1997 Paper 12 Question 10

Introduction to Functional Programming

Write an ML function `cart` which behaves as in the following example:

```
cart ([1,2,3],[6,7]) = [(1,6),(1,7),(2,6),(2,7),(3,6),(3,7)]
```

and give the type of `cart`. [5 marks]

Show that Y defined as $\lambda f.(\lambda x.f(xx))(\lambda x.f(xx))$ is a fixed point combinator in that for suitable g we have $Yg = g(Yg)$. [5 marks]

Discuss applicative order (eager) *versus* normal order evaluation giving an example of an expression which illustrates the difference. [5 marks]

Write an ML function `filter` of type `(int -> bool) -> int list -> int list` which when called as `filter p l` gives, in order, the elements x of `l` for which `p` applied to x is `true`. [5 marks]