

2011 Paper 1 Question 2

Foundations of Computer Science

- (a) Write brief notes on exceptions in ML and on the functions and control structures available for programming with them. [6 marks]

Parts (b) and (c) make use of the following ML exception:

```
exception Olive;
```

- (b) Code in ML a function called `cannot` which takes two arguments, a function `f` and a value `x`. Define the `cannot` function in such a way that it returns `true` if and only if evaluation of `f(x)` causes exception `Olive`. For all other inputs, it should return `false`. [Hint: evaluation of `f(x)` may cause exceptions other than `Olive`.] [4 marks]
- (c) Consider the following ML datatype and functions `bun` and `cheese`.

```
datatype 'a tree = Leaf of 'a
                | Branch of 'a tree * 'a tree;

fun bun (x,Leaf y)          = if x=y then raise Olive else Leaf y
  | bun (x,Branch (t1,t2)) = Branch (bun(x,t1),bun(x,t2))

fun cheese (x,t) = if cannot(bun,(x,t)) then Leaf x else bun(x,t)
```

- (i) Write down the type of `cheese`. [3 marks]
- (ii) Write a function that is equivalent to `cheese` but makes no use of exceptions. Briefly explain why your function is equivalent to `cheese`. [7 marks]