

Virtual Machines

Summer Semester 2007

Exercise sheet 4

Deadline: 15 May 2007 12:00

Exercise 1:

6 Points

Write the following functions in OCaml (without using OCaml library functions with the same names).

- a) *filter*, which takes as argument a predicate p and a list l , and returns the list of elements from l for which p is true.
- b) *fold_right*, such that
$$\text{fold_right } f \ e \ [x_1, \dots, x_n] = f(x_1, f(x_2, \dots, f(x_n, e)) \dots).$$
- c) *mapi*, such that
$$\text{mapi } f \ [x_1, \dots, x_n] = [f(x_1, 1), \dots, f(x_n, n)].$$
For example, for $f(x, i) = x + i$ and $l = [3, 3, 3]$, *mapi* f l should return $[4, 5, 6]$.

Exercise 2:

4+4 Points

- a) Give a formal definition of the function *free* such that $\text{free}(e) \subseteq \text{Vars}$ is the set of global variables in e , where Vars is the set of variables used for building expressions.
- b) Determine the set of global variables for each of the following expressions.
 - $(\text{fn } x \Rightarrow x \ y) \ (\text{fn } y \Rightarrow y)$
 - $\text{fn } x, y \Rightarrow z \ (\text{fn } z \Rightarrow z \ (\text{fn } x \Rightarrow y))$
 - $(\text{fn } x, y \Rightarrow x \ z \ (y \ z)) \ (\text{fn } x \Rightarrow y \ (\text{fn } y \Rightarrow y))$
 - $((\text{fn } x \Rightarrow x) \ z) + \text{let } a = x; \\ \quad \quad \quad x = f \ y; \\ \quad \quad \quad y = z \\ \text{in } x+y+z$