Remarks: Solve the 5 following questions. In all algorithm, always explain how and why they work. ALWAYS, analyze the complexity of your algorithms. In all algorithms, always try to get the fastest possible. A correct algorithm with slow running time may not get full credit. Do not use material not taught in class.

Last time to hand in the exam: 14 od December 17:00 at my office.
BSB third floor room 319.

1. **Question 1:** Given an array \( A \) give an algorithm that counts the number of pairs \( A[i], A[j], i \neq j \) so that \( A[i] = A[j] \).

2. **Question 2:** Say that an unsorted array contains \( n + 1 \) integral numbers that are pairwise disjoint. The median is the number that is smaller than \( (n - 1)/2 \) other numbers and larger than \( (n - 1)/2 \) numbers.
   Say that we are given an \( O(n) \) algorithm to find the median. Given a number \( 1 \leq k \leq n \) use the above algorithm to find the \( k \) smallest number in the array (for example in \( k = n \) we are looking for the maximum). Give a precise analysis of the running time.

3. **Question 3:**

4. **Question 4:**

5. **Question 5:**