

algebra $list_2$

sorts $list, elem, pos$

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|-----|-------------------------------|---|---------------------------------------|---------------------------------|
| ops | <u>empty</u> | : | | $\rightarrow list$ |
| | <u>front</u> , <u>last</u> | : | $list$ | $\rightarrow pos$ |
| | <u>next</u> , <u>previous</u> | : | $list \times pos$ | $\rightarrow pos \cup \{null\}$ |
| | <u>bol</u> , <u>eol</u> | : | $list \times pos$ | $\rightarrow bool$ |
| | <u>insert</u> | : | $list \times pos \times elem$ | $\rightarrow list$ |
| | <u>delete</u> | : | $list \times pos$ | $\rightarrow list$ |
| | <u>concat</u> | : | $list \times list$ | $\rightarrow list$ |
| | <u>isempty</u> | : | $list$ | $\rightarrow bool$ |
| | <u>find</u> | : | $list \times (elem \rightarrow bool)$ | $\rightarrow pos \cup \{null\}$ |
| | <u>retrieve</u> | : | $list \times pos$ | $\rightarrow elem$ |

functions

$$\text{empty} = (\emptyset, \langle p_0 \rangle)$$

Sei für die restlichen Funktionsdefinitionen $l = (a_1 \dots a_n, p_0 \dots p_n)$.

$$\text{front}(l) = p_0$$

$$\text{last}(l) = \begin{cases} p_n & \text{falls } n > 0 \\ \text{undefiniert} & \text{sonst} \end{cases}$$

$$\text{next}(l, p) = \begin{cases} p_{i+1} & \text{falls } \exists i \in \{0, \dots, n-1\}: p = p_i \\ \text{null} & \text{sonst} \end{cases}$$

$$\text{previous}(l, p) = \begin{cases} p_{i-1} & \text{falls } \exists i \in \{1, \dots, n\}: p = p_i \\ \text{null} & \text{sonst} \end{cases}$$

$$\text{bol}(l, p) = (p = p_0)$$

$$\text{eol}(l, p) = (p = p_n)$$

Für *insert* sei $p = p_i \in \{p_0, \dots, p_n\}$. Sonst ist *insert* undefiniert. Sei $p' \in \text{POS} \setminus \{p_0, \dots, p_n\}$.

$$\text{insert}(l, p, x) = (\langle a_1, \dots, a_i, x, a_{i+1}, \dots, a_n \rangle, \langle p_0, \dots, p_i, p', p_{i+1}, \dots, p_n \rangle)$$

Für *delete* sei $p = p_i \in \{p_1, \dots, p_n\}$. Sonst ist *delete* undefiniert.

$$\text{delete}(l, p) = (\langle a_1, \dots, a_{i-1}, a_{i+1}, \dots, a_n \rangle, \langle p_0, \dots, p_{i-1}, p_{i+1}, \dots, p_n \rangle)$$

$$\text{concat}((a_1 \dots a_n, p_0 \dots p_n), (b_1 \dots b_m, q_0 \dots q_m)) = (\langle a_1, \dots, a_n, b_1, \dots, b_m \rangle, \langle p_0, \dots, p_n, q_1, \dots, q_m \rangle)$$

$$\text{isempty}(l) = (n = 0)$$

$$\boxed{\text{find}(l, f)} = \begin{cases} p_i & \text{falls } \exists i: f(a_i) = \text{true} \wedge \\ & \forall j \in \{1, \dots, i-1\}: f(a_j) = \text{false} \\ \text{null} & \text{sonst} \end{cases}$$

Für *retrieve* sei $p = p_i \in \{p_1, \dots, p_n\}$. Sonst ist *retrieve* undefiniert.

$$\text{retrieve}(l, p) = a_i$$

and list₂.