More Recursion

4-1-2010

Opening Discussion

- Do you have any questions about the assignment?
- Do you have any questions about the reading?
- Aside
  - You can do this. It might take effort.
  - No one pays you well for doing things that are easy.
- Minute Essays
  - “Every place I've used recursion I've been able to use loops.”
  - How could recursion be used in other problems? Is it always the most efficient?
  - How could our shortest path get into infinite recursion?

Mazes

- Let's work on a DrawMaze class and write some different algorithms that work with it.
- The normal recursive algorithms try all paths. In some mazes this can take a very long time. Let's look at why that is and how we might be able to fix it.

Divide and Conquer

- A standard approach to solving problems with recursion is divide and conquer. In this approach we break the problem up into two or more smaller problems, solve the smaller problems, them make an answer for the larger problem with the solutions of the smaller pieces.
- Of course, the key to the recursion is that the smaller problems are solved by breaking them up in the same way.
- You can use this approach for simple array functions, but there isn't much benefit there.
- For some problems though, divide and conquer can provide much simpler and/or efficient solutions to problems.

Formula Parsing

- One problem we can solve nicely with a divide and conquer approach is formula parsing.
- What we want to do is repeatedly find the lowest priority operator and split the string around it. We recursively call the method on the two sides.
- Numbers or variables are the terminal cases.

Sorts

- The most commonly used divide and conquer algorithms are sorts. Mergesort and quicksort or both divide and conquer. They differ in how they do the division and when they do the majority of their work.
- Mergsort does virtually no work going down the call stack. It simply breaks the input array in half each time until it gets to single elements. The work happens coming back up as the two sorted pieces are merged.
- Quicksort does work on the way down. At each step a “pivot” element is picked and moved to the right spot. Recursion is done on both sides of the pivot.

Minute Essay

- Recursion and induction are very closely linked. Describe the similarity.
- Or, if you aren't in discrete, why can the maze functions be so remarkably slow?
- Interclass Problem – Use a recursive algorithm to figure out the two possible solutions to this comic.
  - http://xkcd.com/287/