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1 exType Theory

Built: 10 August 2019
Parent Theories: indexedLists, patternMatches

1.1 Definitions

[APP_def]

$\vdash$ $(\forall l.\ \texttt{APP []}\ l = l) \land \forall h\ l_1\ l_2.\ \texttt{APP}\ (h::l_1)\ l_2 = h::\texttt{APP}\ l_1\ l_2$

[Map_def]

$\vdash$ $(\forall f.\ \texttt{Map}\ f\ \texttt{[]} = \texttt{[]}) \land \forall f\ x\ f_1.\ \texttt{Map}\ f\ (x::f_1) = f\ x::\texttt{Map}\ f\ f_1$

1.2 Theorems

[LENGTH_APP]

$\vdash$ $\forall l_1\ l_2.\ \texttt{LENGTH}\ (\texttt{APP}\ l_1\ l_2) = \texttt{LENGTH}\ l_1 + \texttt{LENGTH}\ l_2$

[Map_APP]

$\vdash$ $\texttt{Map}\ f\ (\texttt{APP}\ l_1\ l_2) = \texttt{APP}\ (\texttt{Map}\ f\ l_1)\ (\texttt{Map}\ f\ l_2)$

2 nexp Theory

Built: 10 August 2019
Parent Theories: indexedLists, patternMatches

2.1 Datatypes

nexp = Num num | Add nexp nexp | Sub nexp nexp | Mult nexp nexp

2.2 Definitions

[nexpVal_def]

$$
\begin{aligned}
\vdash\ & (\forall f.\ \texttt{nexpVal}\ (\texttt{Num}\ f) = f) \land \\
& (\forall f_1\ f_2.\ \texttt{nexpVal}\ (\texttt{Add}\ f_1\ f_2) = \texttt{nexpVal}\ f_1 + \texttt{nexpVal}\ f_2) \land \\
& (\forall f_1\ f_2.\ \texttt{nexpVal}\ (\texttt{Sub}\ f_1\ f_2) = \texttt{nexpVal}\ f_1 - \texttt{nexpVal}\ f_2) \land \\
& \forall f_1\ f_2.\ \texttt{nexpVal}\ (\texttt{Mult}\ f_1\ f_2) = \texttt{nexpVal}\ f_1 \times \texttt{nexpVal}\ f_2
\end{aligned}
$$

2.3 Theorems

[Add_0]

$\vdash \forall f.\ \texttt{nexpVal (Add (Num 0)}\ f\texttt{)} = \texttt{nexpVal}\ f$

[Add_SYM]

$\vdash \forall f_1\ f_2.\ \texttt{nexpVal (Add}\ f_1\ f_2\texttt{)} = \texttt{nexpVal (Add}\ f_2\ f_1\texttt{)}$

[Mult_ASSOC]

$$\begin{array}{l} \vdash \forall f_1\ f_2\ f_3. \\ \quad \texttt{nexpVal (Mult}\ f_1\ \texttt{(Mult}\ f_2\ f_3\texttt{))} = \\ \quad \texttt{nexpVal (Mult (Mult}\ f_1\ f_2\texttt{)}\ f_3\texttt{)} \end{array}$$

[nexp_distinct_clauses]

$$\begin{array}{l} \vdash (\forall a_1\ a_0\ a.\ \texttt{Num}\ a \neq \texttt{Add}\ a_0\ a_1) \wedge \\ \quad (\forall a_1\ a_0\ a.\ \texttt{Num}\ a \neq \texttt{Sub}\ a_0\ a_1) \wedge \\ \quad (\forall a_1\ a_0\ a.\ \texttt{Num}\ a \neq \texttt{Mult}\ a_0\ a_1) \wedge \\ \quad (\forall a_1'\ a_1\ a_0'\ a_0.\ \texttt{Add}\ a_0\ a_1 \neq \texttt{Sub}\ a_0'\ a_1') \wedge \\ \quad (\forall a_1'\ a_1\ a_0'\ a_0.\ \texttt{Add}\ a_0\ a_1 \neq \texttt{Mult}\ a_0'\ a_1') \wedge \\ \quad \forall a_1'\ a_1\ a_0'\ a_0.\ \texttt{Sub}\ a_0\ a_1 \neq \texttt{Mult}\ a_0'\ a_1' \end{array}$$

[nexp_one_one]

$$\begin{array}{l} \vdash (\forall a\ a'.\ (\texttt{Num}\ a = \texttt{Num}\ a') \iff (a = a')) \wedge \\ \quad (\forall a_0\ a_1\ a_0'\ a_1'. \\ \qquad (\texttt{Add}\ a_0\ a_1 = \texttt{Add}\ a_0'\ a_1') \iff (a_0 = a_0') \wedge (a_1 = a_1')) \wedge \\ \quad (\forall a_0\ a_1\ a_0'\ a_1'. \\ \qquad (\texttt{Sub}\ a_0\ a_1 = \texttt{Sub}\ a_0'\ a_1') \iff (a_0 = a_0') \wedge (a_1 = a_1')) \wedge \\ \quad \forall a_0\ a_1\ a_0'\ a_1'. \\ \qquad (\texttt{Mult}\ a_0\ a_1 = \texttt{Mult}\ a_0'\ a_1') \iff (a_0 = a_0') \wedge (a_1 = a_1') \end{array}$$

[Sub_0]

$$\begin{array}{l} \vdash \forall f. \\ \quad (\texttt{nexpVal (Sub (Num 0)}\ f\texttt{)} = 0) \wedge \\ \quad (\texttt{nexpVal (Sub}\ f\ \texttt{(Num 0))} = \texttt{nexpVal}\ f) \end{array}$$

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