Figures for Combinatorial Optimization in Pattern Assembly (Extended Abstract)

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This is a collection of all figures in the following paper:

S. Seki.
Combinatorial optimization in pattern assembly (extended abstract).
UCNC 2013, to appear.

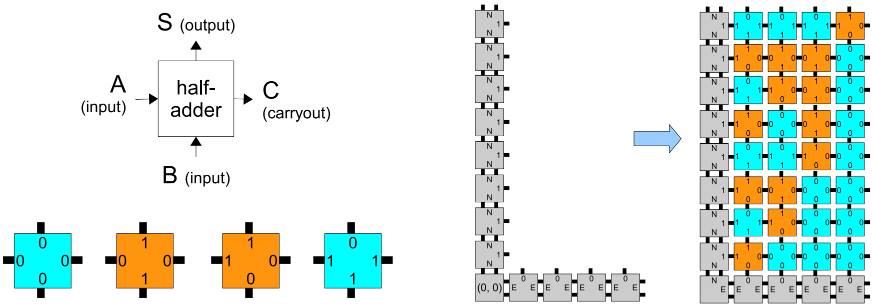

Figure 1: (Left) Four tile types implement together the half-adder with two inputs A, B from the west and south, the output S to the north, and the carryout C to the east. (Right) Copies of the "half-adder" tile types turn the L-shape seed into the binary counter pattern, whose origin is at the bottom-left corner as illustrated.

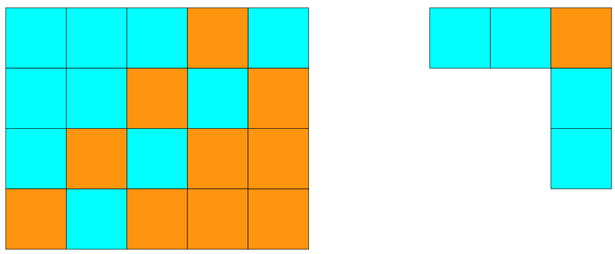

Figure 2: (Left) If this blue-orange subpattern is on a pattern P, a directed RTAS needs at least 2 blue tile types and at least 2 orange ones in order to uniquely self-assemble P; (Right) This pattern has a directed RTAS contain at least 2 blue tile types.

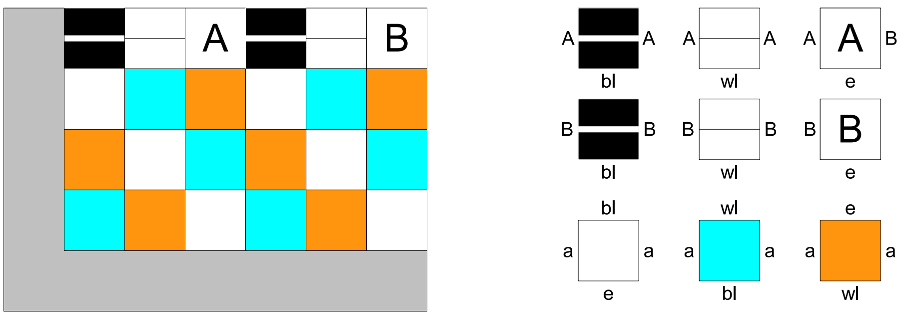

Figure 3: A 3-mosaic pattern $P_{\mathrm{mos}(3)}$ (the gray part can be regarded as the seed). Using the 9 tile types shown right, an RTAS can uniquely self-assemble this pattern, and this is the sole minimum tile set.

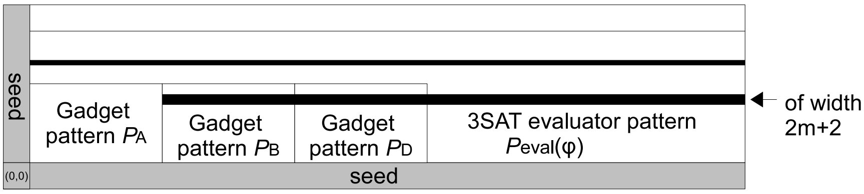

Figure 4: The pattern $P(\phi)$ to which a 3SAT instance ϕ is reduced. The 3 black lines represent variable wires, and the lowest one of width $2m + 2$ is a fake one. Note that this one stems from the right of P_A, while the others originate from the seed.

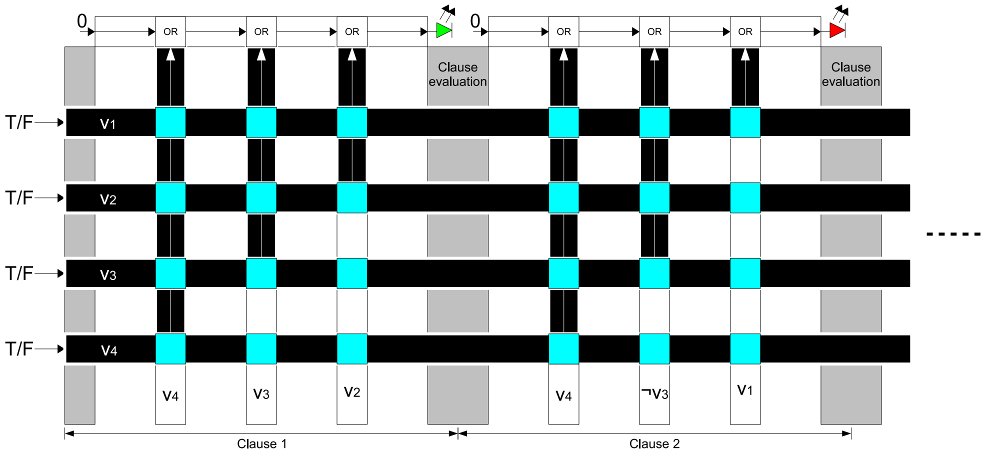

Figure 5: The 3SAT evaluator for the specific 3SAT instance $(v_4 \vee v_3 \vee v_2) \wedge (v_4 \vee \neg v_3 \vee v_1)$. Literals (white stripes) are evaluated at substituters (blue squares), and the evaluation (black stripes with a white arrow) is transmitted upward for the evaluation of clause they belong to. The design principle works for arbitrary number of variables or clauses. LED signals at the top indicate that the input satisfies Clause 1 but not Clause 2.

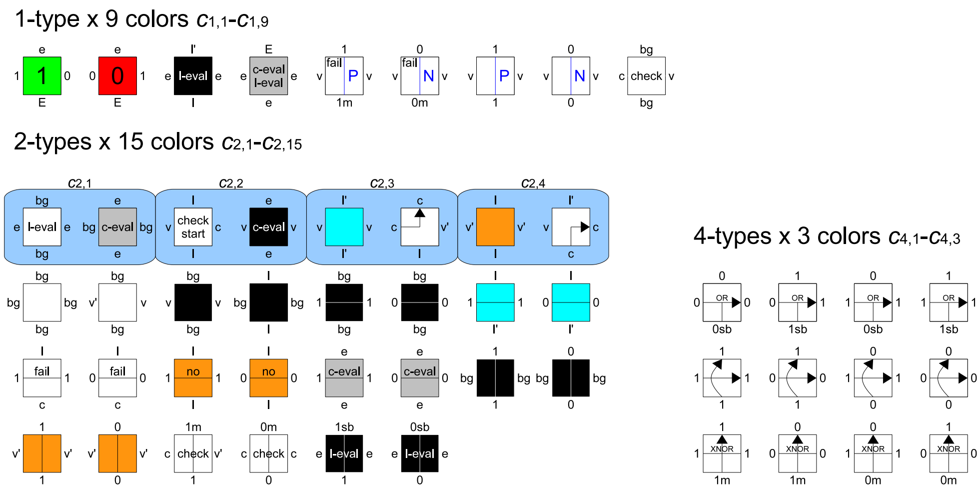

Figure 6: The 51 tile types (of 27 colors) to simulate the 3SAT evaluator by an RTAS. Two tile types surrounded by the blue rounded rectangle are of the same color, though they are drawn with different colors in order to clarify their roles.

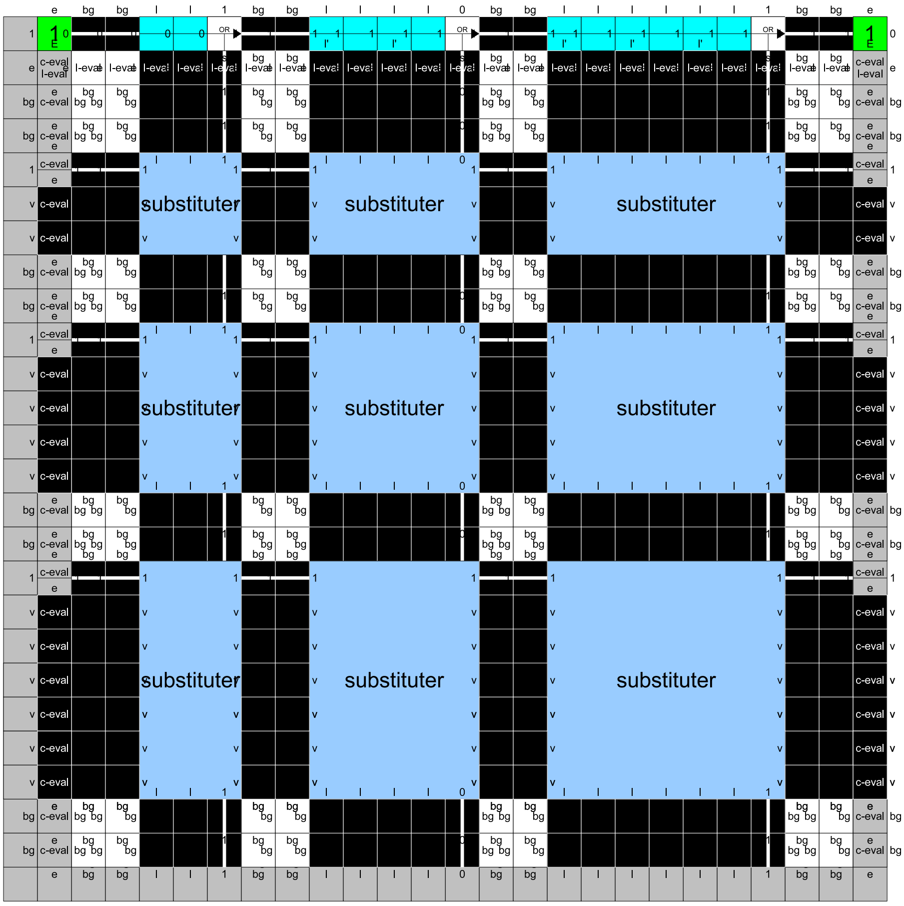

Figure 7: Using tiles in the set T_{eval}, this pattern uniquely self-assembles from the L-shape seed that encodes a 3SAT instance with 3 variables v_1, v_2, v_3 and a clause $\{v_1, \neg v_2, v_3\}$ with the assignment $(1, 1, 1)$.

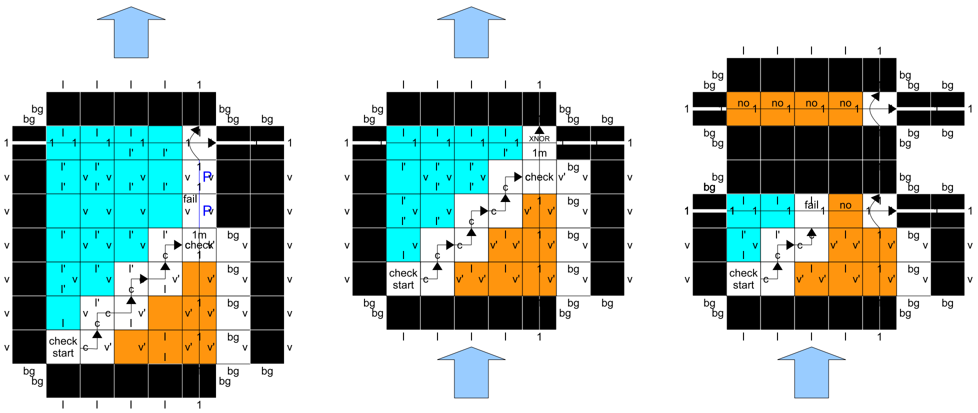

Figure 8: Patterns occurring at the intersection of the literal wire v_2 (Left) with the variable wire v_3, (Middle) with the wire for matching variable v_2, or (Right) with the variable wire v_1 and with the thinnest possible wire, which encodes no variable.

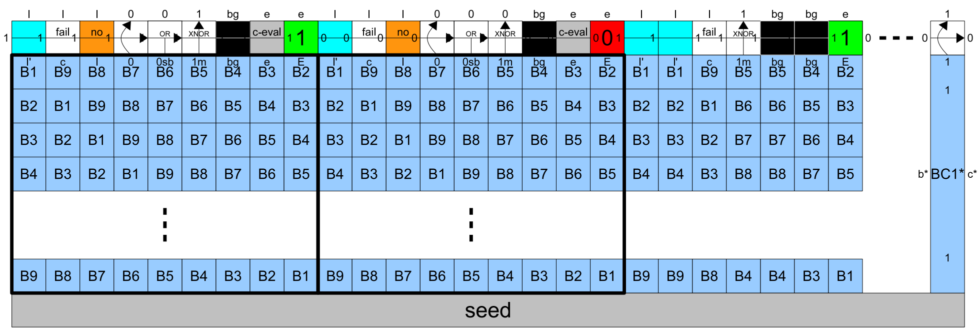

Figure 9: A part of the gadget pattern P_B. Thick black rectangulars indicate mosaics.

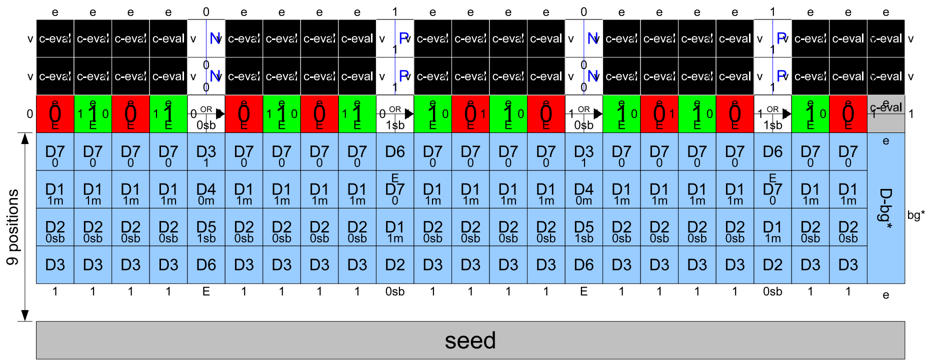

Figure 10: A part of the gadget pattern P_D.