SACO Competition Rules

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Competition Dates

The Final Round of the Standard Bank/CSSA Computer Olympiad will start at 17:30 on Friday 25 September(arrival day). The first Competition Day is Saturday 26 September and the second Competition Day is Sunday 27 September. There will be a practice session before the competition session.

Competition Equipment

The competition machine (TSL) is an Intel Pentium 4 processor with a standard US keyboard, a mouse, and a colour screen.

Paper and writing utensils will be provided. Competitors may *not* take any material such as computing equipment (including calculators, communication devices, cell-phones, organisers, PDAs, digital cameras), books, manuals, written or printed materials, or digital media (diskettes, CD-ROMs, flash drives etc) into the competition venue. A competitor who is in possession of any of these materials in the competition venue may be disqualified.

Programming Environment

The following programs will be available:

- GCC compiler for C and C++, version 4.1, with the KDevelop IDE
- The Sun JDK 1.6 with Eclipse IDE
- Python 2.5, with the included IDE (IDLE)
- kate, vim, gedit and other text editors
- The Firefox web browser.

The marking system will use the same versions of all compilers and interpreters.

The competitor should be familiar with the programming package of his/her choice, including the use of libraries, units or classes. The competitor should be able to execute programs, change the working directory, manage files and use a web browser.

Additional tools may be available for assisting the competitors with the tasks. *Documentation about the computing environment, which does not reveal the nature of the tasks, will be made available at the practice session.*

Web browsers other than Firefox may be available, but these are not guaranteed to be compatible with the hand-in system.

Competition Tasks

All of the tasks in SACO are designed to be algorithmic in nature. There are three types of tasks: tasks for which a solution comprises a single source file of a non-interactive computer program, tasks for which the solution comprises a set of output data files, and tasks for which a solution comprises a single source file for an interactive computer program.

Efficiency plays an important role in some tasks. Whenever efficiency of algorithmic

computations is important, it will be possible to obtain part score with at least one correct, but inefficient algorithm. It is important, therefore, for competitors to attempt a task even if they do not know how to solve the hardest possible test cases.

Tasks for which a program source file is requested as a solution

When a program source file is required as a solution, the program source provided by the competitor must be contained in a single file. The task documentation will specify:

- constraints on the input and output data values;
- smaller value ranges valid for certain percentages of the test cases;
- the resource limitations for the computations (e.g. CPU time, memory);
- any other constraints on the program behaviour.

In non-interactive tasks, the program should read its input from the standard input stream (as if from the keyboard) and should write its output the standard output stream (as if to the screen). The format of the input and output will be specified in the task documentation.

In interactive tasks, the program will interact with an evaluation program via the standard input and output streams. The format of this interaction will be specified in the task documentation.

In tasks where a limit on CPU time is given, that limit applies to all programming languages except Python. Programs written in Python will be allowed more CPU time than programs in other languages. The amount of extra time will be announced before the contest. This Python-specific limit may not be mentioned in the task description.

Tasks for which a set of output files is requested as a solution

When a set of output data files is required as a solution, no program source should be handed in. The input data files are obtained from the hand-in system. The task documentation will specify the input and output data format.

Input and output data

In all tasks, input and output data consists of a sequence of items. An item is a string of printable non-white-space characters (ASCII code from 33 through 126). An item may represent an integer or a general string; the meaning of each item will be given in the task specification.

Spaces and end-of-line characters separate items. The format of the input data will be given in the task specification. The output data should be formatted strictly according to the task-specific instructions. However, the grading system scores output in such a way that extra white space (spaces and end-of-line characters) between or around items is ignored.

Practising

The competition computers will be available for practice during the Saturday morning. All competitors must take part in the practice session on Saturday. Before each competition round, the computers will be assigned randomly to the competitors (with a different assignment each round).

Competition Procedures

The following procedures will be adopted during the competition.

Starting the competition

Competitors will be ushered into the competition room 5 minutes before the competition starts. A randomly chosen computer is assigned to each competitor (with a different assignment each round). The computer will be powered up and will display a login window. The competition envelope containing the task definitions and other necessary information will be in front of the computer. Competitors are not allowed to touch the keyboard or open the envelope until the starting signal is given. At the starting signal, competitors may open their envelopes and begin using their computers.

Questions

During the first two and a half hours of competition, competitors may submit written questions concerning any ambiguities or points needing clarification in the competition tasks. Questions must be submitted on the provided Clarification Request Forms. The questions are submitted to the Scientific Committee.

The Scientific Committee will answer every question submitted by the competitors. Since this may take some time, competitors should continue working while waiting for the answers to their questions. Each question will be answered with one of the following:

- Yes
- No
- Answered in task description (explicitly or implicitly)
- Invalid question
- No comment

If the committee feels that the contestant has not understood the task, they may choose to provide extra explanatory text. Competitors should nevertheless phrase their questions so that a yes/no answer will be meaningful. Competitors will not be involved in or exposed to discussion regarding their questions.

Assistance

Competitors may ask for assistance at any time. The committee members will not answer questions about the competition tasks, but will deliver Clarification Request Forms, help locate toilets and refreshments, and assist with computer problems.

Printing

Competitors will *not* be able to print during the competition.

Backups

There are no backup facilities, so competitors should make copies of important files before overwriting them. The marking server, however, will backup accepted submissions for each problem. A submission is accepted if it passes the sample test case or if the force submission box is checked.

Test execution

For tasks that require programs as solutions, a competitor will be able to submit a solution along with an input file for test execution. The test execution system will compile and execute the

program under Linux, enforcing the resource limitations for the particular task. The program output, the execution time and possibly error messages will be displayed. The test system will be turned off 5 minutes before the end of the competition. This is done in order to improve the hand-in response at the crucial hand-in time.

For non-interactive problems, the submitted input file will be used directly as input to the submitted program, and thus should follow the input format in the task description. For interactive problems, the submitted input file will control the behaviour of the evaluation program. The format accepted by the evaluator will be specified separately in the task description.

Test execution will not be available for tasks that require a set of output files as the solution.

Submitting

Competitors will be able to submit their solutions through a facility provided in the competition environment. For tasks that require programs as solutions, the submission facility will verify that the program compiles and obeys the stated limits on source code size and compile time. It will run the program on a simple test input that is given in the task description, enforcing the relevant run-time resource constraints. If the submission produces the correct output for the test input, then the submission is accepted for grading. For tasks that require output data files as solutions, the submission facility will run a format check on the submitted file; the submission is accepted if this test passes. These checks are designed to prevent trivial errors and are *not exhaustive:* it is the contestant's responsibility to ensure that the submission is correctly format.

Competitors may submit any number of times for each task; each accepted submission replaces any other submissions of that task by that competitor. The last accepted submission by a competitor for a task is officially graded in a separate process and competitors will not be informed of the results until after the competition.

Competitors may use any combination of programming languages. However, only the scores from problems where the final accepted submission is in Python will be considered for the awarding of Python-specific prizes.

Detailed feedback on submissions

For some of the tasks, detailed feedback may be enabled. When detailed feedback is enabled for a task, every time a competitor submits a solution the solution will be evaluated with some of the official test runs. After the evaluation is done, the hand-in system will show to the competitor a summary of their results on the executed test runs. The summary will contain, for each test run, one of the following possible outcomes:

- The program executed within the constraints and the output produced by it was correct.
- The program executed within the constraints, but the output produced by it was not correct.
- The program exceeded the run-time limit specified by the task.
- The program terminated prematurely or irregularly (exit code other than 0, illegal instruction, floating point exception, invalid memory reference, etc.).

No information on the actual data or the output produced by the contestant solution will be given to the contestant. The detailed feedback will be disabled for all tasks during the last 15 minutes of each competition round.

Ending the competition round

Warnings will be given with 15 minutes remaining in the round (a verbal announcement "15 minutes"), 5 minutes remaining (a verbal announcement "5 minutes") and 1 minute remaining (a verbal announcement "1 minute") and the end of the round will be announced (a verbal announcement "end of competition round").

At the announcement ending the round, competitors must immediately stop working without switching off their computers. Competitors should then wait at their desks without operating their computers or touching anything on their desks. An additional announcement will be made instructing them to leave their tables and exit the competition room. At this point, competitors may take with them the contents of their competition envelopes.

Grading

The grading system evaluates the submitted tasks after the competition round. For tasks that require programs as solutions, the submitted source files will be re-compiled on the handin system, enforcing the source file size and compilation time constraints. The compiler options are as follows:

- C/C++: `-pipe -Wall -O2 -s -lm`
- Java: `-g:none`
- Python: `-O -O`

The source file may be at most 4MB, may take at most 30 seconds to compile, and may not cause the compiler to consume more than 64MB of memory.

The grading system will then execute the compiled program under GNU Gentoo/Linux, enforcing the task-specific run-time resource constraints. Typically, there will be a CPU run-time limit and a limit on total memory use. Every limit applies independently for each test run; if any limit is exceeded, no points will be awarded for that test run. Any applicable limits will be specified in the task materials. If the submission facility accepts a program, that only means that the program compiled successfully and it correctly solved the simple test run within the resource constraints, but no more. In particular, it does not mean that the program would obey the resource constraints when given different input. The grading results and evaluation data used for grading will be made available to each competitor after the competition. Appeals requesting re-grading can be submitted to the Evaluation Committee.

Each test run consists of running the program on a different test input. Test runs are grouped into test cases. Each test case may test different aspects such as the efficiency and correctness of submitted programs. The score for a test case is the minimum score of all the test runs in that test case. The total score for a problem is the sum of the scores for each test case.

Other Information

A competitor will be disqualified from the competition if the competitor tries to:

- interfere with another competitor's activities,
- break the installations or evaluation facilities,
- harmfully interfere with the running of the competition in any way, or
- communicate in any way during a competition round with anyone other than the competition staff.

The competition computers are connected via a local area network for submitting solutions and running test executions. Competitors are not allowed to access the network for any other purpose

or with any tools other than the tools provided by the organisers. Even sending a single 'ping' is strictly prohibited. The competition staff should be contacted for help with any suspected network problems. Also, competitors are not allowed to make any material accessible to the network from their computers.

Submitted programs

Submitted programs are not allowed to:

- access the network,
- fork or execute external programs,
- create or access files other than those required in the task definition,
- attack the system security or the grader,
- attempt to execute other programs,
- change file system permissions, or
- read file system information.

A competitor whose program attempts any of the above may be disqualified.