CECS 528, Homework Assignment 2, Fall 2025, Dr. Ebert

Directions: Please review the `Homework` section of the syllabus including a list of all rules and guidelines for writing and submitting solutions.

Due Date: Wednesday, October 8th as a PDF-file upload to the HW2 Canvas dropbox.

Problems

1. The dynamic-programming algorithm that solves the `Edit Distance` optimization problem defines a recurrence for the function $d(i, j)$, where $d(i, j)$ is the edit distance between prefixes $u[1 : i]$ and $v[1 : j]$.

   (a) Provide a new dynamic-programming recurrence for $d(i, j)$ assuming that changing one letter to another is no longer allowed but swapping two adjacent letters is allowed (we still allow for the deleting or adding of a letter). Note: when two adjacent letters are swapped, neither letter may be subsequently deleted nor may we add a letter between the two letters. In other words, all subsequent edits must occur to the left of the swapped letters. (10 pts)

   (b) Apply the new recurrence from Part a to the words u = baababab and v = abbbabba. Show the matrix of subproblem solutions and use it to provide an optimal sequence of right-to-left edits. Continue to use arrows to indicate which edit choice(s) is the optimal first edit for a particular subproblem. (10 pts)

2. A meeting hall is rented to different events that occur on the same day. Associated with an event is a start time (s_i), finish time (f_i) and a bid amount (b_i) provided by the host of the event in order to secure the hall. The owner of the hall has the objective of maximizing total profit by accepting an optimal combination of event bids. For a given day, assume the owner has received bids for events $e_1 = (s_1, f_1, b_1), \ldots, e_n = (s_n, f_n, b_n)$, where we assume the bids are listed in increasing order of finish time.

   (a) Provide a dynamic-programming recurrence that determines the optimal set of bids that the owner should accept in order to maximize profit. Clearly define the function for which a recurrence is being provided. No credit shall be awarded to ill-defined functions. (10 pts)

   (b) Apply your recurrence to the list of events

   $$e_1 = (2, 3, 40), e_2 = (0, 4, 60), e_3 = (2, 4, 30), e_4 = (1, 6, 60), e_5 = (3, 7, 70),$$

   $$e_6 = (5, 7, 20), e_7 = (5, 8, 60), e_8 = (7, 8, 50), e_9 = (6, 10, 40).$$

   (10 pts)