

Computer Science Tripos – Part II – Progress Report

Comparison of CSP-solving algorithms

D-A. Aleca, Homerton College

Project Supervisor: Dr Sean Holden

Director of Studies: Dr John Fawcett

Project Overseers: Ross Anderson & Jean Bacon

Work completed

The project is on schedule.

The work to be done has been split into sub-projects and each one was completed separately. With one exception where slack time was used, sub-projects were finished on time.

Sub-project: Implement a general CSP-validator

There was some discussion on how the input/output should be formatted. Opted to go with the simplest way available.

Sub-project: Implement a basic backtracking solution for solving CSPs

Attempted to do as much separation into classes as possible for easier individual maintenance on classes further in the project.

Sub-project: n-Queens set

Implemented a n-Queens problem generator (directly in CSP-format), translator from CSP-solution to matrix representation and a validator for the matrix representation.

There was some difficulty whilst debugging, as at this point variables did not have a name. Opted to introduce a name field in the Variable class.

Sub-project: Map Colouring set

Implemented a Map generator, translators to/from CSP-format and a Map-Colouring validator.

Some slack time was used for this sub-project, as the laptop has unexpectedly broken down for a few days. There was no loss (there were saves on github and the separate drive) and the laptop was recovered, but progress was slowed down.

Sub-project: Implement CSP-solving algorithms

As the project was done in sprints, there were small modifications to the format of input/output to various functions, particularly at this section. They were recorded in a log.

Including the basic backtracking algorithm heuristics, the following heuristics are available for use:

Look-Ahead Variable Ordering Heuristics:

- Random Variable Ordering
- Most Constrained Variable
- Least Constrained Variable
- There is also a flag which allows switching between static variable ordering and dynamic variable ordering.

Look-Ahead Value Selection Heuristics:

- Consistent Assignment
- Forward Checking
- Full Look-Ahead
- Arc-Consistency
- Partial Look-Ahead

Look-Back Heuristics:

- Backtrack
- Gaschnig's Backjumping
- Graph-Based Backjumping

Due to careful planning and separation of the Heuristics, one extension was also realised:

- Heuristics can be manually mixed to form new Algorithms.