Grundlagen der künstlichen Intelligenz
Exam Bonus Programming Exercise 2 2nd November 2015[1]

Problem 2: Constraint Satisfaction

The Fellowship of the Ring: Frodo, Sam, Merry, Pippin, Aragorn, Legolas, Gimli, Gandalf and Boromir, are in a forest. On a certain day, they need to divide into three groups to cook breakfast, lunch and dinner. Consider the following constraints:

1. each person must be in exactly one group,
2. each group contains no more than 4 people and no fewer than 2,
3. each group contains exactly 3 people,
4. Frodo must be in the same group as Sam,
5. Legolas is not allowed to be in the same group as Gimli,
6. Merry, Pippin, Frodo and Sam will not cook breakfast,
7. Aragorn and Boromir will not cook dinner,
8. Merry is not allowed to be in the same group as Pippin,
9. Gimli must always cook after Merry (i.e. if Merry cooks breakfast, then Gimli cooks lunch or dinner; if Merry cooks lunch, then Gimli cooks dinner),
10. Frodo must always cook after Merry,
11. Aragorn is not allowed to be in the same group as Boromir, Legolas or Gandalf.

Figure 1: The Fellowship. Image source: `cinema.theiapolis.com`.

Model the constraint satisfaction problem in Savile Row. For each of the following subsets of constraints, find the solution, if it exists:

Problem 2.1: { 1, 3, 4, 5, 6, 7, 8, 9 }

Problem 2.2: { 1, 2, 4, 5, 6, 7, 8, 9, 10 }

Problem 2.3: { 1, 2, 4, 5, 6, 7, 8, 9, 10, 11 }

Problem 2.4: { 1, 3, 4, 5, 6, 7, 8, 9, 10, }

Problem 2.5: { 1, 3, 5, 6, 8, 9, 10, 11 }

[1] Updated 15.11.15 to remove ambiguity between may not be/is not allowed to be, and 19.11.15 to correct spelling error from "cps" to "csp" and include submission instructions.

Please send your answer to `aaron.pereira@tum.de` under the subject header "CSP". Your answers should be in the following format: A zipped directory named `"csp_firstname_lastname"`. In this directory you will have the following files:

- `csp1.eprime` – your `.eprime` file for problem 2.1
- (`csp1.param` – your `.param` file for problem 2.1, if used)
- `csp2.eprime` – your `.eprime` file for problem 2.2
- (`csp2.param` – your `.param` file for problem 2.2, if used)
- `csp3.eprime` – your `.eprime` file for problem 2.3
- (`csp3.param` – your `.param` file for problem 2.3, if used)
- `csp4.eprime` – your `.eprime` file for problem 2.4
- (`csp4.param` – your `.param` file for problem 2.4, if used)
- `csp5.eprime` – your `.eprime` file for problem 2.5
- (`csp5.param` – your `.param` file for problem 2.5, if used)
- `answers.txt` – a text file explaining:
  - Your choice of variables,
  - Your solutions to each problem, i.e. which persons are in which group. If multiple solutions exist, you need only give one solution here.

The `.param` files are optional. Therefore the directory will contain between 6 and 11 files. You can use the template uploaded to Moodle.

A pass will be awarded only if:

- the solutions to the problems in `answers.txt` are correct,
- your `.eprime` files (and `.param` files, if used) work and generate a `solution` file if a solution exists, and the problem has been modelled correctly using your choice of variables,
- your submission is submitted in the correct format (i.e., a zipped folder with the files shown above).

Like the rest of the programming exercises, this is an individual project and work **must** be your own. Submission will close on **Sunday 13th December at 23:59**. If your files do not work or the submission is in the wrong format and you submit up to 5 days before the deadline, I will contact you – please respond within 48 hours, or I cannot consider your solution.