MODELLING AND SIMULATION OF SYSTEMS

EXERCISE 2: STATISTICAL TESTS

1. Exercise

Write a program in `C`/`C++` which, for a given integer $d \geq 1$ and a random sample $x_1, x_2, \ldots, x_n$ ($n \geq 1$), computes:

(1) the test statistics K_n^+, K_n^- for a simplified Kołmogorow's test;
(2) the test statistic V for a simplified χ^2 test;
(3) the test statistic for another test, assigned by a teacher during the laboratory.

All results should be given with an accuracy of d decimal places. The program should be written within 2 weeks.

2. Input and output

The accuracy d will be given as the first command-line argument. Assume that $1 \leq d \leq 2^{16}$.

The random sample $x_1, x_2, \ldots, x_n$ should be read from the standard input. The elements of the sample will be rational numbers written as common fractions and separated by whitespaces. The length of the sample will not be given explicitly – the numbers should be read as long as they appear. Assume that $1 \leq n \leq 2^{24}$ and $0 \leq x_i \leq 1$ for $i = 1, 2, \ldots, n$.

The results should be written on the standard output and separated by newline characters. Leading and trailing zeros must not be a part of the output. The decimal point have to be omitted for results being integers. Assume that $F(x) = x$ for $0 \leq x \leq 1$ in the Kołmogorow's test and $k = 10$, $a_i = i^2/100$ for $i = 0, 1, \ldots, 10$, in the χ^2 test. The factor $\sqrt{n}$ that appears in the formulas for K_n^+, K_n^- should be omitted.

3. Points

This exercise is worth 20 points. The score depends on the result of the test that will be performed during the laboratory:

(1) programs that do not compile and or end with a runtime error are worth 0 points;
(2) programs that exceed the 60-second time limit or return incorrect results are worth 0 points;
(3) programs that compute properly x of the four statistics are worth $5x$ points.