

CS2223 HW#2

DUE: Thursday, November 8

1 (8 points) Newt seeks an algorithm to play *DISPARITY*, which accepts as input $2n$ numbers, $x_1, \dots, x_{2n} \in \{1, \dots, 10n\}$, and produces as output a partition of $\{1, \dots, 2n\}$ into two equal sized blocks, *Haves* and *HaveNots*, such that $\sum_{i \in \text{Haves}} x_i - \sum_{i \in \text{HaveNots}} x_i \geq \sum_{i \in A} x_i - \sum_{i \in B} x_i$ for all partitions of $\{1, \dots, 2n\}$ into equal sized blocks A and B . That is, you want to divide x_1, \dots, x_{2n} into subsets of equal cardinalities which are as inequitable as possible. For example, if $n=8$ and $x_1, \dots, x_8 = 9, 12, 9, 0, 3, 15, 7, 7$ then $\text{Haves} = \{1, 2, 3, 6\}$ and $\text{HaveNots} = \{4, 5, 7, 8\}$. Help Newt by describing a linear time algorithm (worst-case execution time in $\Theta(n)$) to solve the *DISPARITY* problem. You don't need to execute your algorithm.

2. (8 points) Which of the following statements are true? Prove your answers.

a $n^4 + 1000000n^3 \in \Theta(n^4)$

b $(n+1)! \in \Theta(n!)$

c $n^2 \in O(n^2 \lg n)$

d $n^2 \in \Theta(n^2 \lg n)$

3. (3 points) Do **Problem 3.14** from page 94 of our text.

4. (3 points) Do **Problem 3.21** from page 95 of our text. Use O notation. You needn't prove your answers.