Informatik and Mathematical Modelling 4/9 06
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02153 Declarative Programming
Programming Exercise 2

The purpose of this exercise is to make you acquainted with some high-level features of SML and to illustrate a solution to a problem, which is based on "declarative" properties of the entities under consideration.

We represent the polynomial $a_0 + a_1 \cdot x + ... + a_n \cdot x^n$ with integer coefficients $a_0, a_1, ..., a_n$ by the list $[a_0, a_1, ..., a_n]$. For instance, the polynomial $x^3 + 2$ is represented by the list $[2, 0, 0, 1]$.

1. Declare an infix SML function for addition of polynomials in the chosen representation.
2. Declare an SML function for multiplying a polynomial by a constant.
3. Declare an SML function for multiplying a polynomial $Q(x)$ by x.
4. Declare an infix SML function for multiplication of polynomials in the chosen representation. The following properties are useful when defining the multiplication:

$$\begin{aligned} &0 \cdot Q(x) = 0 \\ &(a_0 + a_1 \cdot x + ... + a_n \cdot x^n) \cdot Q(x) \\ &\qquad = a_0 \cdot Q(x) + x \cdot ((a_1 + a_2 \cdot x + ... + a_n \cdot x^{n-1}) \cdot Q(x)) \end{aligned}$$

5. Declare an SML function to give a textual representation for a polynomial.