

# Virtual Machines

## Exercise Sheet 6

Deadline: 3 June 2008, during lecture, by email, or in room 02.07.041

### Exercise 1:

10 Points

Consider the following Call-By-Value generated code for a PuF expression.

```
alloc 1          mkbasic          pushloc 4
pushloc 0        pushloc 5          pushglob 0
mkvec 1          pushglob 0        apply
mkfunval _0     apply              _7:jump _6
jump _1         _4:jump _3         _5:pushloc 0
_0:targ 2       _2:pushloc 0       _6:
pushloc 0       getbasic           _3:return 2
getbasic        pushloc 2         _1:rewrite 1
pushloc 2       getbasic          mark _8
getbasic        le                loadc 6
gr             jumpz _5           mkbasic
jumpz _2        mark _7           loadc 4
mark _4         pushloc 4         mkbasic
pushloc 3       getbasic          pushloc 5
getbasic        pushloc 4         apply
pushloc 5       getbasic          _8:slide 1
getbasic        sub                halt
sub            mkbasic
```

- Determine the stack distance  $sd$  for every program point (initially  $sd = 0$ ).
- What does this program compute?

### Exercise 2:

3+7 Points

Compute  $code_V$  for the following expressions

a)        `let x = 5 + 5 in x * x`  
using CBN with  $\rho = \emptyset$  and  $sd = 0$ .

b)        `letrec`  
          `fib = fn x => if x <= 1 then 1 else (fib (x-1)) + (fib (x-2))`  
          `in fib 4`  
using CBV with  $\rho = \emptyset$  and  $sd = 0$ .