A limited queue is a queue with a limited number of places for items. Let the limit be positive natural \( n \), and let \( Q: [n*X] \) and \( p: nat \) be implementer's variables. Here is an implementation.

\[
\begin{align*}
\text{mkemptyq} & \equiv p := 0 \\
\text{isemptyq} & \equiv p = 0 \\
\text{isfullq} & \equiv p = n \\
\text{join x} & \equiv Qp := x, p := p + 1 \\
\text{leave} & \equiv \text{for } i := 1,..p \text{ do } Q(i-1):= Qi \text{ od. } p := p - 1 \\
\text{front} & \equiv Q0
\end{align*}
\]

Removing the front item from the queue takes time \( p - 1 \) to shift all remaining items down one index. Transform the queue so that all operations are instant.