

Analysis of Algorithms
CS 375, Spring 2020

Homework: Dynamic Programming

Due by 11:59pm Anywhere on Earth, **DATE TBD**

- To submit this HW, please email a PDF named `HW_DynamicProgramming_<yourName>` to `eaaron@colby.edu`.
- **READING:** From your textbook, please read Ch. 15, pages 359–360, 378–396; Ch. 24, pages 643–top of page 647; Chapter 25.2.

Exercises

1. A pair of rabbits, one male and one female, is placed in a large sealed enclosure. How many pairs of rabbits will be there in a year if the initial pair are newborn and all rabbit pairs are not fertile during their first month of life but thereafter give birth to one new male / female pair at the end of every month?

Please explain your answer; a short explanation (3–4 sentences or so) could suffice, as long as it contains the ideas underlying the solution.

2. CLRS Exercise 15.4-1 (pg. 396). This exercise is intended to give you practice with the algorithm in Section 15.4—for your answer, please show the table constructed (see Figure 15.8) for this example, and give the LCS derived from that table (following the methods in the textbook).
3. In chess, a rook can move horizontally or vertically to any square in the same row or in the same column of a chessboard. Find the *number of shortest paths* by which a rook can move *from the bottom-left corner of a chessboard to the top-right corner*. (The length of a path is measured by the number of squares it passes through, including the first and the last squares.)

Solve the problem by a dynamic programming method. That is, come up with a relevant recurrence—i.e., a recursive definition of the relevant values for a solution, as we’ve seen in the examples from class—and using dynamic programming techniques, calculate the solution. Please show your work by giving an 8×8 table (each element in the table represents the corresponding square on the chessboard), where each entry in the table should be the number of paths from the bottom-left corner to that square on the chessboard; therefore, the answer to this exercise will be the number in the top-right element of your table.

Note that you do not need to provide a shortest path from one corner to the other, just the number of shortest such paths. Please be sure to include an explanation of the correctness of your recurrences (a well-worded paragraph could suffice); you do not need to explain how you used the generated the table from the recurrence.

4. CLRS exercise 25.2-1 (pg. 699). Be sure to show all the requested matrices; no other explanation of your answer is necessary.