Algorithms and Data Structures

Summer Semester 2022

For discussion on Tuesday, May 31, 2022

1. (GTG R-5.6) Our implementation of insert for the `DynamicArray` class, as given in the code `ch05/dynamic_array.py` of the book's repository, has the following inefficiency. In the case when a resize occurs, the resize operation takes time to copy all the elements from an old array to a new array, and then the subsequent loop in the body of insert shifts many of those elements. Give an improved implementation of the insert method, so that, in the case of a resize, the elements are shifted into their final position during that operation, thereby avoiding the subsequent shifting.

2. (GTG R-5.7) Let A be an array of size $n \geq 2$ containing integers from 1 to $n - 1$, inclusive, with exactly one repeated. Describe a fast algorithm for finding the integer in A that is repeated.

3. (GTG C-5.16) Implement a pop method for the `DynamicArray` class that removes the last element of the array, and that shrinks the capacity, N, of the array by half any time the number of elements in the array goes below $N/4$.