Problem 17 (5 points):
Prove that when using the cut-and-paste strategy with \( n \) units, the location of every object can be determined in at most \( O(\log n) \) computations. (Hint: it suffices to show that every object is replaced at most \( O(\log n) \) times when increasing the system one by one from 1 to \( n \) units; replaying these hops gives the time bound for the computations.)
Also, show that for every perfectly faithful strategy it holds: If the number of units grows one by one from 1 to \( n \), then on average an object has to be replaced \( \Omega(\log n) \) times. (Hint: compute the total number of object replacements, and divide it by the number of objects.)

Problem 18 (3 points):
Suggest an algorithm and a data structure for the SHARE strategy that allows it to compute the location of an object in \( O(\log n) \) steps.