

## Computability theory

### Exercise 2

1. Show that any any URM-program can be expressed without using transfer instructions, that is, write a program without transfer instructions that has the same effect as  $T(m, n)$  on any configuration of the URM.
2. Show that the predicate ' $x$  is even' (that is, the set  $\{x \in \mathbb{N} \mid x \text{ even}\}$ ) is decidable.
3. Show without writing a program that the function  $mx$ , for every  $m \in \mathbb{N}$  is computable.
4. Suppose  $f(x, y)$  is a computable function and  $m \in \mathbb{N}$ . Show that the function  $g(x) \simeq f(x, m)$  is computable.
5. Suppose that  $g(x)$  is a total computable function. Show that the predicate  $M(x, y)$  given by  $M(x, y) \equiv 'g(x) = y'$  is decidable (in other words,  $M(x, y)$  corresponds to the relation  $\{(x, y) \in \mathbb{N}^2 \mid g(x) = y\}$ ).