

# CompSci 767: Intelligent Software Agents

## Assignment 2

**Worth: 25%**

**Due: Monday 28 May 2012**

### Goal of Assignment:

To give a taste of what research is like.

### Context:

There are various formulas for predicting how many nodes will be generated/expanded by IDA\* heuristic searches. No one has published a formula that accurately predicts the number of nodes generated/expanded for A\*. The same formulas that are so accurate for IDA\* are quite inaccurate for A\*. One main difference between A\* and IDA\* is that A\* does global duplicate state checking and IDA\* does not. Global duplicate state checking is one extreme of duplicate state checking. The other extreme is grandfather pruning. *Grandfather pruning* is the removal of a node's child which has a state that matches the state of the node's parent.

### Task:

You will need to read the papers in the reading list and try to understand theorem 1's formula in the Korf, Reid, Edelkamp 2001 paper. Check out how accurate that is for IDA\* with and without grandfather pruning. Assuming that it is more accurate for IDA\* without grandfather pruning, you need to:

- Hypothesize why this is so.
- Propose a modification to the formula (that you believe will increase its accuracy for IDA\* with grandfather pruning).
- Explain the basis for your belief.
- Test whether it has increased the accuracy, in particular, how close the accuracy of the new formula is to IDA\* with grandfather pruning as the old formula's accuracy was to IDA\* without grandfather pruning.
- Write a report describing all of this (including the initial checking).

The domain you will be using is the 8-puzzle and the heuristic will be Manhattan Distance.

### Resources:

The following will be provided:

- Reading list.
- Prolog implementation of IDA\*.
- Prolog implementation of 8-puzzle domain.
- Prolog implementation of Manhattan Distance heuristic.
- Collection of 8-puzzle problems categorized by optimal solution length.

**Outline of Report:**

- Introduction
- Problem Description
- Tutorial based on reading list
- Description of test runs between IDA\* with and without Grandfather pruning
- Description of your proposed modification to the formula and the rationale behind the modification
- Description of experimental runs to validate your model
- Analysis of the experiments
- Conclusions

**Reading List:**

“The branching factor of regular search spaces” by Edelkamp, S. and Korf, R.E. in 1998 Proceedings of the National Conference on Artificial Intelligence.

“Complexity analysis of admissible heuristic search” by Korf, R.E. and Reid, M. in 1998 Proceedings of the National Conference on Artificial Intelligence.

“Time complexity of iterative-deepening-A\*” by Korf, R.E. and Reid, M. and Edelkamp, S. in Artificial Intelligence Journal, Volume 129, number 1, 2001.

I recommend that you read these papers in the order given above. These papers are not light reading, I suggest that you get together with other students in this class and discuss them. This will not only improve your understanding of the papers, but may make them more enjoyable.