

Task

You are given sequence of unique English lowercase words, all of which have to be used for generation of a crossword. By using an evolutionary algorithm (EA), you have to generate a crossword following several rules from the next section. You are allowed to use any type of EA, however, you are obliged to use both crossover and mutation for evolving crosswords.

Crossword Rules

1. Grid 20*20 has to be used
2. Words may contain only lowercase English words of length $N \in [2;20]$. In inputs we guarantee this
3. Words can be placed horizontally (left to right) or vertically (top down)
4. All words have to fit the row or column depending on orientation and words can't be cut
5. Each word has to be crossed by at least one another perpendicular word
6. Any pair of same orientation words cannot be intersecting
7. Parallel horizontal/vertical words' symbols shouldn't be existing for neighbour rows/columns. Exception is first (last) symbol of the first word and last (first) symbol of the second word, also being parts of the third perpendicular word (see Table 1). The idea is not to create new words
8. No word or set of words can be separated from other words (the graph of all letters has to be connected)

Invalid							Valid																																																																																																								
<table><tr><td></td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>...</td></tr><tr><td>0</td><td></td><td></td><td>z</td><td></td><td></td><td></td></tr><tr><td>1</td><td></td><td></td><td>o</td><td>f</td><td></td><td></td></tr><tr><td>2</td><td></td><td>g</td><td>o</td><td>a</td><td>l</td><td></td></tr><tr><td>3</td><td></td><td></td><td></td><td>t</td><td></td><td></td></tr><tr><td>4</td><td></td><td></td><td></td><td>e</td><td></td><td></td></tr><tr><td>...</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>								0	1	2	3	4	...	0			z				1			o	f			2		g	o	a	l		3				t			4				e			...							<table><tr><td></td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>...</td></tr><tr><td>0</td><td></td><td></td><td>z</td><td></td><td></td><td></td></tr><tr><td>1</td><td></td><td></td><td>o</td><td></td><td></td><td></td></tr><tr><td>2</td><td></td><td>g</td><td>o</td><td>a</td><td>l</td><td></td></tr><tr><td>3</td><td></td><td></td><td></td><td>p</td><td></td><td></td></tr><tr><td>4</td><td></td><td></td><td></td><td>e</td><td></td><td></td></tr><tr><td>...</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>								0	1	2	3	4	...	0			z				1			o				2		g	o	a	l		3				p			4				e			...						
	0	1	2	3	4	...																																																																																																									
0			z																																																																																																												
1			o	f																																																																																																											
2		g	o	a	l																																																																																																										
3				t																																																																																																											
4				e																																																																																																											
...																																																																																																															
	0	1	2	3	4	...																																																																																																									
0			z																																																																																																												
1			o																																																																																																												
2		g	o	a	l																																																																																																										
3				p																																																																																																											
4				e																																																																																																											
...																																																																																																															
<table><tr><td></td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>...</td></tr><tr><td>0</td><td>f</td><td>z</td><td></td><td></td><td></td><td></td></tr><tr><td>1</td><td>o</td><td>o</td><td></td><td></td><td></td><td>d</td></tr><tr><td>2</td><td>g</td><td>o</td><td>a</td><td>l</td><td></td><td>a</td></tr><tr><td>3</td><td></td><td></td><td></td><td>b</td><td>a</td><td>y</td></tr><tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>								0	1	2	3	4	...	0	f	z					1	o	o				d	2	g	o	a	l		a	3				b	a	y	4							<table><tr><td></td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>...</td></tr><tr><td>0</td><td></td><td></td><td>z</td><td></td><td>o</td><td></td></tr><tr><td>1</td><td></td><td></td><td>o</td><td></td><td>w</td><td></td></tr><tr><td>2</td><td></td><td>g</td><td>o</td><td>a</td><td>l</td><td></td></tr><tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>								0	1	2	3	4	...	0			z		o		1			o		w		2		g	o	a	l		3							4																				
	0	1	2	3	4	...																																																																																																									
0	f	z																																																																																																													
1	o	o				d																																																																																																									
2	g	o	a	l		a																																																																																																									
3				b	a	y																																																																																																									
4																																																																																																															
	0	1	2	3	4	...																																																																																																									
0			z		o																																																																																																										
1			o		w																																																																																																										
2		g	o	a	l																																																																																																										
3																																																																																																															
4																																																																																																															

Example

input1.txt	output1.txt
cage	6 6 0
cemetery	4 7 0
chemistry	2 12 1
engine	4 8 1
fairytale	3 4 1
gate	1 10 1
pillow	10 1 0
train	8 4 0
widow wine	9 2 1
	10 6 1

Graphical representation:

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0																				
1											g									
2											a		c							
3					f						t		h							
4					a			c	e	m	e	t	e	r	y					
5					i				n				m							
6					r		c	a	g	e			i							
7					y				i				s							
8					t	r	a	i	n				t							
9			w		a				e				r							
10		p	i	l	l	o	w						y							
11			d		e		i													
12			o				n													
13			w				e													
14																				
15																				
16																				
17																				
18																				
19																				
