Pattern Reduction Test Instances

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Background

These instances are solutions to the 1D-CSP and are intended to provide a test-bed to evaluate pattern reduction heuristics, i.e. whether the solution be transformed into another with fewer patterns, but the same run length, order allocation and waste. See for example

> Foerster, H., & Wascher, G. (2000). Pattern reduction in one-dimensional cutting stock problems. International Journal of Production Research, 1657-1676.

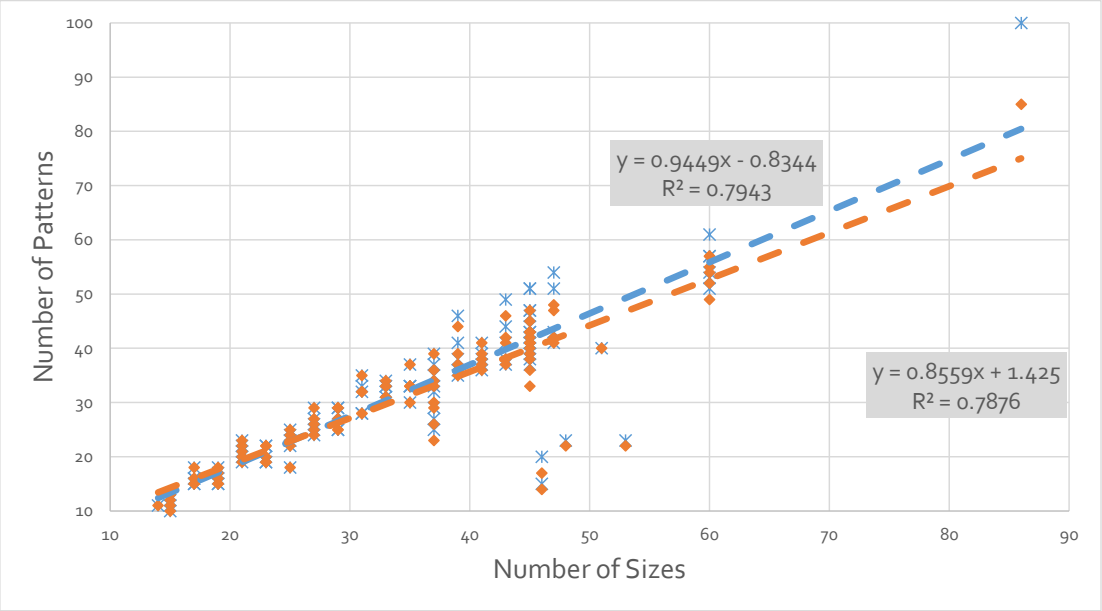
Although most of the problems are randomly generated, they have been designed broadly to represent real-world problems.

These instances have a lot of potential in terms of pattern reduction. For example, #87 has 61 patterns, but solutions with 46 are known. However trivial reductions (e.g. Johnston's 2:1 rule) are not possible (in the initial solution).

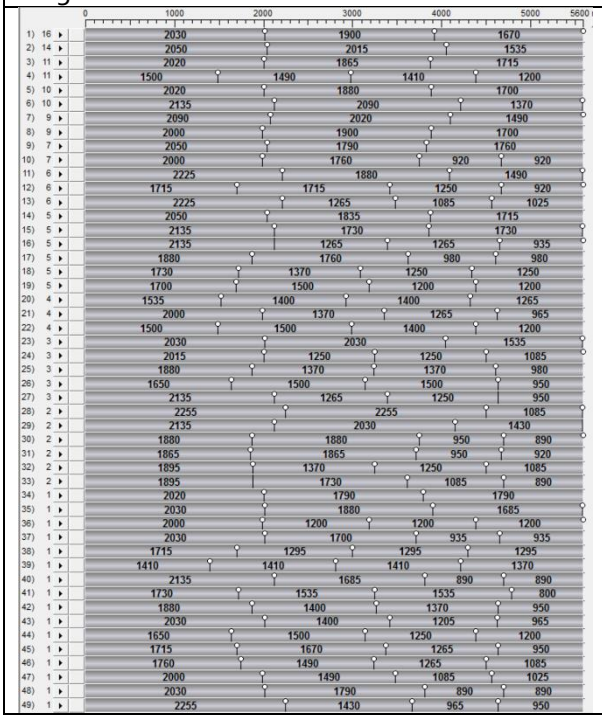
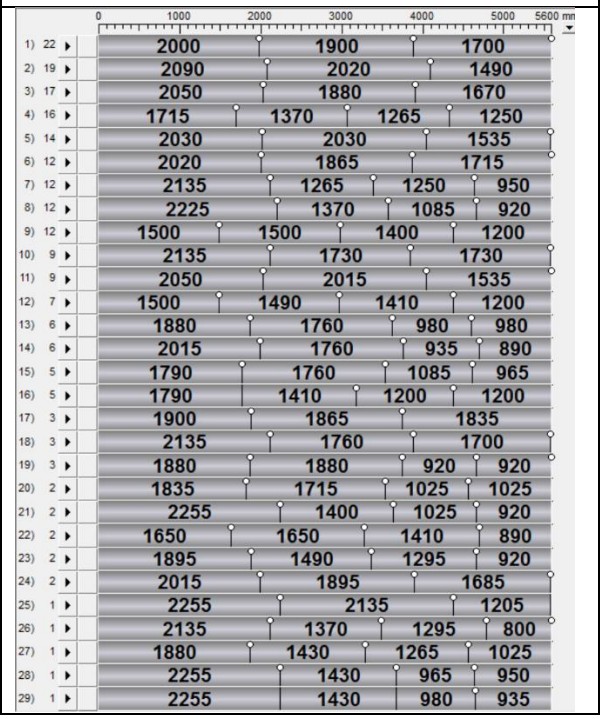
In looking at algorithms, we would suggest that two measures (other than computational time) are employed:

a. The total number of patterns across all the instances

b. The regression in terms of sizes before and after, e.g.:



It is known that there is considerable room for fewer patterns, particularly in the larger instances. For example, PR_00010.PRX, with 49 patterns, is known to have a solution with only 29:

Original	Best Known
	

Description of Test Instances

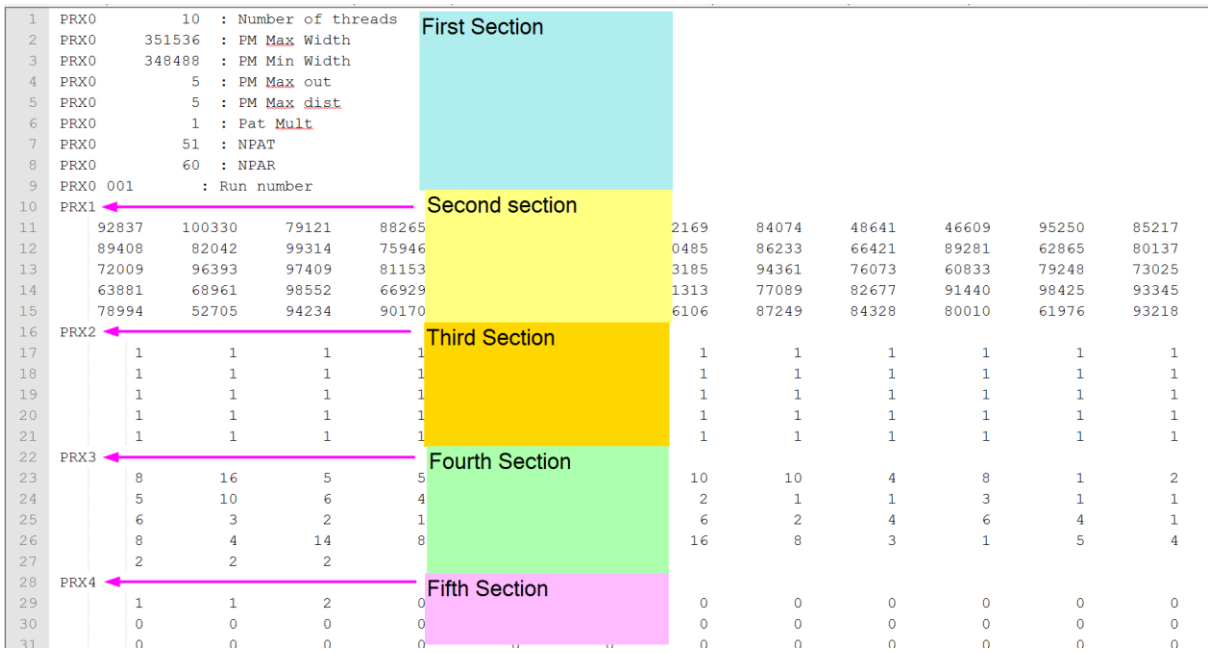
Name	Widths	Description
PR_00001.PRX - PR_00005.PRX	45	Correspond to the 80 random cases of the pattern reduction test suite

Name	Widths	Description
PR_00006.PRX - PR_00010.PRX	43	Correspond to the 80 random cases of the pattern reduction test suite
PR_00011.PRX - PR_00015.PRX	41	Correspond to the 80 random cases of the pattern reduction test suite
PR_00016.PRX - PR_00020.PRX	39	Correspond to the 80 random cases of the pattern reduction test suite
PR_00021.PRX - PR_00025.PRX	37	Correspond to the 80 random cases of the pattern reduction test suite
PR_00026.PRX - PR_00030.PRX	35	Correspond to the 80 random cases of the pattern reduction test suite
PR_00031.PRX - PR_00035.PRX	33	Correspond to the 80 random cases of the pattern reduction test suite
PR_00036.PRX - PR_00040.PRX	31	Correspond to the 80 random cases of the pattern reduction test suite
PR_00041.PRX - PR_00045.PRX	29	Correspond to the 80 random cases of the pattern reduction test suite
PR_00046.PRX - PR_00050.PRX	27	Correspond to the 80 random cases of the pattern reduction test suite
PR_00051.PRX - PR_00055.PRX	25	Correspond to the 80 random cases of the pattern reduction test suite
PR_00056.PRX - PR_00060.PRX	23	Correspond to the 80 random cases of the pattern reduction test suite
PR_00061.PRX - PR_00065.PRX	21	Correspond to the 80 random cases of the pattern reduction test suite
PR_00066.PRX - PR_00070.PRX	19	Correspond to the 80 random cases of the pattern reduction test suite
PR_00071.PRX - PR_00075.PRX	17	Correspond to the 80 random cases of the pattern reduction test suite
PR_00076.PRX - PR_00080.PRX	15	Correspond to the 80 random cases of the pattern reduction test suite
PR_00081.PRX - PR_00085.PRX	47	Based on the first 5 problems of the (random) pattern reduction test suite, but with two additional orders each, so with 47 orders in total.
PR_00086.PRX	86	From PR004 (SAPPI). Solutions with as few as 75 patterns are known.
PR_00087.PRX	60	From PR032 (IP). Solutions with as few as 46 patterns are known.
PR_00088.PRX	53	From PR056 (Liansheng).
PR_00089.PRX	51	From PR014 (Bemis Finland).

Name	Widths	Description
PR_00090.PRX	25	From PR051 (Orora).
PR_00091.PRX - PR_00095.PRX	45	Randomly generated with 45 distinct sizes. Winder has a set multiple of 2.
PR_00096.PRX - PR_00100.PRX	45	Randomly generated with 45 distinct sizes (derived from the above). Winder has a set minimum of 3.
PR_00101.PRX	60	Randomly generated with 60 distinct sizes. Best known answer has 51 patterns.
PR_00102.PRX	60	Randomly generated with 60 distinct sizes. Best known answer has 57 patterns.
PR_00103.PRX	60	Randomly generated with 60 distinct sizes. Best known answer has 49 patterns.
PR_00104.PRX	60	Randomly generated with 60 distinct sizes. Best known answer has 51 patterns.
PR_00105.PRX	60	Randomly generated with 60 distinct sizes.
PR_00106.PRX	37	From J'ian, min sets / pattern = 4; manually generated solution
PR_00107.PRX	37	From J'ian, min sets / pattern = 4; different solution to the same problem.
PR_00108.PRX	37	From J'ian, min sets / pattern = 4; variation of above.
PR_00109.PRX	49	From J'ian, solutions with 21 patterns are possible.
PR_00110.PRX	46	From the same J'ian run, different starting solution. The seven 1-set patterns are reducible.
PR_00111.PRX	46	From the same J'ian run, different starting solution. The six 1-set patterns are reducible.
PR_00112.PRX	36	From Kipas, one of the largest runs.
PR_00113.PRX	22	From Blue Paper, one of the largest runs (35831). Solutions with 12 patterns are possible.
PR_00114.PRX	28	From Blue Paper, one of the largest runs (38270). Solutions with 18 patterns are possible.
PR_00115.PRX	70	Randomly generated, solutions with 49 patterns are possible.
PR_00116.PRX	72	Randomly generated, solutions with 47 patterns are possible.
PR_00117.PRX	74	Randomly generated, solutions with 51 patterns are possible.
PR_00118.PRX	76	Randomly generated, solutions with 45 patterns are possible.
PR_00119.PRX	78	Randomly generated, solutions with 60 patterns are possible.
PR_00120.PRX	80	Randomly generated, solutions with 51 patterns are possible.

Structure of the Input Files (PRX)

The text files with the input have a PRX extension, which has five sections:




```
PRX0         10  : Number of threads
PRX0     351536  : PM Max Width
PRX0     348488  : PM Min Width
PRX0          5  : PM Max out
PRX0          5  : PM Max dist
PRX0          1  : Pat Mult
PRX0         51  : NPAT
PRX0         60  : NPAR
PRX0 001         : Run number
PRX1
    92837    100330     79121     88265                2169     84074     48641     46609     95250     85217
    89408     82042     99314     75946                0485     86233     66421     89281     62865     80137
    72009     96393     97409     81153                3185     94361     76073     60833     79248     73025
    63881     68961     98552     66929                1313     77089     82677     91440     98425     93345
    78994     52705     94234     90170                6106     87249     84328     80010     61976     93218
PRX2
        1         1         1         1                   1         1         1         1         1         1
        1         1         1         1                   1         1         1         1         1         1
        1         1         1         1                   1         1         1         1         1         1
        1         1         1         1                   1         1         1         1         1         1
        1         1         1         1                   1         1         1         1         1         1
PRX3
        8        16         5         5                  10        10         4         8         1         2
        5        10         6         4                   2         1         1         3         1         1
        6         3         2         1                   6         2         4         6         4         1
        8         4        14         8                  16         8         3         1         5         4
        2         2         2
PRX4
        1         1         2         0                   0         0         0         0         0         0
        0         0         0         0                   0         0         0         0         0         0
        0         0         0         0                   0         0         0         0         0         0
```

First Section – Parameters

This section contains (in sequence):

1. Number of threads – should be ignored
2. Maximum width
3. Minimum width
4. Maximum number of items / pattern
5. Maximum number of distinct items / patterns
6. Minimum pattern utilisation
7. Number of patterns in solution NPAT
8. Number of sizes in solution NPAR
9. Run number – should be ignored

Second Section – List of Sizes

Array of size NPAR, contains the list of sizes.

Third Section – Multi-pack

Array of size NPAR, containing the number of times each size appears in each pattern. For these problems the number is 1, so can be ignored.

Fourth Section – Pattern Multiplicity

Array of size NPAT, containing the number of times each pattern should be produced.

Fifth Section – Pattern Contents

Array of size NPAT x NPAR, the (i,j) element contains the number of times the j^{th} size appears in the i^{th} pattern.

Questions & Corrections

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