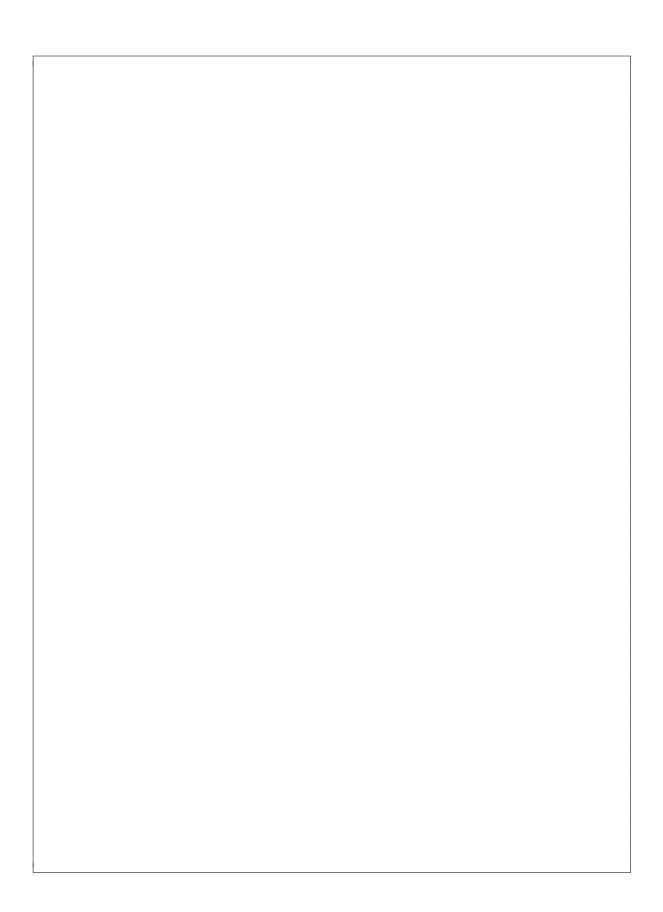
CS 577: Introduction to Al	gorithms Homework (
Out: 03/16/21	Due: 03/23/21
Name:	Wisc ID:
Ground Rules	
	provided on the question sheets. If you run out of room for an answer, add a to not feel obligated to fill the entire solution box. The size of the box does also length.
• The homework is to be done and su section but you must write up the so	bmitted individually. You may discuss the homework with others in either lution <i>on your own</i> .
	naterial outside of assigned textbooks and material the instructors post on the alting the internet will be considered plagiarism and penalized appropriately.
 The homework is due at 11:59 PM C circumstances. 	CST on the due date. No extensions to the due date will be given under any
Homework must be submitted electr	onically on Gradescope.
Problem 1	
programming. You leave the company to orders. In particular, each order now takes Suppose on a certain day, n customers giv takes t_i days to deliver, and the customer paid 0 dollars). On-time delivery means the	ompany $Algo\ Express$ for many years, you discover the power of dynamic start a new venture ($DPAlgo\ Express$) that can process very big delivery several days for the teleportation machine to complete. We you packages to deliver. Each delivery i should be made within d_i days, pays you p_i dollars for doing it on time (if you don't do it on time, you get lat if package i is due within $d_i = k$ days, the delivery should be completed should start on or before day $k - t_i$). As before, your teleportation machine
Input : A set of n deliveries with due date payments $p_i > 0$ for each delivery $i \in \{1, \dots, n\}$	es $d_i \in \mathbb{N}, d_i \geq 1$, number of days needed for delivery $t_i \in \mathbb{N}, t_i \geq 1$ and \dots, n .
profit. (Note: unlike the previous ve	ermine which deliveries to make and in what order so as to maximize your ersion of the problem, deliveries may now take more than one day). Your nomial running time – running time polynomial in n and T , where T is the



(b)	Provide a clear explanation for your recurrence relation for part (a) and analyze its running time.

Problem 2

Two players are arguing over which of their characters is the best at 1v1 combat in a tabletop RPG game, and they have asked you to help solve this dispute. In this game, combat works as follows: each character starts with a certain number of hitpoints, and players take turns selecting actions that could either harm their opponent or benefit themselves. The first character to reach 0 or fewer hitpoints loses.

Player 1's character starts with H_1 hitpoints and has two actions to choose from on each turn: attack and flex. Their character starts with an attack power of 1, and each time they choose the flex option their attack power increases by 1, up to a maximum of 5. If they choose to attack, then their character deals their attack power times A_1 damage to their opponent, removing that same amount of hitpoints. Player two's character starts with H_2 hitpoints and also has two actions to choose from: attack and heal. If they choose to heal, then their character recovers 20 of their missing hitpoints (up to a maximum of H_2). Because heal is a spell, it can only be used a total of two times in combat. If player 2 chooses to attack, then they deal A_2 points of damage to their opponent.

Because player 1's character initiative attribute is greater than player 2's character, player 1 is always the first one to choose an action. Notice that there are no draws, and if both players play optimally then one of them is always guaranteed to win. The problem you are asked to solve is the following: given as input integer values H_1 , H_2 and H_2 , decide which player is guaranteed to win when both play optimally.