Discrete Optimization Specialization: Workshop 5
Poetry Challenge

1 Introduction

Liu Bei is seriously smitten by Sun Shangxiang, the sister of Sun Quan. After he successfully composed a piece of music for her, she next demanded a poem exalting her positive attributes. Liu Bei has written a model to solve the problem, but it isn't working The aim of this workshop is to debug his model. This can be a challenging process.

Poetry - `poetry.mzn`

Liu Bei has written stanzas of poetry of 3 kinds

E: k stanzas of poetry exalting the wonderful attributes of Sun ShangXiang,

S: l stanzas that express how suited he is as a match to Sun ShangXiang, and

O: m other stanzas.

Each stanza of the first two types has an effectiveness rating.

His problem is to arrange the stanzas so that no stanza exalting her attributes (E) directly follows another of the same type (E), and similarly no stanza expressing his suitability (S) directly follows another of the same type (S). He wishes to maximise the impact of the poem which is given by the sum of all the changes in effectiveness of the adjacent stanzas of the first two types ($\{S, E\}$).

The input format gives the number of stanzas of each type, and an array `effect` giving the effectiveness of each of the stanzas of the first two types: first the effectiveness of the exaltation E stanzas, and then the effectiveness of the suitability S stanzas.

Liu Bei has writtena model, `poetry_buggy.mzn`, but it doesn't work. There are a number of problems with the model. For input data (`poetry0.dzn`)

```
k = 3;
l = 3;
m = 3;
effect = [10,13,14,9,7,6];
```

working out by hand the best solution seems to be 29 difference with the order [4, 3, 6, 2, 5, 1].

Stanza:	4	3	6	2	5	1
Type:	S	E	S	E	S	E
Effect:	9	14	6	13	7	10
Diffs:		5	8	7	6	3

Unfortunately the model says

```
=====UNSATISFIABLE=====
```

Change the model to return the correct answers for this example and also `poetry1.dzn` which has best answer 21, `poetry2.dzn` which has best answer 19, and `poetry3.dzn` which has best answer 16.

Try your corrected model on `poetry4.dzn`. It should say unsatisfiable. Is this an error in your model or is this the correct answer? If it is the correct answer how would you adjust the problem so that you could find a solution for this data.

Finally `poetry5.dzn` is substantially harder to solve. What's the best valued solution you can find? Hint the optimal is somehere in the range 80 - 88!

2 Technical Requirements

For completing the workshop you will need MiniZinc 2.0 (`http://www.minizinc.org/2.0/`).