

/*Deq is a double-ended queue. The head is the first element from the front (on the left hand side) and the last is the first element from the back (on the right hand side). Init returns a Deq without the last, and tail returns a Deq without the head */

NEWTYPE Deq

LITERALS EMPTY

OPERATORS

insFront: Real, Deq \rightarrow Deq;
insEnd: Deq, Real \rightarrow Deq;
head: Deq \rightarrow Real;
last: Deq \rightarrow Real;
init: Deq \rightarrow Deq;
tail: Deq \rightarrow Deq;
count: Real, Deq \rightarrow Int;
len: Deq \rightarrow Int;

AXIOMS

FOR ALL Q IN Deq (
FOR ALL e, e1, e2 IN Real (
insEnd (Empty, e) == insFront(e, Empty);
insEnd (insFront(e1, Q), e2) == insFront(e1, insEnd(Q, e2));
head(Empty) == error!
head(insFront(e, Q)) = e;
last(Empty) == error!
last(insFront(e, Q)) =
IF Q=Empty
THEN e
ELSE last(Q);
init(Empty) == Empty;
init(insFront(e, Q)) =
IF Q=Empty
THEN Empty
ELSE insFront(e, init(Q));
tail(Empty) == Empty;
tail(insFront(e, Q)) = Q;
count(e, Empty) = 0;
count(e1, insFront(e2, Q)) =
IF e1 = e2
THEN count(e1, Q) +1
ELSE count(e1, Q);
len(Empty) = 0;
len(insFront(e, Q)) = len(Q) +1;
)
)

ENDNEWTYPE