Exercises IV

Labelled algorithms, figures, and chapters refer to the course book.

IV-1 (CLRS 17.1-1) If the set of stack operations included a MULTIPUSH operation, which pushes $k$ items onto the stack, would the $O(1)$ bound on the amortized cost of stack operations continue to hold?

IV-2 (CLRS 17.1-3) Suppose we perform a sequence of $n$ operations on a data structure in which the $i$th operation costs $i$ if $i$ is an exact power of 2, and 1 otherwise. Use aggregate analysis to determine the amortized cost per operation.

IV-3 (CLRS 17.2-2 and CLRS 17.3-2) Redo the previous exercise using (a) an accounting method of analysis and (b) a potential method of analysis.

IV-4 (CLRS 17.3-4) What is the total cost of executing $n$ of the stack operations PUSH, POP, and MULTIPOP, assuming that the stack begins with $s_0$ objects and finishes with $s_n$ objects?

IV-5 (CLRS 17.4-3) Suppose that instead of contracting a table by halving its size when its load factor drops below $1/4$, we contract it by multiplying its size by $2/3$ when its load factor drops below $1/3$. Using the potential function $\Phi(T) = |2 \cdot N(T) - S(T)|$, show that the amortized cost of a TABLE-DELETE that uses this strategy is bounded above by a constant. Here $N(T)$ and $S(T)$ denote the number of items stored in table $T$ and the size of $T$, respectively.