PLC: Homework 4 [100 points, 120 max]

Deadlines

If the first letter of your HawkId is between 'a' and 'k' inclusive, then your solution is due by 9pm Wednesday, February 26th. Otherwise, it is due by 9pm Friday, February 28th. As mentioned in class, students with HawkIds between 'a' and 'k' inclusive will be submitting Wednesdays before Spring Break, and then they will be submitting Fridays after Spring Break.

Remember that late homework is **not** accepted, but we will use second-chance grading as for previous homeworks. Do not forget to check your grade for the first-chance submission. We will post grades by Monday, March 3rd at noon, at the latest (but likely much earlier than that). Your second-chance submission is then due Tuesday, March 4th, by noon.

Subversion, Partners

The same instructions as for previous homeworks apply for turning in your solution via subversion, and for extra files you need to submit if you are working with a single partner.

For this assignment, you will check in files to the `hw4` subdirectory of your personal repository (see hw1 instructions for how to check out this repository).

1 Reading

Chapter 5 of the book is just underway, and I will hopefully add to it by Monday, Feb. 24th. You can find the book as `book/book.pdf` in the class repository, or directly here:

`https://svn.divms.uiowa.edu/repos/clc/class/111-spring14/book/book.pdf`

2 Problems

There are two sets of problems you can tackle in this assignment. There are some miscellaneous theorems in the style of the problems from `hw1`, `hw2`, and `hw3` in `hw/hw4/misc.agda` in the class repository. These are only worth a total of 74 points. There are also just under 100 points worth of problems in `hw/hw4/matrices.agda`. You are free to do any combination of these problems you wish, for 120 maximum points (we will not award more than this, though you are free to do more problems if you wish). 100 points is a perfect score. See the files for the number of points that are given for the different problems.

The problems in `misc.agda` include several problems that could have been included on earlier homeworks. My hope is that problems that used to be hard for you may now be easier, and you could get some more points that way. I have also included a few problems from `hw2` that no one solved, just in case anyone is motivated to tackle them now.

The problems in `matrices.agda` concern matrices in the sense of linear algebra. An $n \times m$ matrix has n rows and m columns. In `matrices.agda`, this is encoded with the following definition:

```
_by_matrix : ℕ → ℕ → Set
n by m matrix = 𝕍 (𝕍 ℕ m) n
```

This says that an `n by m matrix` is a vector of length `n`, where each element of that vector is a vector of length `m` of natural numbers. Your job is to define a bunch of standard matrix-manipulating operations in the style of internal verification (see Chapter 5 of the book), where in this case we are using the indices `n` and `m` in the type to keep track of the dimensions of the matrix. Various operations on matrices can now impose constraints on their arguments using these indices. For example, for matrix addition, the code can insist that the dimensions of the matrices are the same. See `matrices.agda` for more details, including quite a few hints on how to approach the various problems.

Very important: as for previous homeworks, for any holes you choose not to fill in, you should remove those problems from the file before you submit. In the end, we are requiring the file you submit to check in Agda, and not to contain any holes. Also, it should not contain any highlighting. Your file may contain other Agda code or comments if you like. Do not change the names of any of the functions or theorems in the file.

3 Grading, Help

As for hw1, we will first confirm that your file can be checked in Agda, and that it does not contain any holes. Then we will determine which problems you solved, in order to compute your grade. We may use additional test cases to check the problems in `matrices.agda`. The problems in `misc.agda` are mostly theorems, which are correct if they type-check.

As for previous homeworks, you can post questions in the `hw4` section on Piazza. As before, feel free to post anonymously or privately, though we may subsequently make your question (and our answer) public, if we feel it would help other students. For truly private questions about the homework or class in general, please just email us. Note that you will likely get a faster answer if you ask on Piazza than if you email us.

You are also welcome to come to our office hours. See the "Course Staff" section of the Piazza page for times and locations of office hours, which we may change at the start of the week.