Exercise 4

Problem 1. Given the algorithm that implements immediate snapshot in the lecture, your task is to show that if at most $x$ processes invoke $\text{rec_update\_snapshot}(x, -)$, then

(a) At most $(x - 1)$ processes invoke $\text{rec_update\_snapshot}(x - 1, -)$ and

Problem 2. In the lecture, we saw that in Epoch-based Reclamation, a deleting process takes a snapshot of all process epochs and records it with the deleted node in the limbo list. Does this snapshot need to be atomic? Why or why not?

Problem 3. Write pseudocode for the \textsc{Scan} method of Hazard Pointers. Recall that the \textsc{Scan} method goes through the limbo list of a process and checks for every node in the list if it protected by some process’ hazard pointer. Can you implement \textsc{Scan} such that it runs in $O(m + n)$ time, where $m$ is the number of nodes in the limbo list and $n$ is the number of processes?