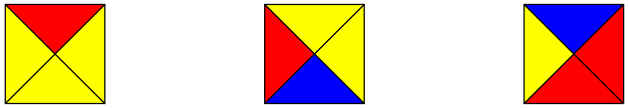
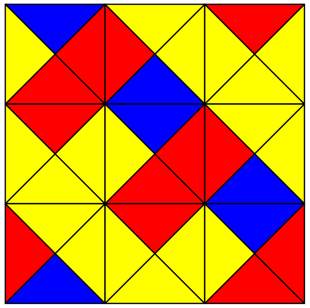
The barber of Knegsel shaves exactly those men who do not shave themselves.

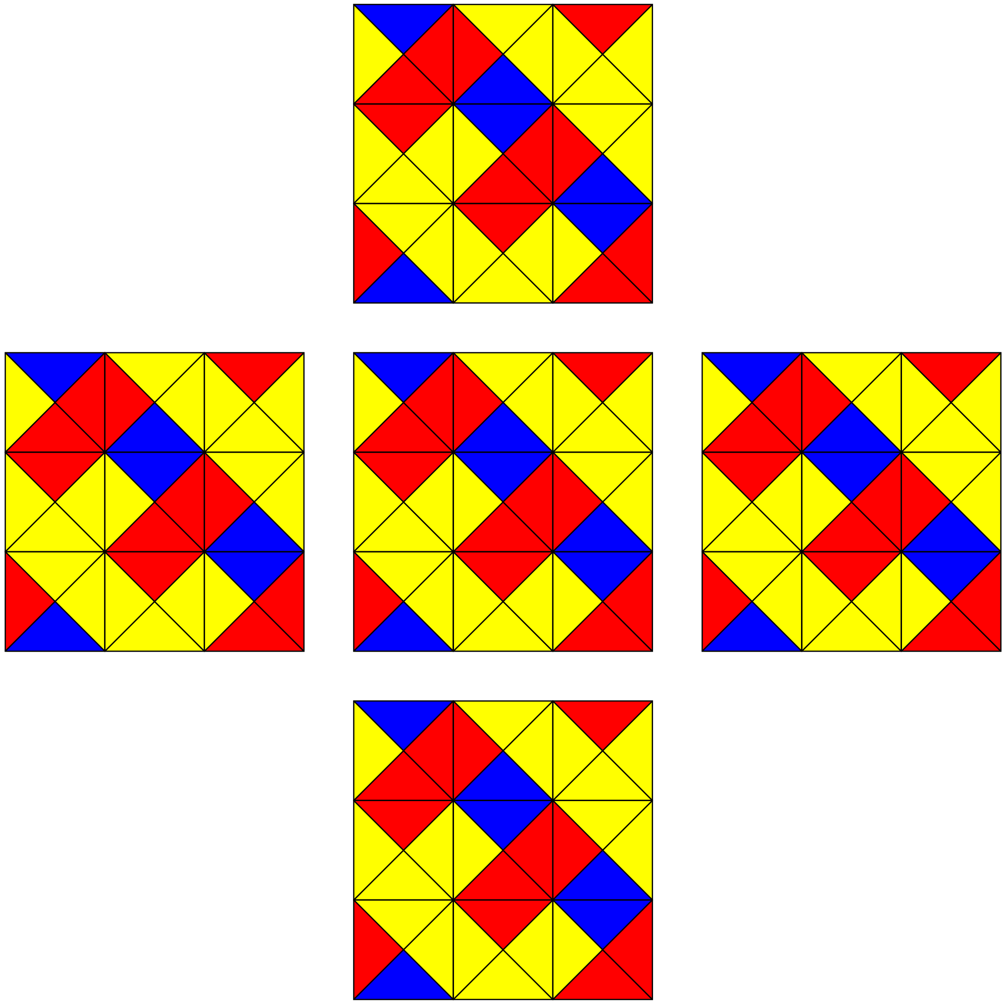
- sample tile set



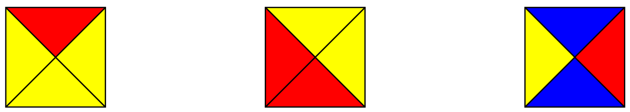
- pattern



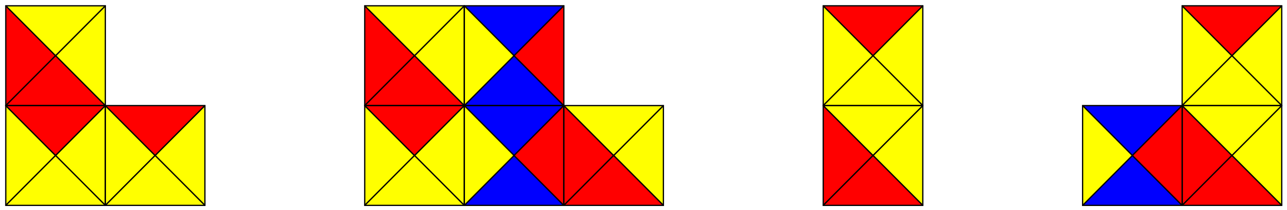
- the pattern fills the plain



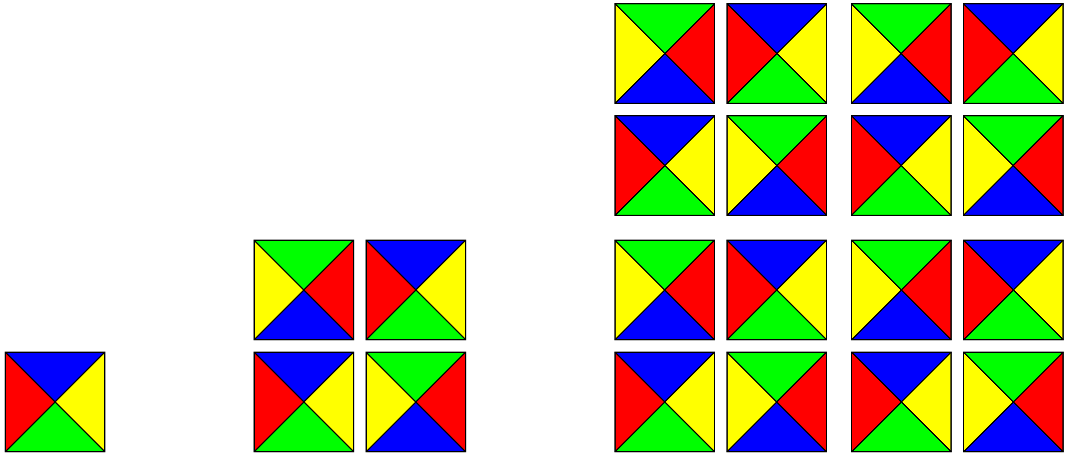
- another sample tile set



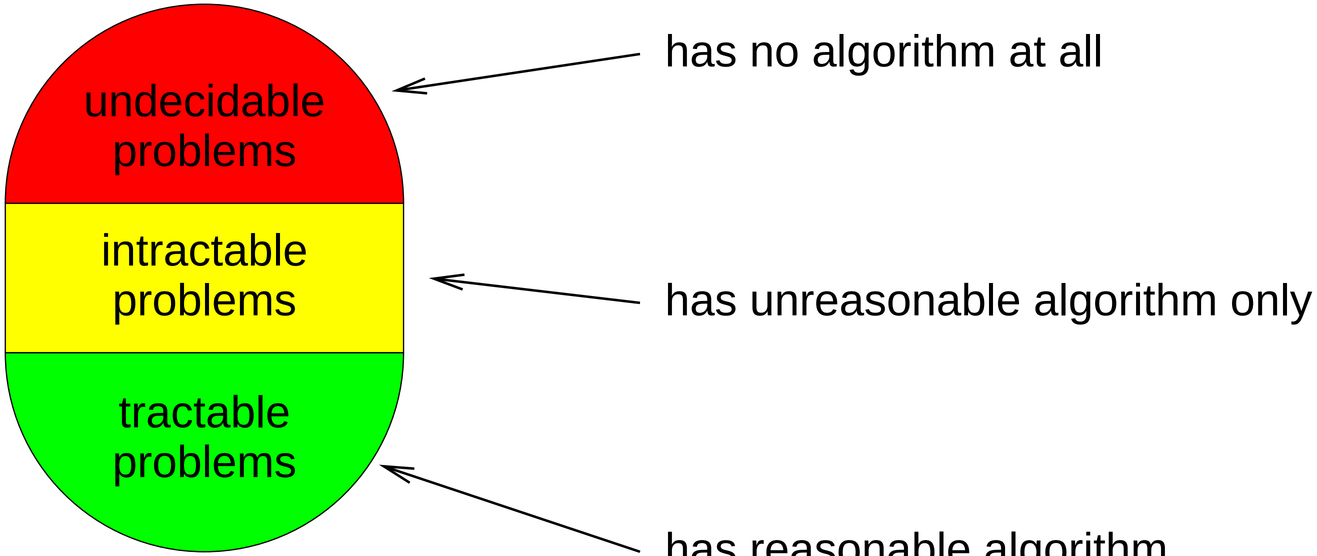
- no tilings of arbitrary size



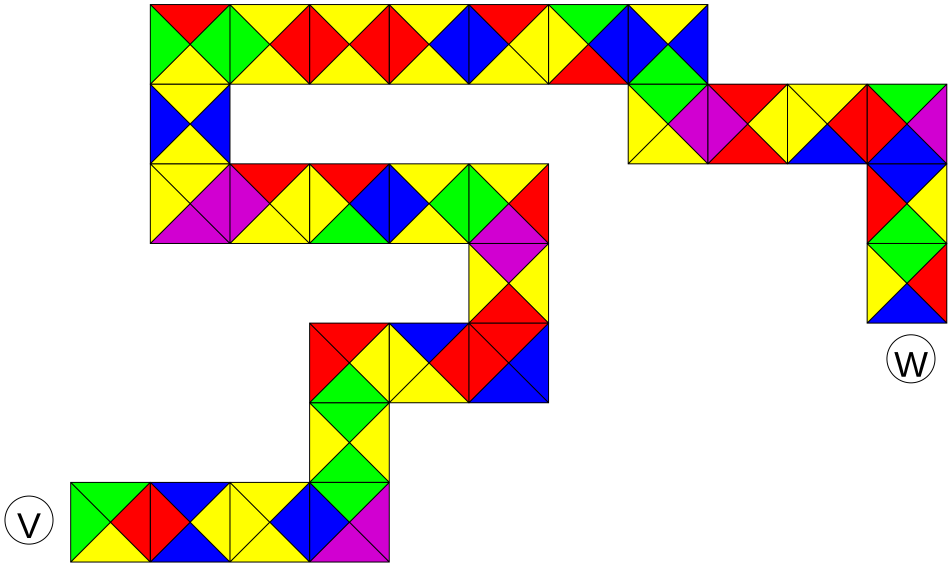
- orientation makes sense



- the sphere of algorithmic problems II



- a domino snake



  - decidable in the plane, undecidable for a half plane
  - in a half plane with specific start and end tile?
  - in a half plane with at least 5 tiles?
  - in a half plane with at most N tiles?

- word correspondence problem

	1	2	3	4	5
X	abb	a	bab	$baba$	aba
Y	$bbab$	aa	ab	aa	a

correspondence: 2, 1, 1, 4, 1, 5

	1	2	3	4	5
X	bb	a	bab	$baba$	aba
Y	bab	aa	ab	aa	a

admits no correspondence

- algorithms that sometimes/always terminate

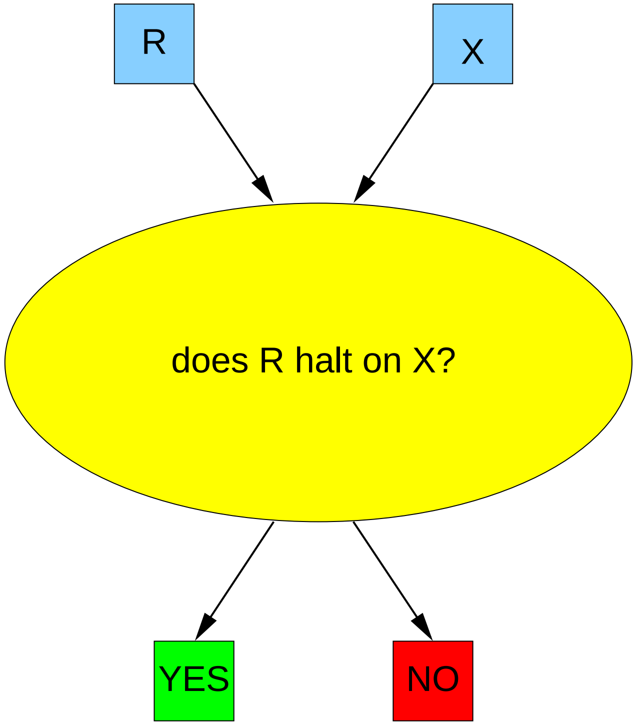
while $X \neq 1$ **do** $X := X - 2$

while $X \neq 1$ **do**
  if even(X**) then** $X := X/2$ **else** $X := 3 * X + 1$

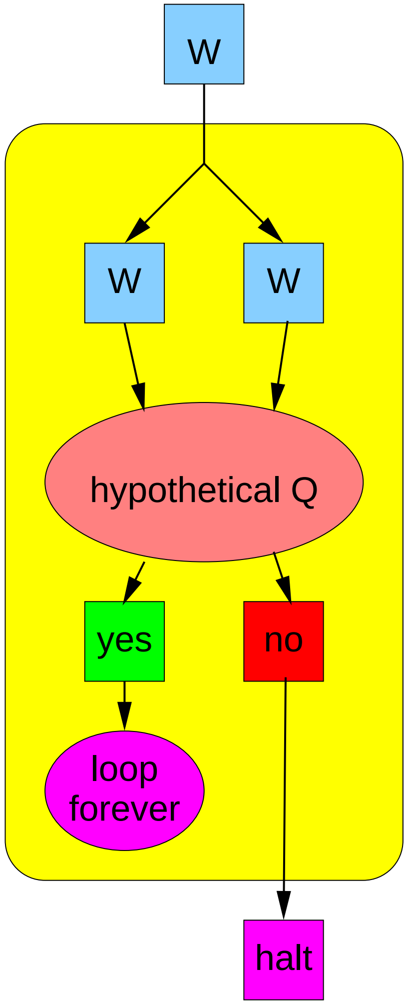
input	highest	iterations
256	256	8
101	304	25
55	9232	112
103	9232	87
383	13120	45
71209	3079780	174

$R(X)\downarrow$: algorithm R terminates for input X

$R(X)\uparrow$: algorithm R does not terminate for input X



- the program S



- construction of the program S

	1	2	3	4	5	6	7	8
1	yes	yes	no	yes	no	no	no	yes
2	yes	no	no	no	no	yes	no	no
3	no	yes	yes	yes	no	yes	yes	no
4	yes	no	yes	no	yes	yes	no	yes
5	no	no	yes	yes	no	yes	yes	no
6	no	yes	yes	no	no	no	yes	no
7	yes	yes	yes	no	yes	no	yes	no
8	no	no	yes	no	yes	yes	yes	no
$\vdots$								
S	no	yes	no	yes	yes	yes	no	yes

programs vertical, inputs horizontal

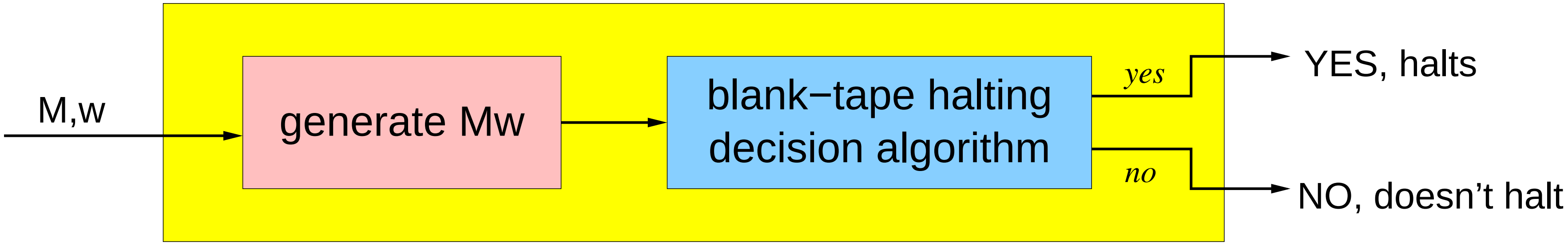
- the state-entry problem

Does TM M enter state q on input w?

M' has $\delta(q_i, a) = (q', a, R)$ if $\delta(q_i, a)$ is undefined for M

- the blank-tape halting problem

Does TM M halt if started on a blank tape?



- ambiguity

Is CFG grammar G ambiguous?

for PCP $A = (w_1, \ldots, w_n)$ and $B = (v_1, \ldots, v_n)$ construct

$S \to S_A \mid S_B$

$S_A \to w_i S_A a_i \mid w_i a_i$

$S_B \to v_i S_B a_i \mid v_i a_i$

if G is ambigious then $w_{i_1} \ldots w_{i_k} = v_{i_1} \ldots v_{i_k}$

- non-empty intersection problem

For grammars G_1 and G_2, do we have $\mathcal{L}(G_1) \cap \mathcal{L}(G_2) = \emptyset$?

- the sphere of algorithmic problems III