Computing and Software 701

Logic and Discrete Mathematics In Software Engineering

Fall 2005

Exercise Group 3

60 pts.

Due 7 November 2005

Revised: 21 October 2005

1. [12 pts.] Show that the following functions are primitive recursive:

   (a) Addition.
   (b) Multiplication.
   (c) Exponentiation.

2. [8 pts.] Let $f : \mathbf{N} \to \mathbf{N}$ generate the Fibonacci sequence.

   (a) Define f by well-founded recursion.
   (b) Show that f is a primitive recursive function.

3. [4 pts.] Exercise 14 on p. 253 of Rosen.

4. [4 pts.] Exercise 16 on p. 253 of Rosen.

5. [4 pts.] Exercise 36 on p. 272 of Rosen.

6. [4 pts.] Exercise 44 on p. 272 of Rosen.

7. [4 pts.] Exercise 52 on p. 273 of Rosen.

8. [4 pts.] Formalize in STT the theory of well-orders.

9. [8 pts.] Formalize in STT the theory of stacks of natural numbers. You may use two base types of individuals, ι_1 and ι_2, to represent the domain of natural numbers and stacks of natural numbers, respectively.

10. [8 pts.] Formalize in STT the theory of two abstract monoids. You may use two base types of individuals, ι_1 and ι_2, to represent the domains of the two monoids. Define in the theory the notion of a homomorphism from the first monoid to the second and the notion of the kernel of such a homomorphism.