Grundlagen der Wissensverarbeitung
Computer Science
Universität Hamburg

Tutorial 6: Search and Parsing

Rafael Ruz Gómez
Miguel Robles Urquiza

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Exercise 7.1

Formalize this riddle in the form of a constraint network, with the constraints being reasonably small. (I.e. writing a single constraint is not a good solution!) In the following pattern each letter stands for a digit so that the resulting sum is correct.

```
  S E N D
  M O R E
=========
M O N E Y
```

Let's call S_i the sum done in the last step. Then the constraints are:

- Different letter have different values: $S \neq E, E \neq N, N \neq D...$
- $(D + E)\,\%10 == Y \qquad (S_0 = (D + E))$
- $(((S_0 - S_0)\,\%10)/10 + N + R)\,\%10 == E \qquad (S_1 = ((S_0 - S_0)\,\%10)/10 + N + R)$
- $(((S_1 - S_1)\,\%10)/10 + E + O)\,\%10 == N \qquad (S_2 = ((S_1 - S_1)\,\%10)/10 + E + O)$
- $(((S_2 - S_2)\,\%10)/10 + S + M)\,\%10 == O \qquad (S_3 = ((S_2 - S_2)\,\%10)/10 + S + M)$
- $(((S_3 - S_3)\,\%10)/10 == M$

Manual constraint solving.

Crossword puzzles are often used in newspapers because they provide joy in solving semi-complex problems by combining logics and human experience. For the crossword above we want to find 6 words of length 3 that fit into the 3x3 table in a way that 3 words can be read horizontal from left to right and 3 words can be read vertically from top to bottom. Choose the words from the following list:

add, ado, age, ago, aid, ail, aim, air,
and, any, ape, apt, arc, are, ark, arm,
art, ash, ask, auk, awe, awl, aye, bad,
bag, ban, bat, bee, boa, ear, eel, eft,
far, fat, fit, lee, oaf, rat, tar, tie.

First, try to solve the problem without any formal methods or tools. How do you approach this problem as a human? (It is not necessary to give a full solution to the problem at this point, but you should report on the strategies you employ as a human and the problems you encounter.)

Solve the problem by hand using domain consistency as a first step and as a second step the arc consistency. Document this process thoroughly.

• Implement the arc consistency algorithm (found in sect. 4.5 of Poole and Mackworth (2010)) along with a suitable representation of the problem to solve this puzzle.