

Problem Prove that if every element of L is zero then $\text{suml } L = 0$. Use the following definition of suml .

```
suml [] = 0
suml (x:xs) = x + (suml xs)
```

Solution Proof is by induction on the length of L . If L is an empty list then,

$$\begin{aligned}
 & \text{suml } L \\
 = & \{L = []\} \\
 & \text{suml } [] \\
 = & \{\text{definition of suml}\} \\
 & 0
 \end{aligned}$$

If L is non-empty, then it is of the form $(x : xs)$ where $x = 0$ and every element of xs is zero. Then,

$$\begin{aligned}
 & \text{suml } L \\
 = & \{L = x : xs\} \\
 & \text{suml}(x : xs) \\
 = & \{\text{definition of suml}\} \\
 & x + (\text{suml } xs) \\
 = & \{x = 0\} \\
 & \text{suml } xs \\
 = & \{\text{induction: the length of } xs \text{ is smaller than that of } L\} \\
 & 0
 \end{aligned}$$