Exercise I

**Remarks:** Solve the following 4 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.

1. **Question 1:** We are given two sorted arrays $A$ and $B$. All the numbers in $A \cup B$ are pairwise distinct. Write an algorithm to find the median of $A \cup B$. This is the number in the middle of $A \cup B$ (in $n$ is odd the median is smaller than $1/2$ the numbers and larger than $1/2$ the numbers. If $n$ is even there are two medians).

2. **Question 2:** Say that in an unsorted array $A$, each element is at most 10 places from its sorted position.

3. **Question 3:** Solve the Knapsack problem, if there are only two prices possible.

4. **Question 4:** Let $T$ be a rooted tree $T(V, E, r)$. We say that a subset $A \subseteq V$ is *proper* if there is not some node $v$ and its parent $p(v)$ in $A$. Give a greedy algorithm to find a proper subset of $V$ of maximum size.