Model Checking, SS2011: Exercise Sheet 12

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Note. You may want to consult some online references on OCaml.

1. The Caml language:
   `http://caml.inria.fr/`
2. Download Objective Caml:
   `http://caml.inria.fr/download.en.html`
3. A concise introduction to Objective Caml:
   `http://www.csc.villanova.edu/~dmatusze/resources/ocaml/ocaml.html`

Exercise 12.1. Create the following OCaml procedures.

1. `fact : int -> int` that computes the factorial of its parameter.
2. `max : int -> int -> int` that returns the greatest of two numbers.
3. `gcd : int -> int -> int` that gives the greatest common divisor of two numbers.
4. `coprime : int -> int -> bool` that returns `true` iff the two parameters are coprime..
5. `fib : int -> int` that returns the n-th Fibonacci number.
6. `sum : int list -> int` that returns the sumof the elements of a list.
7. `reverse : 'a list -> 'a list` that reverses a list.
8. `last : 'a list -> 'a` that returns the last element of a list.
9. `remove_at : int -> 'a list -> int` that removes the k-th element of a list. Example:

```
# remove_at 2 [1; 2; 3];;
- : int list = [1; 3]
```

Exercise 12.2. Construct a type derivation for each of the following typing propositions.

1. `incr` : `int -> int` $\vdash$ `incr 1` : `int`
2. $\emptyset \vdash$ `let incr x = x + 1 in incr 1` : `int`
3. $\emptyset \vdash$ `fun x -> fun y -> x - y` : `int -> int -> int`
4. $\emptyset \vdash$ `let d = fun x -> y -> x - y in d 1 2` : `int`
5. $\emptyset \vdash$ `if true then 0 else 1` : `int`
6. $\emptyset \vdash$ `let rec fact x = if x <= 0 then 1 else x * fact(x - 1) in fact 2` : `int`