

2003 Paper 12 Question 10

Introduction to Functional Programming

- (a) Give a definition of an ML datatype `bool_exp` to describe Boolean expressions built up from named variables using Boolean operations of conjunction, disjunction and negation:

For example, the Boolean expression $((A \vee B) \wedge \neg C) \wedge D$ would be given by

```
Conj(Conj(Disj(Var "A",Var "B"),Neg (Var "C")),Var "D")
```

[4 marks]

- (b) Write an ML function `variables` which takes an argument `e` of type `bool_exp` and returns a value of type `string list` which lists all variables occurring in `e`. [8 marks]
- (c) Write an ML function `eval` which takes two arguments—`e` of type `bool_exp` and `a` of type `(string * bool) list` giving a value for each variable—and returns the value of the expression `e` under the assignment `a`. [8 marks]