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).
- ${\rm E3.2}\,$ 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.