CMPSC 465 | Data Structures & Algorithms
Fall 2024 | Mingfu Shao and Debarati Das

# HW 11

## Due November 15th (Friday), 11:59 pm

Formatting: Each problem should begin on a new page. When submitting in Gradescope, try to assign pages to problems from the rubric as much as you can. Make sure you write all your group members' names. For the full policy on assignments, consult the syllabus.

1. (15 pts.)
   Apply the greedy algorithm for Horn formulas (covered in the lecture) to find the variable assignment that solves the following horn formulas:

   1. $(w \wedge y \wedge z) \Rightarrow x, (x \wedge z) \Rightarrow w, x \Rightarrow y, \Rightarrow x, (x \wedge y) \Rightarrow w, (\bar{w} \vee \bar{x} \vee \bar{y}), (\bar{z})$
   2. $(x \wedge z) \Rightarrow y, z \Rightarrow w, (y \wedge z) \Rightarrow x, \Rightarrow z, (\bar{z} \vee \bar{x}), (\bar{w} \vee \bar{y} \vee \bar{z})$

   You need to describe each step of running the algorithm, i.e., the current assignment, which variable will be changed because of what, etc.

2. (15 pts.)
   Given two strings $x = x_1 x_2 x_n$ and $y = y_1 y_2 y_m$, we wish to find the length of their longest common substring, that is, the largest $k$ for which there are indices $i$ and $j$ with $x_i x_{i+1} \ldots x_{i+k-1} = y_j y_{j+1} \ldots y_{j+k-1}$. Show how to do this in time $O(mn)$. Write the subproblem definition, recurrence relation, base case with explanation, and analyze the running time.

3. (20 pts.)
   A contiguous subsequence of a list $S$ is a subsequence made up of consecutive elements of $S$. For instance, if $S$ is $1, 5, -10, 11, 20, -5$ then $5, -10$, is a contiguous subsequence but $5, 11, 20$ is not. Give a linear-time algorithm for the following task:

   Input: A list of numbers $S = a_1, a_2, ..., a_n$.

   Output: The contiguous subsequence of maximum sum (a subsequence of length zero has sum zero). For the preceding example, the answer would be $11, 20$ with a sum of 31. Write the subproblem definition, recurrence relation, base case with explanation, and analyze the running time.