

1999 Paper 1 Question 6

Foundations of Computer Science

This question has been translated from Standard ML to OCaml

Describe OCaml's facilities for treating functions as data, giving examples of their use in programs. Illustrate your answer by discussing the function `fold_right`:

```
let rec fold_right f l e
  match l with
  | [] -> e
  | x::xs -> f x (fold_right f xs e)
```

[7 marks]

You have been asked to implement a data structure to represent family relationships. For each person, it should record his or her name, mother, father, and children. As a first attempt, you have been given the following variant `type` declaration:

```
type person = Person of string * person * person * person list
```

Identify two problems with this declaration that make it unusable. Modify the declaration to correct these problems. [6 marks]

Consider the following, simpler data structure for associating a person with his or her children:

```
type famtree = B of string * famtree list
```

Write an OCaml function that takes two arguments: a predicate P over family trees (a function of type `famtree -> bool`) and a family tree t . The result should be the list of all subtrees of t (possibly including t itself) satisfying the predicate. For full credit, give due attention to efficiency. [7 marks]