

2001 Paper 12 Question 11

Introduction to Functional Programming

- (a) Write a polymorphic curried function `prefix` which, when applied to x and a list L , gives the list of pairs (x, y) for each y in L .

For example,

```
prefix "a" [1,2] = [("a",1), ("a",2)]
```

What is the type of `prefix`? [5 marks]

- (b) Using your definition of `prefix`, write a definition of a function `cartesian` which, when applied to a pair of lists L_1 and L_2 , produces a list of pairs containing the pair (x, y) for *every* element x in L_1 and y in L_2 .

For example,

```
cartesian (["a","b"], [1,2]) =
      [("a",1), ("a",2), ("b",1), ("b",2)]
```

What is the type of `cartesian`? [5 marks]

- (c) Write definitions in ML for the built-in higher-order functionals `foldl` and `map`. [6 marks]
- (d) Combine your definition of `prefix` with the functionals `map` and `foldl` to give an alternative definition of `cartesian`, which is not explicitly recursive. [4 marks]