*Technische Universität München*
*Fakultät für Informatik*
*Prof. Dr. H. Seidl*

*Dr. K. N. Verma*
*verma@in.tum.de*
*Room: MI 02.07.041*

# Virtual Machines

*Summer Semester 2007*

*Exercise sheet 5* *Deadline: 22 May 2007 12:00*

Exercise 1: *6 Points*

Consider the expression $e \equiv$ `if x > 1 then x else x + y * x` along with the address environment $\rho = \{x \mapsto (L, 1), y \mapsto (L, -1)\}$ and stack distance $sd = 3$. Compute $code_V\ e\ \rho\ sd$. Annotate every instruction with the current stack distance like in the examples in the lecture.

Exercise 2: *4 Points*

Consider the function definition

```
fn x,y,z => let x = 1;
                a = 3;
                b = 4
            in (a+(b+(x+(y+z))))
```

Determine the address environment $\rho$ that will be used to generate code for the sum $(a + (b + (x + (y + z))))$. Determine the absolute addresses of $a, b, x, y, z$ when code for $(a + (b + (x + (y + z))))$ is generated with initial stack distance $sd = 5$.

Exercise 3: *10 Points*

Generate code for the following expressions:

a) 
```
1 + let
        x = g+10
        y = x*4
    in y*g
```
with the address environment $\rho = \{g \mapsto (G, 1)\}$ and with stack distance $sd = 1$.

b) `fn x,y,z => x z (y z)`
with address environment $\rho = \emptyset$ and initial stack distance $sd = 0$.

c) `fn x => if x=1 then 1 else x*fac(x-1)`
with address environment $\rho = \{fac \mapsto (L, 1)\}$ and initial stack distance $sd = 0$.