Fall Semester, 2011 **B.Y. Choueiry**

CSCE 496/896: Problem Solving with Constraints

Super Homework 7

Full Lookahead in Backtrack Search

Assigned: Wednesday, Nov 16, 2011

Due: Wednesday, Nov 30, 2011

Total value: 30

Notes: This homework must be done individually. *If you receive help from anyone, you must clearly acknowledge it.* Always acknowledge sources of information (URL, book, class notes, etc.). Please inform instructor quickly about typos or other errors.

The goal of this exercice is to implement an advanced algorithm for arc consistency or path consistency, integrate them as full lookahead strategy in backtrack search (with dynamic variable ordering), and conduct an extensive evaluation of the implemented algorithm over randomly generated problems along with a performance comparison to FC or FC-CBJ of previous homework.

- Choose one of the following two tasks (the second will be bonus).

  1. Implement AC2001 [Bessière *et al.* 2005] and integrate it with search as a full lookahead strategy. You should use eith FC or FC-CBJ with a dynamic variable ordering of your choice. (13 points)
  2. Implement PC8 [Chmeiss and Jégou 1998] and integrate it with search as a full lookahead strategy. You should use eith FC or FC-CBJ with a dynamic variable ordering of your choice. (13 points)

  The challenge of full lookahead is that you need to collect all domain reductions before updating the reductions array.

- Report the results for finding all solutions obtained on the simple examples of Homework 3. (2 points)

- Report the results for finding the first solutions on the random instances of Homework 4. (4 points)

- Report the results for finding all solutions only for the instances with few solutions (closer to the phase transition) on the random instances of Homework 4. (4 points)

- Compare your results with those obtained on FC or FC-CBJ for each instance, comment *as thoroughly and critically as possible*.

  (2 points)

- Write a report and make a class presentation.

  (5 points)

General Indications

- If you implement both consistency algorithms, you will receive a 8 points bonus.
- If you implement both look ahead strategies, the additional points will count towards bonus.
- Note that all results are reported by reporting the number of constraint checks, nodes visited, backtrack, and the CPU time.
- *Please make sure that you keep your code and protect your files.* Your name, date, and course number must appear in each file of code that you submit.
- All programs must be compiled, run and tested on `cse.unl.edu`. Programs that do not run correctly in this environment will not be accepted.
- You must submit a README file with precise steps on how to compile, run and test your code. Failure to do so may result in no points for the homework.

References

Bessière, Christian; Régin, Jean-Charles; Yap, Roland H.C.; and Zhang, Yuanlin 2005. An Optimal Coarse-Grained Arc Consistency Algorithm. *Artificial Intelligence* 165(2):165–185.

Chmeiss, Assef and Jégou, Philippe 1998. Efficient Path-Consistency Propagation. *International Journal on Artificial Intelligence Tools* 7(2):121–142.