Exercises 7

1. Implement the **Parametric Shortest Paths Algorithm** for computing the value of a minimum mean cycle in a weighted digraph \((G, c)\), i.e.

\[
\min \left\{ \frac{c(E(C))}{|E(C)|} : C \text{ a circuit in } G \right\}.
\]

For simplicity you may implement heap operations to run in linear time.

The implementation must be done either in the C++ or C programming language respecting the C/C++ standard from 1999. You can easily achieve this by using the GNU-compiler (available for Linux, as part of MinGW or cygwin for Windows and XCode for Mac OS X) and by including only standard headers (including the STL).

The input should be read either from an input pipe or directly from a file. The input format is as follows. Ignore empty lines and lines starting with '#' . Then, the first (non-ignored) line specifies the number of vertices and edges:

\[
\text{<number of vertices> <number of edges>}
\]

and the following lines specify the edges with their associated costs of type double:

\[
\text{<from vertex> <to vertex> <edge cost>}
\]

The program should write the value of a minimum mean cycle to the standard output. Your program will be tested using real instances arising from clock skew scheduling. Some instances for testing can be found on the web pages for the exercises class:

http://www.or.uni-bonn.de/~held/vlsi_design_ss09/Chip_Design_Exercises.html.

[15 points]

The deadline for submitting solutions is June 22 via email to held@or.uni-bonn.de.