Consider the Disjointness function mentioned in class DISJ : \( \{0,1\}^n \times \{0,1\}^n \rightarrow \{0,1\} \) defined as

\[
\text{DISJ}(x, y) = \begin{cases} 
1 & \text{if } x_i y_i = 0 \text{ for all } i = 1, 2, \ldots, n \\
0 & \text{otherwise}
\end{cases}
\]

1. Prove that the deterministic communication complexity of DISJ equals \( n + 1 \).

2. In a streaming algorithm, the input is a data stream presented as a sequence of items which can be examined only once in a single pass (this is similar to how a finite automata accesses its input).

Suppose we want a streaming algorithm that on input a stream of integers from \( \{1, 2, \ldots, n\} \) computes the number of distinct elements that occur in the stream. Show that any deterministic streaming algorithm for this task must use \( \Omega(n) \) space.