

Recursion 2

11-12-2002

Opening Discussion

- What did we talk about last class?

Maze Problems and Graph Traversals

- By adding a bit of extra logic to a floodFill we can turn it into a function that searches through mazes. 2D mazes are a special example of the general category of graphs. A graph has vertices that are connected by edges.
- The key to these problems is that we want to leave behind "bread crumbs" to mark our path and pick them up as we backtrack.
- We can also leave other markers that can help speed up our algorithms depending on what we are doing.

Two Maze Problems

- Counting the number of paths. This was your minute essay from last time. It is like a floodFill, but it return the number of paths. That number is 1 for an exit, 0 for a wall, and the sum of all the neighbors for an open spot. Remember bread crumbs.
- Shortest path. This is a slightly harder problem which can be done efficiently or not. Not is almost like the one above.

Divide and Conquer

- Another common usage of recursive functions is in divide and conquer algorithms. In these, we repeatedly break a problem down into smaller pieces until we get to a point where we can solve it easily. We then combine the partial solutions to find a full solution.
- Some extremely simple examples could be finding the sum of the elements of an array or the min of them.

Equation Parsing

- Another fun application of divide and conquer is string parsing for things like equations. Here we break the problem up around the lowest priority operator and recursively parse smaller sections if the formula, then deal with then as we move back up the stack.
- With just a little more work, this type of method can be turned into a very powerful tool.

Faster Sorts

- Divide and Conquer can also be used to come up with faster sorting algorithms.
 - Mergesort - divide directly in two and recurse, then merge the two sorted halves. Does the work on the way back up.
 - Quicksort - pick a pivot, and move everything lower than the pivot to one side and everything higher to the other then recurse on the two sides. Does the work on the way down.

Minute Essay

- Trace a quicksort that uses the first element as a pivot for the array {5,8,2,4,7}.
- Quiz #5 will be next class.
