

# CAS 741: Problem Statement

## Companion Cube Calculator (CCC)

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Table 1: Revision History

Date	Developer(s)	Change
September 15, 2017	Geneva Smith	Added an additional environment constraint; clarified the purpose of the project
September 14, 2017	Geneva Smith	First draft

The GLaDOS architecture[1] is a specialized game engine that enables game designers to create Non-Player Characters (NPCs) that react to their environment by using models of emotion from psychology. A key component of the architecture is the primary appraisal module, where inputs from the environment are converted into emotion values. The equations currently used for this task are not well informed by any scientific research, and will be incrementally revised as more information is collected. These new equations are required to conform to the same mathematical range as the currently implemented equations. Ensuring that this requirement is maintained over consecutive iterations of the equations will become tedious and time consuming, distracting from the main task of developing more rigorous and explainable emotion equations. To help streamline this task, I propose the development of the Companion Cube Calculator (CCC).

The CCC is a tool for calculating the range of a mathematical equation based on its input variables. Users will be able to specify input domains for variables that are known, and the tool will determine the domains for unspecified input variables. For example, the equation  $y = x + 5$  should return  $y \in (-\infty, \infty), x \in (-\infty, \infty)$  whereas the constrained equation of  $y = x + 5, x \geq 0$  should return  $y \in [5, \infty)$ . For the initial version of the CCC tool, the possible values will be limited to the domain of real numbers ( $\mathbb{R}$ ). In the special case of piecewise equations, the ideal tool would be able to accept the full equation set as a single input. However, if this is beyond the scope of the initial version, piecewise equations can be entered as individual equations with constrained input

domains. This project can be implemented as a command line tool. However, one of the only ways to ensure that there are no user input errors is to create a Graphical User Interface (GUI) that will only allow syntactically correct inputs. If this requirement is implemented, the initial version of the CCC tool will only be available for Windows operating systems.

## References

- [1] G. Smith, “GLaDOS: Integrating emotion-based behaviours into non-player characters in computer role-playing games,” M.A.Sc. (Software Engineering) Thesis, McMaster University. [Online]. Available: <http://hdl.handle.net/11375/21369>.