2004 Paper 12 Question 10

Introduction to Functional Programming

(*a*) Consider the following ML function declaration:

```
fun cat (b,f) nil     = b
  | cat (b,f) (x::xs) = f(x,(cat(b,f) xs));
```

(*i*) Give the type of the function `cat`. [2 marks]

(*ii*) Using the function `cat` define a function `filter` such that `filter p l` returns those elements in a list `l` that satisfy the predicate `p`. [3 marks]

(*iii*) Using the function `cat` define a function `cmap` such that `cmap f l` applies function `f` to every element in list `l`. [3 marks]

(*b*) Consider the following ML function declaration:

```
fun ana (p,g) b = if p(b) then
                            []
                  else      let val (a,b1)=g(b)
                            in
                              a::(ana (p,g) b1)
                            end;
```

(*i*) Give the type of the function `ana`. [3 marks]

(*ii*) Using the function `ana` define a function `zip` that converts a pair of lists into a list of pairs. [4 marks]

(*iii*) Using the function `ana` define a function `amap` such that `amap f l` applies function `f` to every element in list `l`. [5 marks]