Below are a few exercises you can do in order to familiarise yourself with the MiniZinc language and toolchain. These exercises are provided for training purposes: nothing needs to be handed in for grading purposes.

1 Warm-Up

Make sure you have access to the installation of the MiniZinc toolchain and our recommended backends on the IT department’s ThinLinc computers. Once this is done, you can start working on the following warm-up problems:

(a) Take the 8-queens model from the slides of Topic 1 and make it parametric so that one can solve the $n$-queens problem for other values of $n$. How large an instance can you solve in a reasonable amount of time with each backend?

(b) If you have both a good model and a good solver, then you should feel relaxed. Do you doubt it? Write a model to find an assignment of different values, between 0 and 9, to the ten letters M, O, D, E, L, S, V, R, A, and X such that MODEL + SOLVER = RELAXED when you replace each letter by the corresponding digit in this equation; in addition, the leading digits M, S, and R should be non-zero.

(c) Write a parametric model to solve Sudoku puzzles ([https://en.wikipedia.org/wiki/Sudoku](https://en.wikipedia.org/wiki/Sudoku)). You can start from the non-parametric model from the slides of Topic 1, but note that it is in future MiniZinc syntax, not the current one. You can easily find Sudoku instances on the internet.

(d) Write a parametric model to solve the magic square problem ([https://en.wikipedia.org/wiki/Magic_square](https://en.wikipedia.org/wiki/Magic_square)). How large an instance can you solve in a reasonable amount of time with each backend?

2 Shikaku

The Shikaku is a puzzle, for which the rules and many instances can be found at [http://www.puzzle-shikaku.com](http://www.puzzle-shikaku.com). Write a parametric model to solve Shikaku instances.
3 Self-Referential Aptitude Test

To prove your ability to study this course further, you first need to achieve a perfect score on the following multiple-choice questionnaire:

1. The first question whose answer is B is question:
   (A) 2       (B) 3       (C) 4       (D) 5       (E) 6

2. The only two consecutive questions with identical answers are questions:
   (A) 2 and 3 (B) 3 and 4 (C) 4 and 5 (D) 5 and 6 (E) 6 and 7

3. The last question with the same answer as this one is question:
   (A) 10      (B) 9       (C) 8       (D) 7       (E) 6

4. The number of questions with answer A is:
   (A) 0       (B) 1       (C) 2       (D) 3       (E) 4

5. The answer to this question is the same as the answer to question:
   (A) 10      (B) 9       (C) 8       (D) 7       (E) 6

6. The number of questions with answer A equals the number of questions with answer:
   (A) B       (B) C       (C) D       (D) E       (E) none of the above

7. Alphabetically, the answers to this question and the following one are:
   (A) 4 letters apart (B) 3 apart (C) 2 apart (D) 1 apart (E) the same

8. The number of questions whose answer is a vowel (A or E) is:
   (A) 2       (B) 3       (C) 4       (D) 5       (E) 6

9. The number of questions whose answer is a consonant (B, C, or D) is:
   (A) a prime   (B) a factorial (C) a square (D) a cube (E) divisible by 5

10. The answer to this question is:
    (A) A       (B) B       (C) C       (D) D       (E) E

While this questionnaire can be answered quickly enough by hand, please refrain from doing so during the tutorial. Your task is to answer this questionnaire using MiniZinc. If you are interested, then note that other such puzzles can be found on the internet. This particular one comes from http://www.lcc.uma.es/~afdez/srq/small_SRAT. If you want an easier one to start with, then have a look at http://mrhonner.com/wp-content/uploads/2012/05/Simple-Self-Referential-Test-1.pdf.

4 Golomb Ruler

Golomb ruler construction (https://en.wikipedia.org/wiki/Golomb_ruler) is a well-known and well-studied NP-hard problem with applications in, for example, information theory and radio antenna placement. Try and write a model for Golomb ruler construction. There is a good model in the MiniZinc Tutorial, but try to write your own model without looking at it.

1Just kidding...