

Definition (Majority Element)

An array $A[1, \dots, n]$ is said to have a *majority element* if more than half of its entries are the same.

Problem

Given an array, the task is to design an efficient algorithm to tell whether the array has a majority element, and, if so, to find that element.

The elements of the array are not necessarily from some ordered domain like the integers, and so there can be no comparisons of the form “is $A[i] > A[j]$?”. (Think of the array elements as GIF files, say.) However you can answer questions of the form: “is $A[i] = A[j]$?” in constant time.

1. Show how to solve this problem in $O(n \log n)$ time.
2. Can you give a linear-time algorithm?