2001 Paper 13 Question 11

Introduction to Functional Programming

(a) Write a recursive definition of a function that appends two lists. [3 marks]

(b) Give a definition of a recursive datatype `sequence` that implements lazy lists. [3 marks]

(c) Write a function

```
applistq : 'a list -> 'a sequence -> 'a sequence
```

which, applied to a list l and a sequence s, produces a sequence s' which corresponds to the lazy list obtained by appending l to the front of s. [6 marks]

(d) Prove, by structural induction on lists, that your definition of `applistq` satisfies the following identity for any lists $l1$ and $l2$ and any sequence s. Make sure you give an accurate statement of the induction hypothesis.

```
applistq l1 (applistq l2 s) = applistq (l1@l2) s
```

[8 marks]