Solving Soft Constraint Problems in Autonomic Systems with MiniBrass (FAS* 2016)

Exercise 1 ***(MiniZinc: HelloWorld)***

Build a MiniZinc model `xopt.mzn` with a decision variable x taking values from 0 to 10, with constraints to ensures that x is divisible by 4, which outputs the value of x that gives the minimum value of $(x-7)^2$.
Test it using the precompiled IDE-bundle. Suppose you cannot use the `mod` function, how would you alternatively model that x is divisible by 4?

Exercise 2 ***(Arrays)***

Define a MiniZinc model `array.mzn` which takes an integer parameter n defining the length of an array of numbers x taking values from 0 to 9. Constrain the array so the sum of the numbers in the array is equal to the product of the numbers in the array. Output the resulting array. Test your model using

```
minizinc array.mzn -a
```

which should print out all the solutions for x. Of course, you can use the IDE with appropriate settings. Add a constraint to ensure that the numbers in the array are non-decreasing, i.e. $x[1] \leq x[2] \leq \ldots \leq x[n]$. This should reduce the number of similar solutions. This is an example of symmetry breaking which will be very useful. How big a number can you solve with your model? Why do you think this happens?

Exercise 3 ***(Group Photo)***

Given a group of n people, we must arrange them for a photo. The best photo is when people are next to their friends, so the aim is to arrange them so that each person is next to (to the left or right) with as many friends as possible. The data for the problem is given as

```
n = <size of problem> ;
array[1..n,1..n] of var bool: friend;
```

where `friend[f1, f2]` means `f1` and `f2` are friends. You can assume that the friend array is symmetric. You should output a list of the people in their position to maximize the number of adjacent friends. For example given the data `groupphoto1.dzn`, you should output the placement of the guests as well as the objective value, i.e.,

```
Obj = 7; [4, 3, 5, 6, 8, 7, 1, 2]
```

Exercise 4 ***(Modeling a Soft Constraint Problem)***

Exercise 5 ***(Influence of Priorities)***