Infero Task

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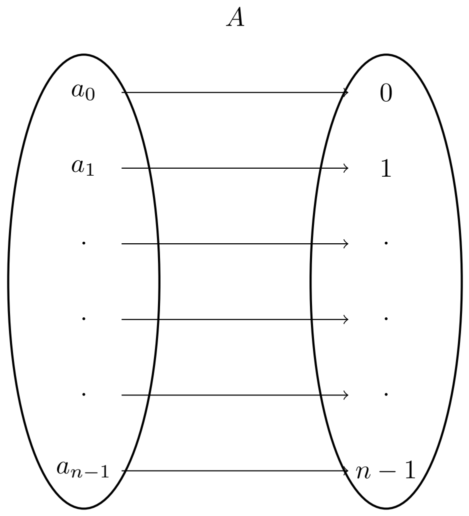
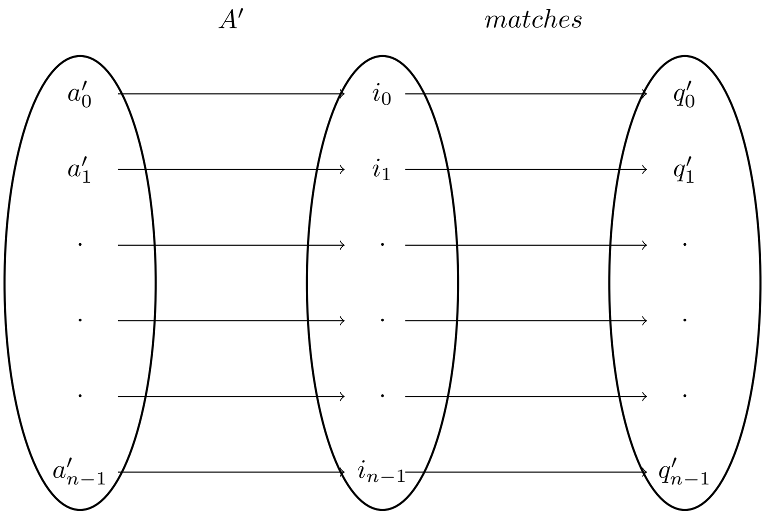
1 Explanation of the Code

Let $A = \{a_0, a_1, \ldots, a_{n-1}\}$ be the original list of applicant's ratings, and $Q = \{q_0, q_1, \ldots, q_{n-1}\}$ be the original list of questions' ratings.

After sorting, let $A' = \{a'_0, a'_1, \ldots, a'_{n-1}\}$ and $Q' = \{q'_0, q'_1, \ldots, q'_{n-1}\}$ be the sorted lists of applicants and questions, respectively, where $a'_0 \leq a'_1 \leq \ldots \leq a'_{n-1}$ and $q'_0 \leq q'_1 \leq \ldots \leq q'_{n-1}$.

Notice that we have used a map to take input. Let us visualize this,





where $0 \le i_0, i_1, \ldots, i_{n-1} \le n-1$. We have used an array named *matches* to map the index of applicants in A' to Q'. We need to sort the questions and allocate them to the applicants in ascending order of their ratings. The code accomplishes this task. Note that the indices of the applicants are jumbled. We can use a for loop on the *matches* to print out the correct order of the questions.

2 Proof of Correctness

We shall use proof by contradiction. Assume that there exists an $i \in \{0, 1, \ldots, n-1\}$ such that it is the smallest index which does not meet the requirements, i.e.,

$$a'_i < \text{matches}[i] = q'_i.$$

According to the problem statement, there must always exist a correct order, i.e., $\forall i \in \{0, 1, \ldots, n-1\} \exists$ a unique j such that $a'_i \ge q'_j$. If q'_i is not the correct match for a'_i, let's try to find a match for a'_i.

For all $t \ge i+1$, q'_t cannot be the correct match because $a'_i < q'_i \le q'_t$. Now, consider $t \le i-1$. If there is a correct match such that $a'_i \ge q'_t$, we can swap q'_i and q'_t, but there is a problem:

$$a'_t \le a'_i, \tag{1}$$
$$a'_i < q'_i. \tag{2}$$

From (1) and (2), $a'_t < q'_i$, which is a contradiction. Hence, there is no correct match for a'_i, but the problem statement asserts that there exists a correct match for all i. Therefore, the code must provide the correct match for all i.