A 9. 1-dim. CA , $k=4, r=1$

- $Z = k^L = k^{k^n} = k^{k^{(2*r+1)}} = 4^{4^3} = 2^{128}$
- print 100 rules per second.

$\Rightarrow \frac{2^{128}}{100}$ s. = 107,902,830,708,060,141,889,705,291,549 years of 365 days.

A 10. Not all totalistic rules are legal, for example, if the state (0,0,0) has an output 1, definitely it is not having a silent state, so it is not legal either, but still could be a totalistic rule.

e.g. $k=2, r=1$, 1-dim

(t) →	(t+1)
0 0 0	1
0 0 1	a
0 1 0	a
0 1 1	b
1 0 0	a
1 0 1	b
1 1 0	b
1 1 1	c

totalistic, no silent state

(a, b, c can be 0 or 1)

A. 11. For Android "1-D Cell Automaton" is a simple and nice app and can be found in the next website: play.google.com , looking the name of the app.

A. 12. 1-dim. CA : d=1, k=2, r=1, totalistic rule 150_0 = 1 0 0 1 0 1 1 0

SUM(t)	3	2	1	0
$a_i(t+1)$	1	0	1	0

- repetitive formula

e.g. cell C2 has a formula = IF(SUM(B1:D1)=3, 1, IF(SUM(B1:D1)=2, 0, IF(SUM(B1:D1)=1, 1, 0)))

We sent the spreadsheet file to Ms. Rybalka.

A.13. formulas Z of possible rules, for 1-Dim. C.A. w.r.t. r, k.

a) all possible rules $Z = k^{k^{(2\cdot r+1)}} = k\hat{}(k\hat{}(2\cdot r+1))$

b) rules that are peripheral $Z_p = k\hat{}(k\hat{}(2\cdot r))$

(ignores the state of the cell itself)

c) rules that are totalistic $Z_t = k\hat{}((2\cdot r+1)\cdot(k-1)+1)$

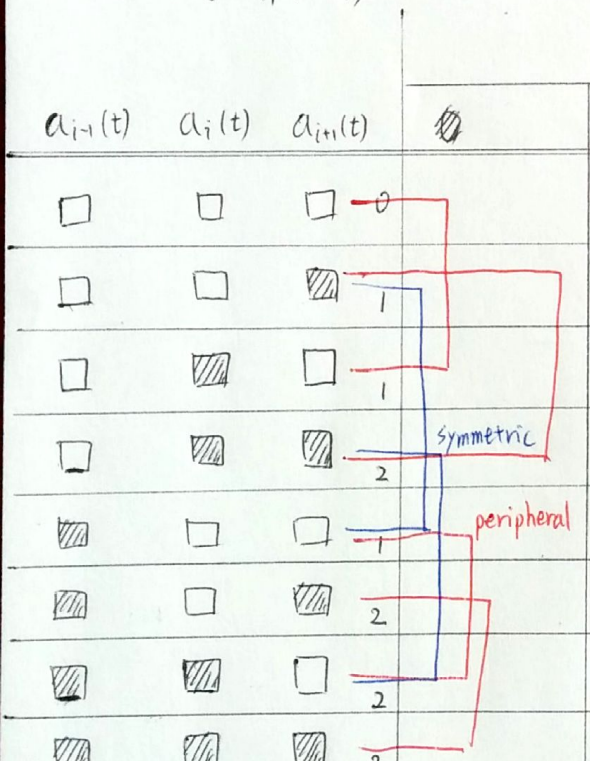
(when, the states are consist of integers and include '0')

the number of the possible sums of cells are

$= (2\cdot r+1)\cdot(k-1)+1$

d) rules that are totalistic and peripheral $Z_{tp} = k\hat{}(2\cdot r\cdot(k-1)+1)$

A.14. $d=1, r=1, k=2$. C.A



$a_{i-1}(t)$	$a_i(t)$	$a_{i+1}(t)$		$a_i(t+1)$							
				0_D	17_D	42_D	51_D	170_D	165_D	204_D	243_D
			0								
			1								
			1								
			2								
			1								
			2								
			2								
			3								
legal				○	×	×	×	×	×	○	×
symmetric				○	×	×	○	×	○	○	×
totalistic				○	×	×	×	×	×	×	×
peripheral				○	×	×	×	×	○	×	×

A.15. 4 behaviours of CAs.

- with CA, we can observe the change of the states of cells based on a rule as time passes. Different rules make different result. (showing different behaviour)

- Class I. monotonous
  states of the cells are monotonous.

- Class II. predictable
  pattern of states is predictable.

- Class III. unpredictable
  pattern of states is unpredictable.

- Class IV. Half-predictable.
  repetitive or stable ~~patterns~~ states, but cells interact with each other in complex way.