## A\&C 3: Random Access Machines.

## Theory.

T3.1 Random Access Machine and what it consists of,
T3.2 RAMs and real-world computers,
T3.3 Variants of RAMs, direct and indirect addressing,
T3.4 Equivalence of RAMs and Turing Machines.

Exercises. Design RAMs that solve the following problems. Suggest the way how the input and output are given.
E3.1 Computes logic functions.
a) binary AND over $\{0,1\}^{*}$ : the result is 0 iff one of arguments consists of zeros only,
b) binary OR over $\{0,1\}^{*}$ : the result is 0 iff both arguments consists of zeros only,
c) negation,
d) bit-wise AND, OR, XOR (assume that arguments have the same length).

E3.2 Reverses the contents of a register.
E3.3 Performs arithmetic operations.
a) increases the given value (written in binary) by one,
b) increases the given (positive) value (written in binary) by one,
c) finds the max of two binary numbers,
d) adds two binary numbers,
e) multiplies two binary numbers.

E3.4 Computes the greatest common divisor of two numbers.
E3.5 Reads a binary sequence and sorts it (first all zeros, then all ones).
E3.6 Sorts a sequence of $k$ binary numbers ( $k$ is a constant).
E3.7 * Sorts a sequence of binary numbers, the length of the sequence is not a constant.

