

**CSC C78F 2000**  
**Assignment 4, alternate question**

due: Wednesday, November 22, 2000

Consider the abstract data type DEPR that consists of a set  $S$  of positive integers upon which the following two operations can be performed:

**DELETE**( $S, i$ ): Delete the integer  $i$  from the set  $S$ . If  $i \notin S$ , then do nothing.

**PREDECESSOR**( $S, i$ ): Return the predecessor of integer  $i$  in  $S$ , i.e.  $\max\{j \in S \mid j < i\}$ . If  $i$  has no predecessor in  $S$ , i.e. if  $i \leq \min S$ , then return 0.

Initially,  $S$  is a set of  $n$  consecutive integers. Describe a data structure with  $O(\alpha(m, n))$  amortized cost per operation, where  $\alpha$  is the inverse of the Ackermann function and  $m$  is the number of operations that are performed. Justify the correctness and complexity of your data structure.

How do you initialize your data structure and how much time does it take?