CS18 Integrated Introduction to Computer Science  Fisler

Lecture 28: 2D Dynamic Programming Setup
11:00 AM, Apr 13, 2020

Contents

Motivating Question

How do we do dynamic programming if our data is richer than a one dimensional array of numbers?

Maximizing Halloween Candy

At the end of the last lecture, we briefly introduced a problem of searching for the best route to maximize how much candy you can get from trick-or-treating on Halloween. The idea is that you will start from some house in the top row, then make your way down to the bottom row. You can pick up candy from one house in each row. From each house you visit, the next one has to be either directly below or diagonally adjacent. The following image (left) shows the idea (only some of the “next” arrows are present to avoid clutter). The blue highlights show the optimal choice.

In the next lecture, we’ll explore this problem and how we calculate not only the max candy but also the route to take to get the candy. To prepare for this, we want to you do the following tasks:

1. The image above shows you the amount of candy available at each house. The following blank table will hold the max candy that you could have by the time you reached each house as you searched the neighborhood. Fill in the second row and at least a cell or two of the third row.

    | 4 | 3 | 1 | 5 |
    |---|---|---|---|
    | 9 | 15| 2 | 7 |
    | 2 | 5 | 6 | 17|
    | 11| 13| 4 | 8 |
2. We could also have constructed this table from the bottom row values up to the top row. In this case, we’d have copied the bottom row values from the original table, and used the arrows to complete the upper rows.

What would the data in each cell of the computed table represent if we had filled in the table from the bottom row up? How would you describe that data?

3. Which approach (fill from top to bottom or fill from bottom to top) made more sense to you?

4. Which approach (fill from top to bottom or fill from bottom to top) makes more sense if you also have to construct the specific set of houses to visit as the dynamic programming algorithm runs?