Software Engineering II

(a) Describe, with examples, how the choice of programming language, programming tools and libraries can affect the reliability of the software developed using them. [5 marks]

(b) Consider the following pair of ML function declarations:

\[
\begin{align*}
\text{fun} & \quad \text{takew} \ p \ [ ] = [ ] \\
& \quad | \quad \text{takew} \ p \ (x::xs) = \text{if} \ p \ x \ \text{then} \ x :: \ \text{takew} \ p \ xs \ \text{else} \ [ ];
\end{align*}
\]

\[
\begin{align*}
\text{fun} & \quad \text{dropw} \ p \ [ ] = [ ] \\
& \quad | \quad \text{dropw} \ p \ (x::xs) = \text{if} \ p \ x \ \text{then} \ \text{dropw} \ p \ xs \ \text{else} \ x::xs;
\end{align*}
\]

Prove \((\text{takew} \ p \ xs) @ (\text{dropw} \ p \ xs) = xs\) using induction. (Assume that function \(p\) always terminates.) [8 marks]

(c) You have been asked to specify some banking software. A bank account has a balance and an overdraft limit, subject to the constraints \(\text{limit} \geq 0\) and \(\text{balance} + \text{limit} \geq 0\).

(i) Write a Z schema to specify the state of a bank account. [2 marks]

(ii) Write a Z schema for the operation to withdraw a given positive amount from the account. [5 marks]