

PSG COLLEGE OF TECHNOLOGY
DEPARTMENT OF APPLIED MATHEMATICS AND COMPUTATIONAL SCIENCES
DESIGN AND ANALYSIS OF ALGORITHMS LAB

WORK SHEET 1

Basic Algorithms

1. Take an array of integers and partition it so that all the even integers in the array precede all the odd integers in the array. Your solution must take linear time in the size of the array and operate in-place with only a constant amount of extra space.
2. During the sweet-corn festival in Urbana, you have been kidnapped by an extreme anti corn organization called Al Corona. To punish you, they give you several sacks with a total of $(n+1)n/2$ cobs of corn in them, and an infinite supply of empty sacks. Next, they ask you to play the following game: At every point in time, you take a cob from every non-empty sack and you put this set of cobs into a new sack. The game terminates when you have n non empty sacks, with the i^{th} sack having i cobs in it, for $i=1, \dots, n$.

For example, if we started with $\{1,5\}$ (i.e., one sack has 1 cob, the other 5), we would have the following sequence of steps : $\{2,4\}$, $\{1,2,3\}$ and the game ends.

Example 2 : $\{3, 3\}$, $\{2, 2, 2\}$, $\{1, 1, 1, 3\}$, $\{2, 4\}$, $\{1, 3, 2\}$

3. Given an unsorted array of size n find the majority element. The majority element is the element that appears more than $n/2$ times. Assume the array is non empty and the majority element exists in the array.

Input : $\{1\ 3\ 3\ 1\ 5\ 4\ 1\ 1\ 1\}$, $\{1\ 1\ 1\ 1\ 5\ 4\ 3\ 3\ 1\}$

//Voting method

4. Let S be a set of n positive integers, where n is even. Give an efficient algorithm to partition S into two subsets S_1 and S_2 of $n/2$ elements each with the property that the difference between the sum of the elements in S_1 and the sum of the elements in S_2 is maximum. What is the time complexity of your algorithm?