Packing Boxes with Score Constraints

Asyl L. Hawa

August 29, 2017

1 Example

1.1 Creating problem instance

In this example, we will attempt to find a feasible alignment of nine boxes, with score widths ranging between 1mm and 70mm. The minimum score separation constraint, or "threshold", will be set at 70mm, the industry standard.

Initially, we create 18 random values between 1 and 70, which will be our score widths. We also need to add an extra box with two score of widths 70mm, which will be our "dominating scores", giving us a total of 10 boxes and 20 scores. These dominating scores will eventually be discarded.

We then sort the scores in non-decreasing order, and place them in a vector. The scores will now be addressed by their indices throughout the rest of the algorithm (see Table 1).

Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Scores	3	4	12	22	25	35	36	37	38	45	49	54	54	55	55	64	65	66	70	70

Table 1: allScores vector.

Since every box consists of two scores, each score is randomly assigned a "mate", so that one score (the smaller score) represents the left-hand side of the box, and the other score represents the right-hand side of the box. The only exceptions to the random allocation of mates are the dominating scores - they must be assigned to one another. We can then assign measurements to each pair of mates to represent the width of each individual box.

Mates		Box Width
0	6	314
1	10	372
2	16	297
3	11	220
4	17	959
5	9	738
7	12	622
8	15	635
13	14	859
18	19	0

Table 2: Mates.

Next, we create an adjaceny matrix. This adjaceny matrix contains information regarding threshold constraint. If the sum of two scores is greater than or equal to the threshold, the adjaceny matrix contains "1" in the relevant cell. If two scores are mates, the adjaceny matrix contains "2". Else, the adjaceny matrix contains "0".

Match	
0	19
1	18
2	17
3	16
4	15
5	14
6	13
7	11
8	12
9	10

Table 3: Match List.

Cycle 0	0	6	13	14	15	9	10	1	18	19
Cycle 1	2	16	3	11	7	12	8	15	4	17

Table 4: Mate-Induced Cycles.

	Edges	
cycle 1	1	2
cycle 2	4	5
cycle 3	6	8

Table 5: T-Matrix.

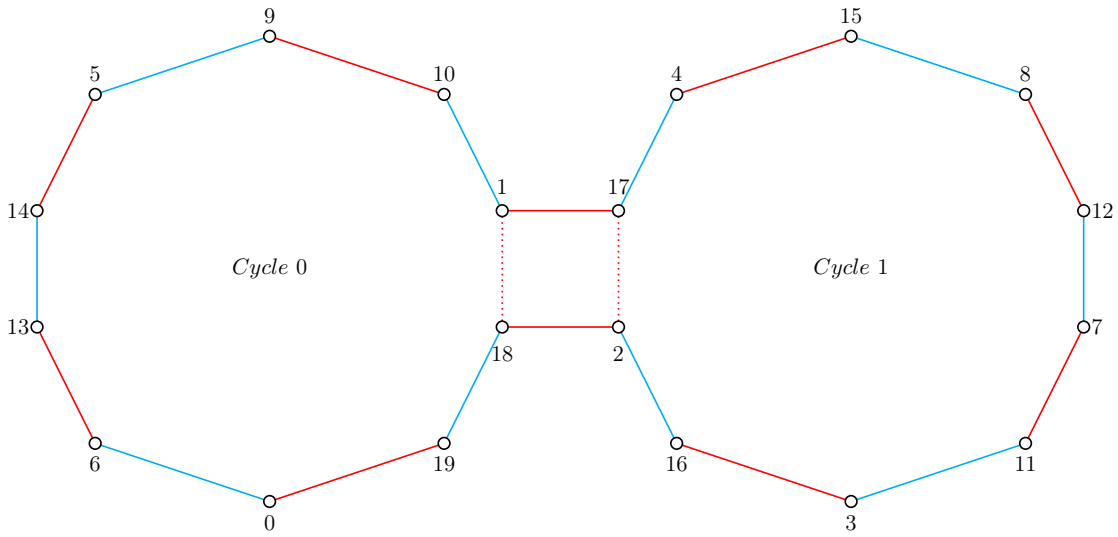

Figure 1: Patching MIS blue = mates, red = matching, explain dotted lines.