Assignment 3

COS30023 - Languages in Software Development

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1. Problem 1

1.1. String specification

$$\begin{aligned} S ::= \quad & \epsilon \\ | \quad & aS \end{aligned}$$

1.2. String Length Specification

$$\begin{aligned} length(\ \epsilon\ ) &= 0 \\ length(\ aS\ ) &= 1 + length(\ S\ ) \end{aligned}$$

1.3. String Concatenation Specification

$$\begin{array}{lll} s_1 = \epsilon : & \epsilon \oplus s_2 & = s_2 \\ s_1 = as_1' : & as_1' \oplus s_2 & = a(s_1' \oplus s_2) \end{array}$$

1.4. a

Show that if $s \in S$, then $s \oplus \epsilon = s$

1.5. b

Show that if $s_1, s_2 \in S$ then $length(s_1 \oplus s_2) = length(s_1) + length(s_2)$
Base Case 1

2. Problem 2

```
% List length predicate
list_length([], 0).
list_length([_|T], N) :- list_length(T,M), N is M+1.

% List concatenation predicate
list_concatenation([],Xs,Xs).
list_concatenation([H|Xs],Ys,[H|Zs]) :- list_concatenation(Xs,Ys,Zs).

% List equality predicate
equal([],[]) :- true.
equal([Xhead|Xtail],[Yhead|Ytail]) :- Xhead =:= Yhead, equal(Xtail, Ytail).

% Check that concatenating the empty set to Xs equals Xs
checkA(Xs) :- list_concatenation([],Xs,R), equal(R,Xs).

% Check that concatenating two strings equals the length of the sum
% of individual lengths of the substrings
checkB(Xs, Ys) :-       list_concatenation(Xs,Ys,Rs),
                                    list_length(Rs, Rl),
                                    list_length(Xs, Xl),
                                    list_length(Ys, Yl),
                                    Rl =:= Xl + Yl.
```