There are 2 questions for a total of 10 points.

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1. Apply the Master theorem and give the solution for the following recurrence relations in big-O notation. Explanation is not required.
   (a) (1 point) $T(n) = 2 \cdot T(n/2) + O(1); T(1) = O(1)$
   (b) (1 point) $T(n) = 2 \cdot T(n/2) + O(n); T(1) = O(1)$
   (c) (1 point) $T(n) = 2 \cdot T(n/2) + O(n^3); T(1) = O(1)$

2. (7 points) You are given a bit-array $A[1...n]$ (i.e., $A[i] \in \{0, 1\}$ for each i) and told that this is a "0-to-1" bit-array. This means that for some (unknown) index $1 \leq j < n$, $A[1], ..., A[j]$ are all 0's and $A[j+1], ..., A[n]$ are all 1's. The index j for such an array is called the transition index.

   Design an algorithm for finding the transition index for a given 0-to-1 bit-array. The input to your algorithm is an array A and the size n of the array A. Give a running time analysis for your algorithm.