Exercise03

Problem 1

a) Loop Invariant: At the start of iteration "j" of the loop, the variable C contains the symmetric difference of sets A and B for the subarray A[0:j]. The symmetric difference represents the elements that are in A or B but not in both.

b) 1. Initialization: At the beginning, C is initialized with the elements of set B, making it a valid starting point for the symmetric difference. No elements in A have been processed yet, so it correctly represents the symmetric difference between A and B up to A[0:0].

2. Maintenance: Assuming the loop invariant holds at iteration "j," we evaluate if the j^{th} element a_j belongs to C. If it does, it means a_j was in B as well, and we remove this element from C. This operation preserves the symmetric difference of sets A and B. If a_j does not belong to B, we add the element to C, which also maintains the symmetric difference. After this step, we move on to evaluate the next element, a_{j+1}, in A, ensuring that the loop invariant holds.

3. Termination: When all elements in A have been processed, the loop ends. At this point, C contains all the unique values from both A and B, correctly representing the symmetric difference between A and B as a whole.

c) Since the loop invariant holds at the beginning, during the loop body, and at the end, we can conclude that after the loop, C contains the symmetric difference between sets A and B, as required by the algorithm's goal.