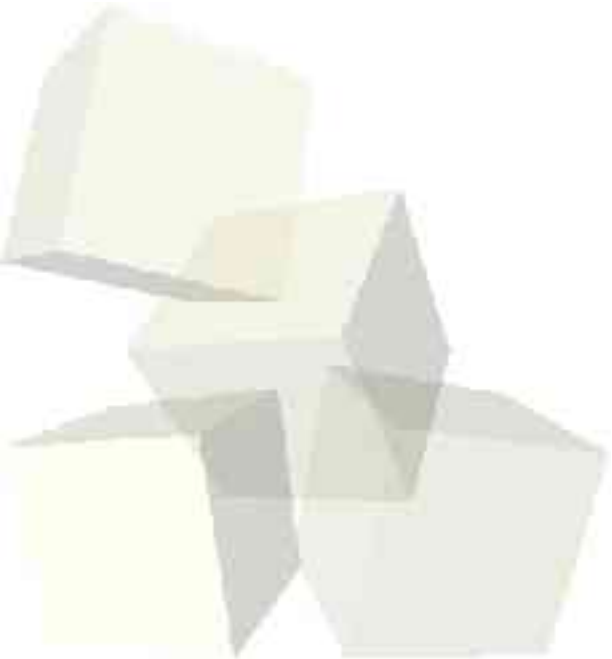
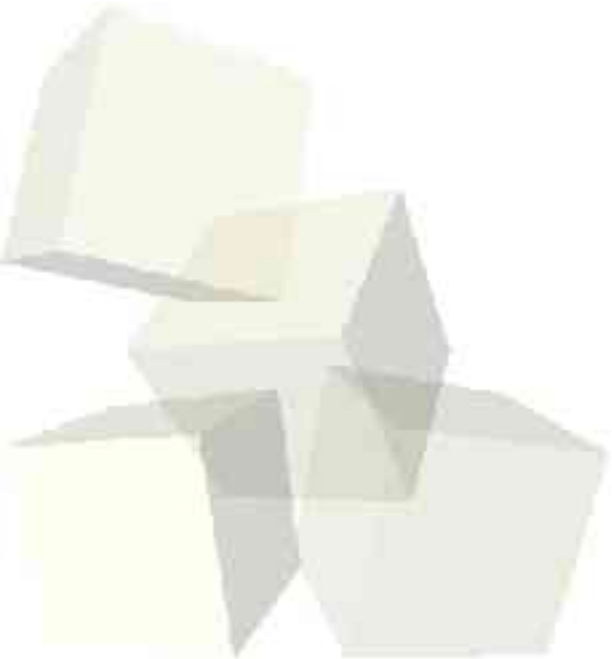
Data Abstraction and Numbers

9-8-2004



Opening Discussion

- Do you have any questions about the quiz?
- What did we talk about last class?
- Order of evaluation in Scheme. Notice how this can lead to parallelism.



Tracing and Debugging

- Obviously, a challenging aspect in any language is how to trace through code and debug problems.
- The most straightforward way to do this is with print statements. In Scheme, the display function does this, but only displays one item.
- Your book gives a simple example of enhancing this to writeln. It also shows nice entering and leaving functions.

Some Possible Functions

- member? – Is the item in the list?
- append – Append two lists together.
- map-list – Apply a function to all the elements of a list and return a new list with the results.
  - This one is more complex. It shows an example of passing a function as an argument.

Mathematical Functions

- Scheme provides a number of mathematical functions that you can use.
  - Abs – absolute value
  - Ceiling – round up
  - Floor – round down
  - Round – normal rounding
  - Truncate – cut off the fraction
  - Expt – exponent
  - Max and min
  - Exp and log – natural based exponent and log
  - Trig functions – sin, cos, tan, asin, acos, atan
  - Quotient and remainder
  - modulo

User Defined Math Functions

- We can write math functions as well. Last time we did factorial and saw how Scheme does exact arithmetic with big integers.
- Let's write some other quick functions as well.
  - List-ref – get the specified element of a list
  - Taylor-cos – do a Taylor approximation of cos

Data Abstraction

- Your book uses the example of rational numbers for data abstraction. The idea is that we define functions to get at data in some list structure and functions to manipulate it.
- The user never has to know the exact internal representation, just the functions to deal with.
- We can instead do this with a complex number data abstraction.

Minute Essay

- How are you doing on recursion? Have you tried doing the assignment yet? Remember that it is due on Thursday.