

fifo+property^{11,40}

$$\begin{aligned}
& \text{fifo+property}(es; codes; decodes; C; S; R; T; Req; Ack; i; f) \\
\equiv_{\text{def}} & \lambda e. \exists j: C. (S(j, i, e)) \leftarrow\leftarrow f \text{---} \lambda e. R(i, e) \\
& \& (\forall e: \{e: E \mid R(i, e)\}, j: \{j: C \mid S(j, i, f(e))\}) . \\
& \quad \text{decodes}(i, e, (\text{state when } e)) = \text{codes}(j, i, f(e), (\text{state when } f(e))) \\
& \& (\forall e, e': \{e: E \mid R(i, e)\}, j: C. \\
& \quad (S(j, i, f(e))) \Rightarrow (S(j, i, f(e'))) \Rightarrow f(e) \text{ c} \leq f(e') \Rightarrow e \text{ c} \leq e') \\
& \& (\forall j: C. \\
& \quad \exists req: \{e: E \mid Ack(j, i, e)\} \rightarrow \{e: E \mid S(j, i, e) \& Req(j, e)\} \\
& \quad (\lambda e. S(j, i, e) \& Req(j, e) \leftarrow\leftarrow req \text{---} \lambda e. Ack(j, i, e) \\
& \quad \& (\forall a: \{e: E \mid Ack(j, i, e)\} . \exists e: \{e: E \mid R(i, e)\} . (f(e) = req(a) \& e \text{ c} \leq a) \\
& \quad \& e.req(e) \text{ is c} < \text{preserving on } e.Ack(j, i, e)))
\end{aligned}$$

clarification:

$$\begin{aligned}
& \text{fifo+property}(es; codes; decodes; C; S; R; T; Req; Ack; i; f) \\
\equiv_{\text{def}} & \text{antecedent-surjection}(es; \lambda e. R(i, e); \lambda e. \exists j: C. (S(j, i, e)); f) \\
& \& (\forall e: \{e: \text{es-E}(es) \mid R(i, e)\}, j: \{j: C \mid S(j, i, f(e))\}) . \\
& \quad \text{decodes}(i, e, \text{es-state-when}(es; e)) = \text{codes}(j, i, f(e), \text{es-state-when}(es; f(e))) \in T) \\
& \& (\forall e: \{e: \text{es-E}(es) \mid R(i, e)\}, e': \{e: \text{es-E}(es) \mid R(i, e)\}, j: C. \\
& \quad (S(j, i, f(e))) \Rightarrow (S(j, i, f(e'))) \Rightarrow \text{es-causle}(es; f(e); f(e')) \Rightarrow \text{es-causle}(es; e; e')) \\
& \& (\forall j: C. \\
& \quad \exists req: \{e: \text{es-E}(es) \mid Ack(j, i, e)\} \rightarrow \{e: \text{es-E}(es) \mid S(j, i, e) \& Req(j, e)\} \\
& \quad (\text{antecedent-surjection}(es; \lambda e. Ack(j, i, e); \lambda e. S(j, i, e) \& Req(j, e); req) \\
& \quad \& (\forall a: \{e: \text{es-E}(es) \mid Ack(j, i, e)\} . \\
& \quad \quad \exists e: \{e: \text{es-E}(es) \mid R(i, e)\} . (f(e) = req(a) \in \text{es-E}(es) \& \text{es-causle}(es; e; a))) \\
& \quad \& \text{causal-order-preserving}(es; e.req(e); e.Ack(j, i, e)))
\end{aligned}$$