages: Elixir, Go, Rust just to name a few.

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  - No exceptions!
- Your continued enrollment in this class implies your consent to these rules.

Email Use & Abuse

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- It is completely at my discretion whether I answer your email.
- Rude, snarky, obnoxious, and/or threatening emails will not be answered and, if appropriate, will be forwarded on to my department chairman and/or provost.

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- When given a programming assignment, start early.
    - Last minute, start-the-night-before may work in other classes, but it's a prescription for disaster in CS4450.
- Realize that you alone are responsible for your performance; be disciplined.

How not to get an A in CS4450

Case Study 1

Professor,
While you were away, I attempted to inquire about my grade via email and your auto email responded saying you were out of the country. I was inquiring about my grade because as a Senior slated to graduate in the fall I was hoping to earn an A- in your class after we had taken the final. I needed the A- for gpa purposes for job applications that I had to begun to fill out for when I graduate in the fall. I work in Dr. Kazic's Lab and she always speaks highly of you so I was hopeful that there may have either been a miscalculation on my final or class attendance points or a way for me to earn a few more points so that I may raise my grade and graduate in the fall.
Is there any way for me to raise my grade a degree?
Gratitude, ...

How not to get an A in CS4450

Case Study 2

I have more than three days left.
The final isn't till next Thursday.
I'm not asking for pity, I'm asking that you do help me with specific material and not throw me to your TA's. I talked to you about this before Thanksgiving, but was out of town all last week for an interview with Amazon. I wasn't able to come in then so there was no point in talking to you about it. I've really been trying to keep up, but I just haven't been able to.

I'll come in multiple times, and only ask specific questions. I'm not just going to come in and say "teach me".

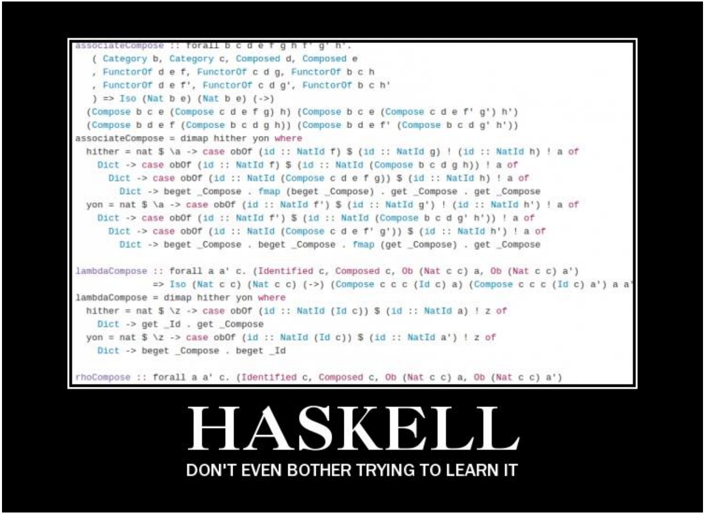
How not to get an A in CS4450

Case Study 2, cont'd

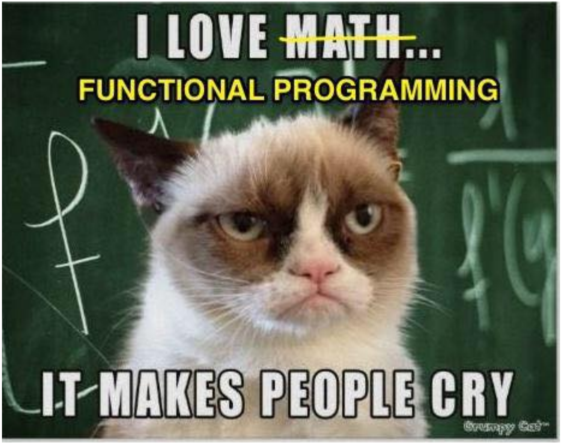
Quite frankly, I'm disappointed that this is the response I get when I ask for help. You still haven't given me potential times to come in, and I assume that by including your TA's I'm going to get the typical response of "go talk to your TA's". I don't pay this University though to talk to TA's. I pay to get help from a professor.

Also, you are the third professor that has been stubborn to work with me with traveling this semester. I'm not taking vacations, I'm trying to get a job at some of the biggest tech companies in the US (Google, Amazon, and Microsoft). This University is supposed to enable me to succeed, not impede me.

So, I'll ask again. When can I come talk to you about the material in class so I can pass this class, and more importantly, understand the material?



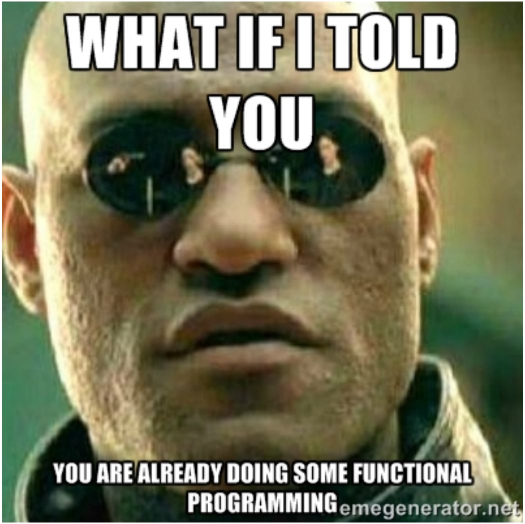
```
associateCompose :: forall b c d e f g h f' g' h'.
   ( Category b, Category c, Composed d, Composed e
   , FunctorOf d e f, FunctorOf c d g, FunctorOf b c h
   , FunctorOf d e f', FunctorOf c d g', FunctorOf b c h'
   ) => Iso (Nat b e) (Nat b e) (->)
  (Compose b c e (Compose c d e f g) h) (Compose b c e (Compose c d e f' g') h')
  (Compose b d e f (Compose b c d g h)) (Compose b d e f' (Compose b c d g' h'))
associateCompose = dimap hither yon where
  hither = nat $ \a -> case obOf (id :: NatId f) $ (id :: NatId g) ! (id :: NatId h) ! a of
    Dict -> case obOf (id :: NatId f) $ (id :: NatId (Compose b c d g h)) ! a of
      Dict -> case obOf (id :: NatId (Compose c d e f g)) $ (id :: NatId h) ! a of
        Dict -> beget _Compose . fmap (beget _Compose) . get _Compose . get _Compose
  yon = nat $ \a -> case obOf (id :: NatId f') $ (id :: NatId g') ! (id :: NatId h') ! a of
    Dict -> case obOf (id :: NatId f') $ (id :: NatId (Compose b c d g' h')) ! a of
      Dict -> case obOf (id :: NatId (Compose c d e f' g')) $ (id :: NatId h') ! a of
        Dict -> beget _Compose . beget _Compose . fmap (get _Compose) . get _Compose

lambdaCompose :: forall a a' c. (Identified c, Composed c, Ob (Nat c c) a, Ob (Nat c c) a')
              => Iso (Nat c c) (Nat c c) (->) (Compose c c c (Id c) a) (Compose c c c (Id c) a') a a'
lambdaCompose = dimap hither yon where
  hither = nat $ \z -> case obOf (id :: NatId (Id c)) $ (id :: NatId a) ! z of
    Dict -> get _Id . get _Compose
  yon = nat $ \z -> case obOf (id :: NatId (Id c)) $ (id :: NatId a') ! z of
    Dict -> beget _Compose . beget _Id

rhoCompose :: forall a a' c. (Identified c, Composed c, Ob (Nat c c) a, Ob (Nat c c) a')
```

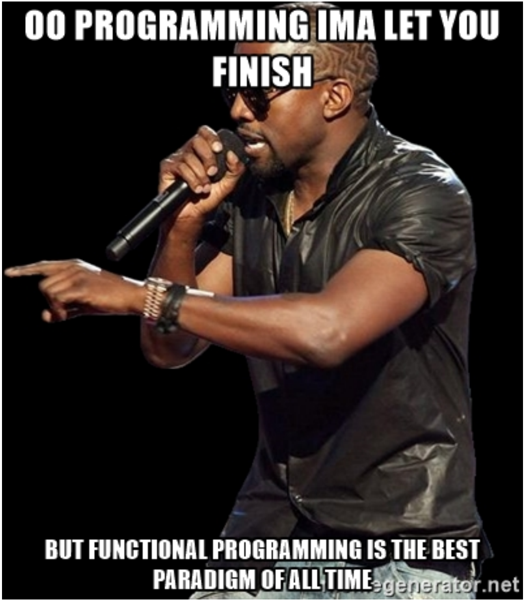

I LOVE ~~MATH~~...
FUNCTIONAL PROGRAMMING
IT MAKES PEOPLE CRY
Grumpy Cat™

AND THIS IS HOW
WE WRITE HELLO WORLD
IN HASKELL

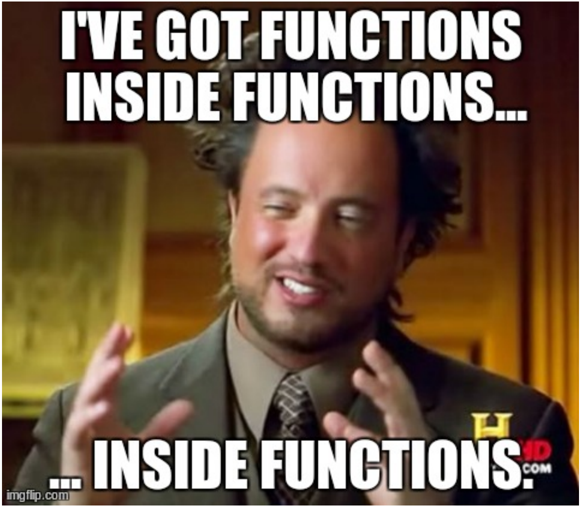
Actually, it's just:

```
main = print "Hello World"
```


WHAT IF I TOLD YOU
YOU ARE ALREADY DOING SOME FUNCTIONAL PROGRAMMING
emegenerator.net


OO PROGRAMMING IMA LET YOU FINISH
BUT FUNCTIONAL PROGRAMMING IS THE BEST PARADIGM OF ALL TIME
egenerator.net

HEY GIRL.
LIKE ALL VALUES IN HASKELL, MY LOVE FOR YOU IS IMMUTABLE.


I'VE GOT FUNCTIONS INSIDE FUNCTIONS...
... INSIDE FUNCTIONS.
imgflip.com

omputer
usiness
Center
DO I LOOK LIKE I KNOW
WHAT A MONAD IS?
made on imgur