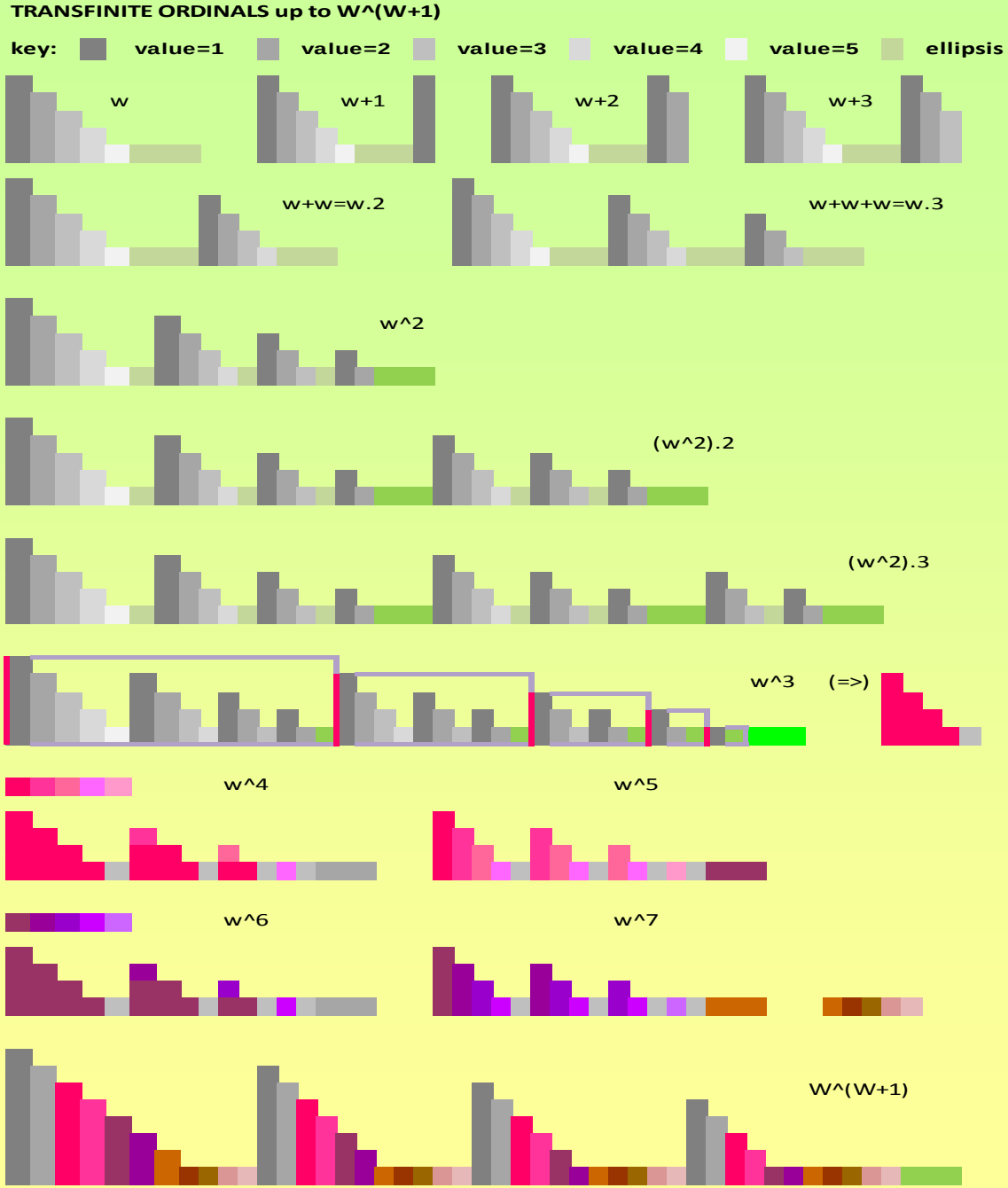
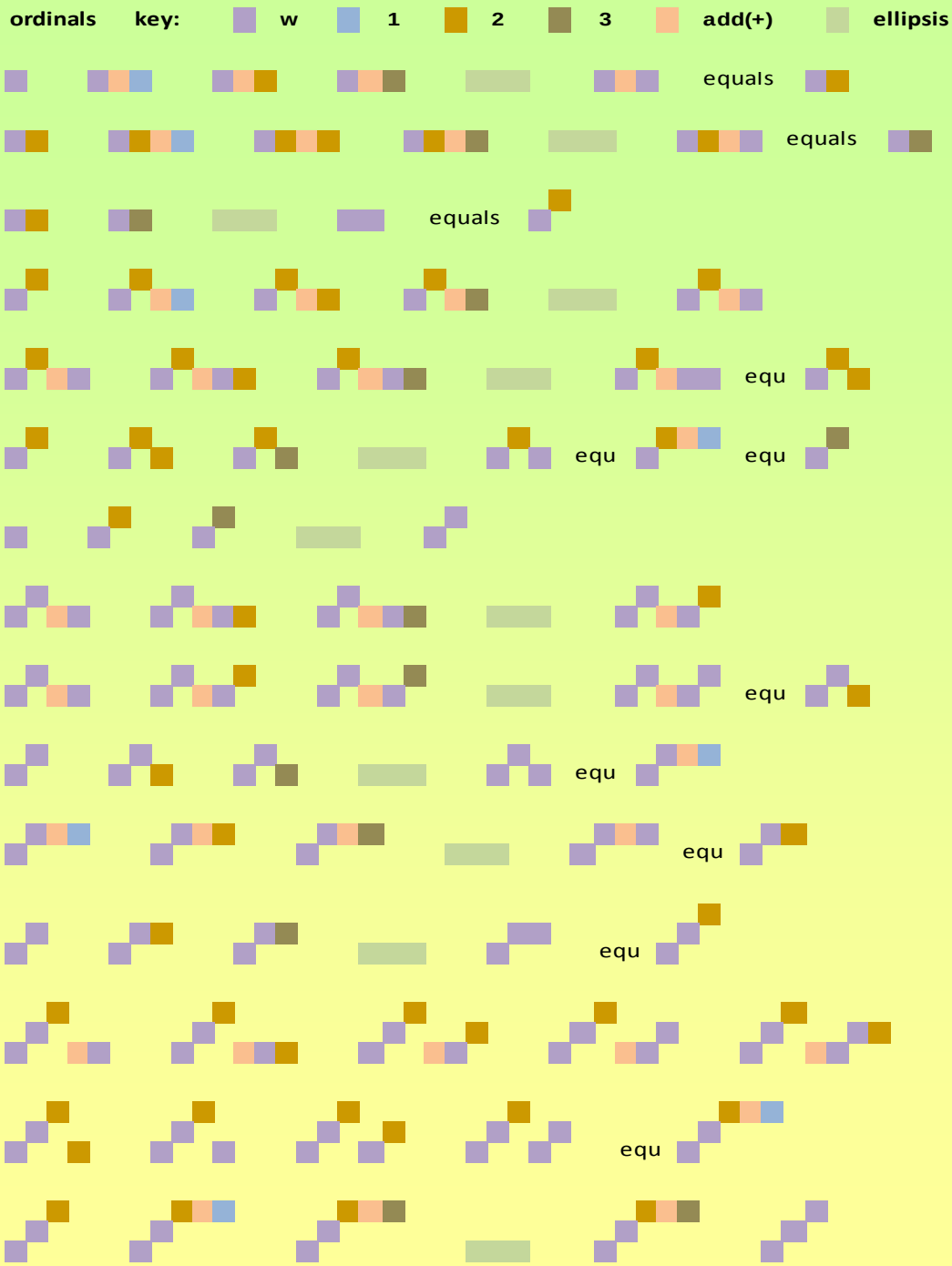
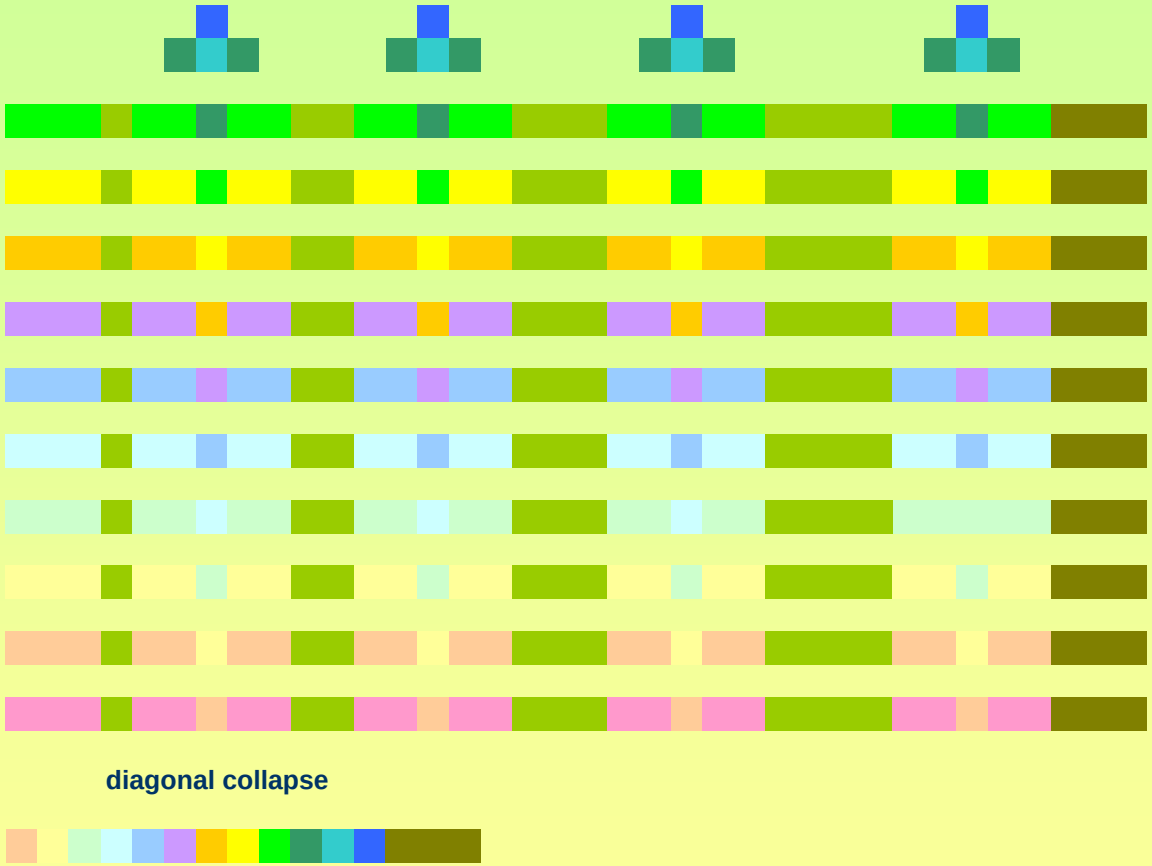
Patterns from Hyperoperations

by Alister Wilson

a^a, ${}^a a$, ${}_a a$, and a_a


TRANSFINITE ORDINALS up to W^(W+1)
key:
value=1
value=2
value=3
value=4
value=5
ellipsis
w
w+1
w+2
w+3
w+w=w.2
w+w+w=w.3
w^2
(w^2).2
(w^2).3
w^3
(=>)
w^4
w^5
w^6
w^7
W^(W+1)

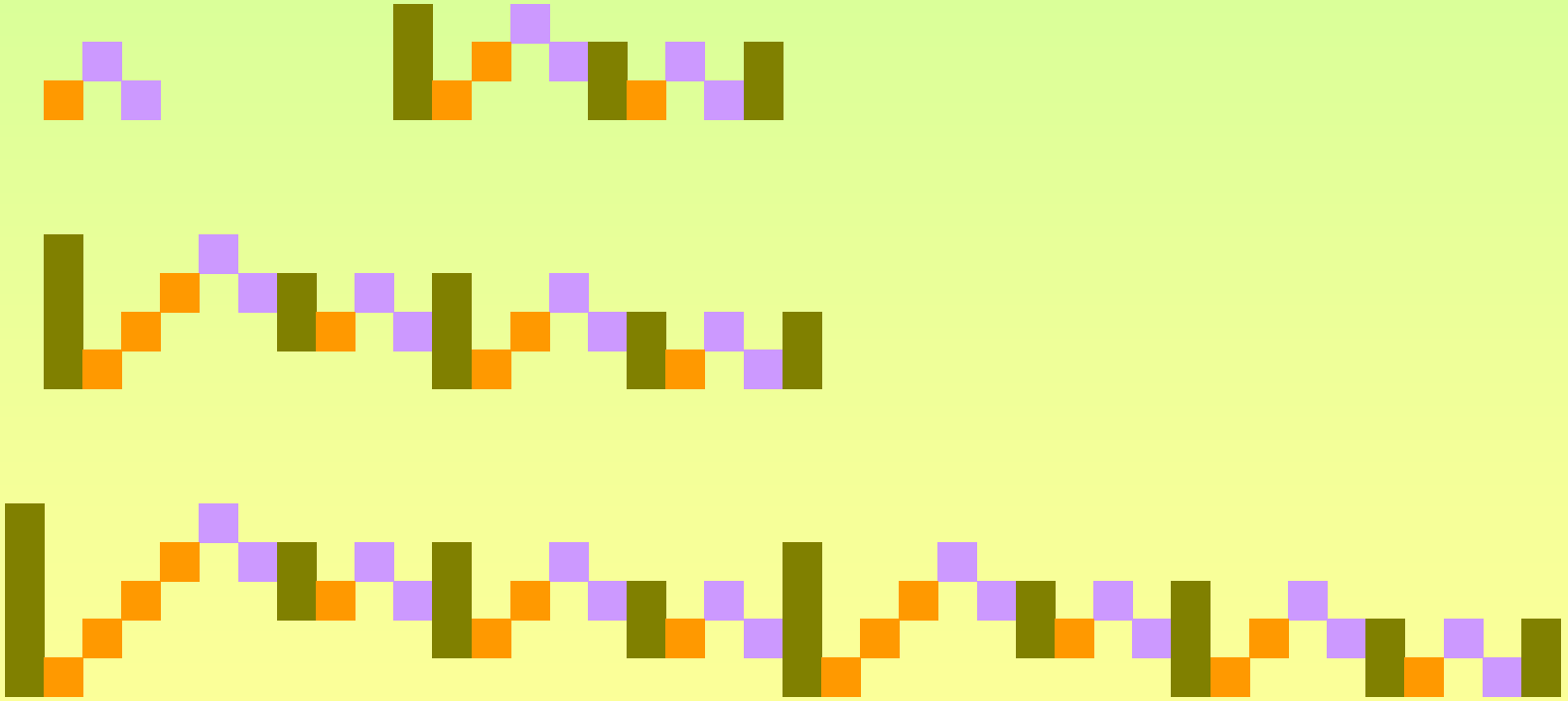

ordinals
key:
w
1
2
3
add(+)
ellipsis
equals
equals
equals
equ
equ
equ
equ
equ
equ
equ


diagonal collapse

value=2 value=n parentheses

f_1(n)

f_2(n)



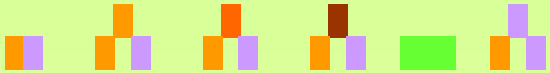
looks pretty reveals patterns also can reflect on maths issues

gh0, gh1, and gh2 function fn = (2^n)*n up towards gh3

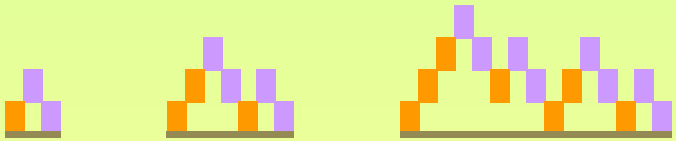
key: value=1 value=2 value=3 value=4 value=n ellipsis

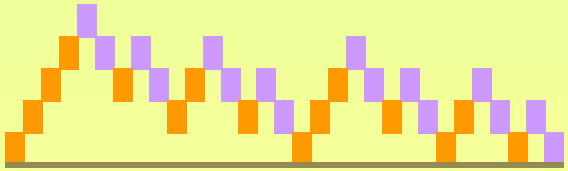
f_0(n) = n+1

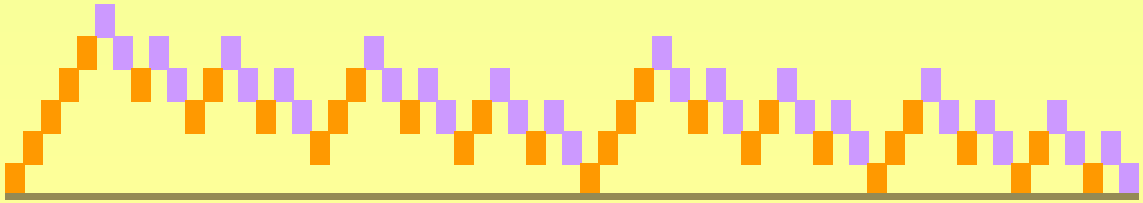
f_1(n) = 2n



f_2(n) = (2^n)*n





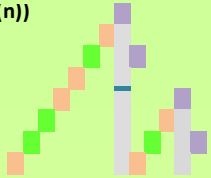


h(2,3)(n) = 2./.2 } n app(n)

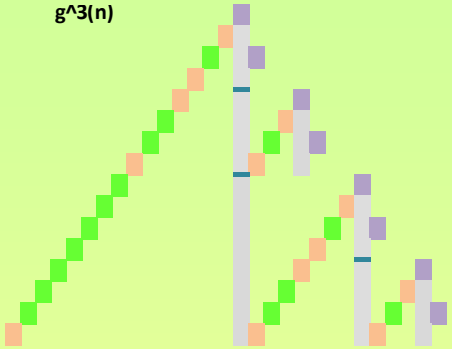
key: two n ellipsis parentheses

g(n)=h(2,3)(n)

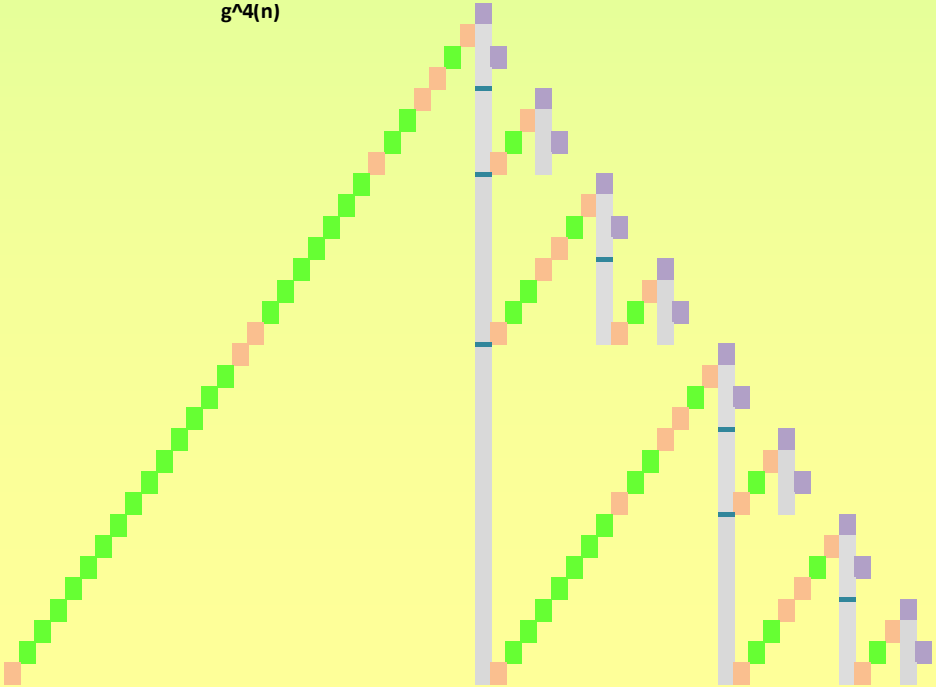
g(g(n))



g^3(n)



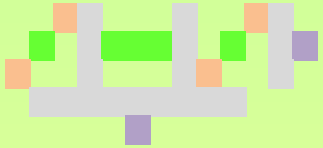
g^4(n)



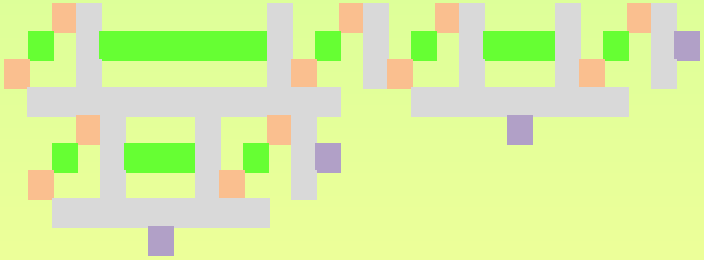
g(n)=h(2,4)(n) and iterates

key: **parentheses** 2 **n** **ellipsis** **parentheses**

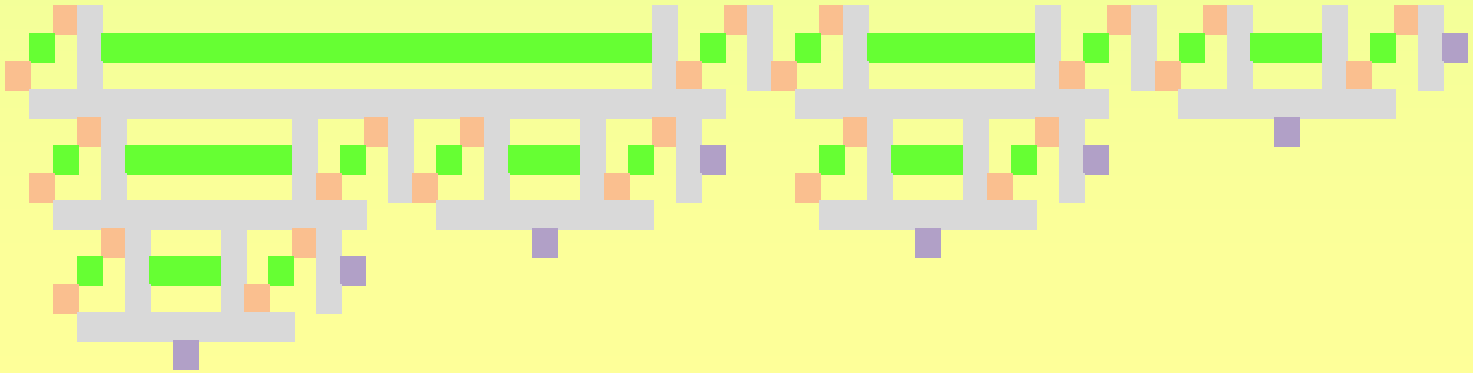
g(n)=h(2,4)(n)



g(g(n))



g(g(g(n)))

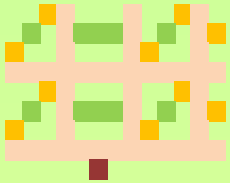


g(n)=h(2,5)(n) and an iteration

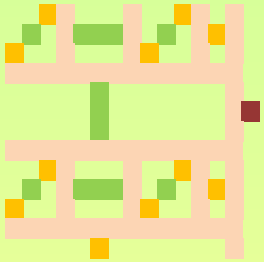
key: 2 n ellipses parentheses

2^^^n

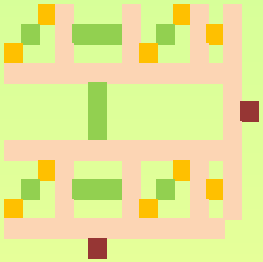
2^^^(2^^^n)



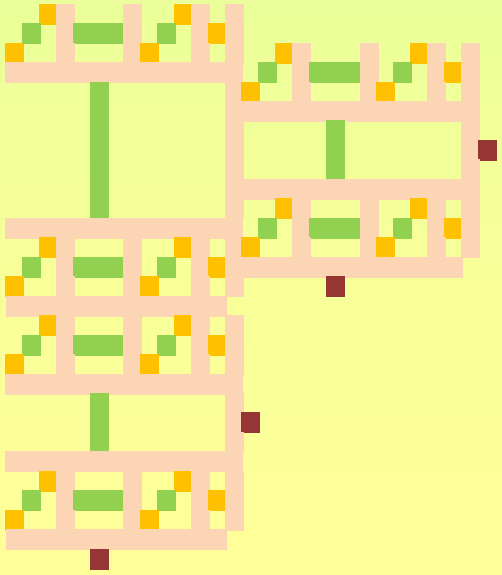
2^^^^n



g(n)=h(2,5)(n)=(2^^^^n)app(n)



g(g(n))



TD THEN TD

A (3^(3^3)) ^ ((3^(3^3)) ^ (3^(3^3)))

TD THEN BU

B ((3^(3^3)) ^ (3^(3^3))) ^ (3^(3^3))

BU THEN TD

C ((3^3)^3) ^ (((3^3)^3) ^ ((3^3)^3))

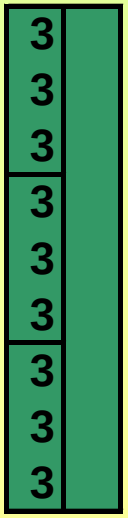
BU THEN BU

D (((3^3)^3) ^ ((3^3)^3)) ^ ((3^3)^3)

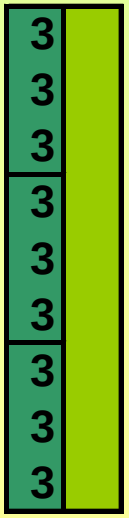
>=3 BU unit

>=3 TD unit

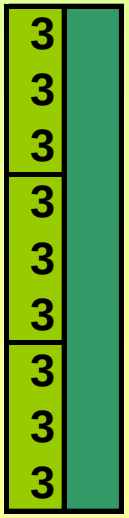
A



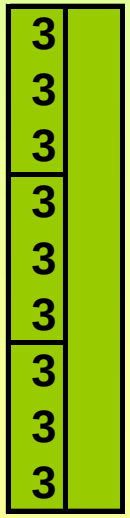
B



C



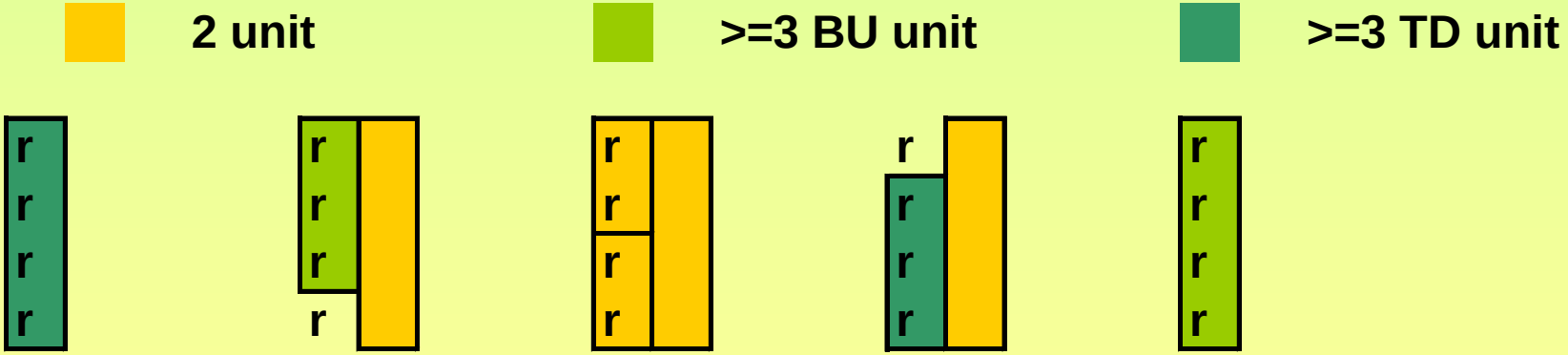
D



Catalan numbers

x(x(xx)) | x((xx) x) | (xx)(xx) | (x(xx)) x | ((xx) x) x

5 binary bracketings on 4 elements



Catalan Space Invaders

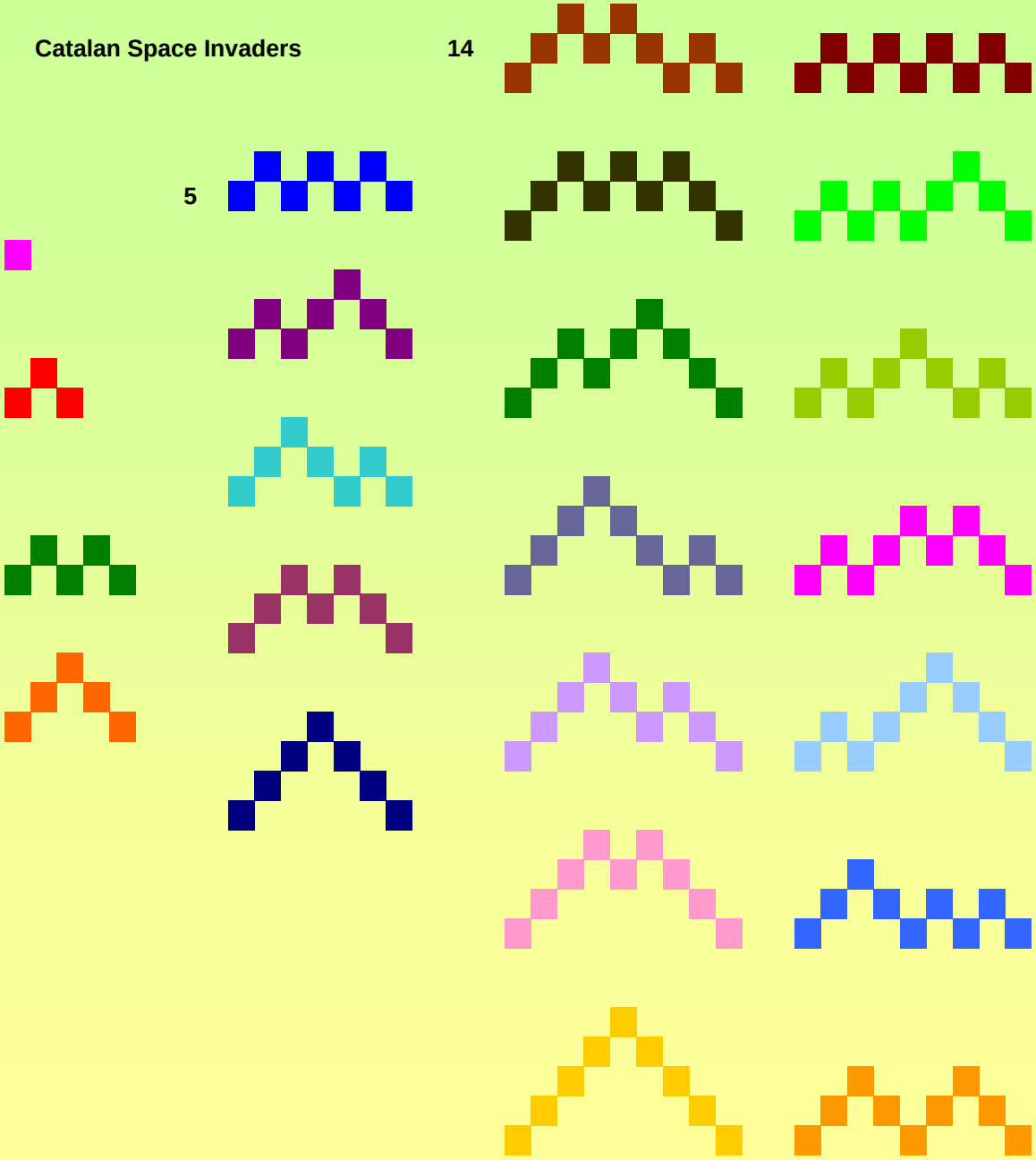
1

1

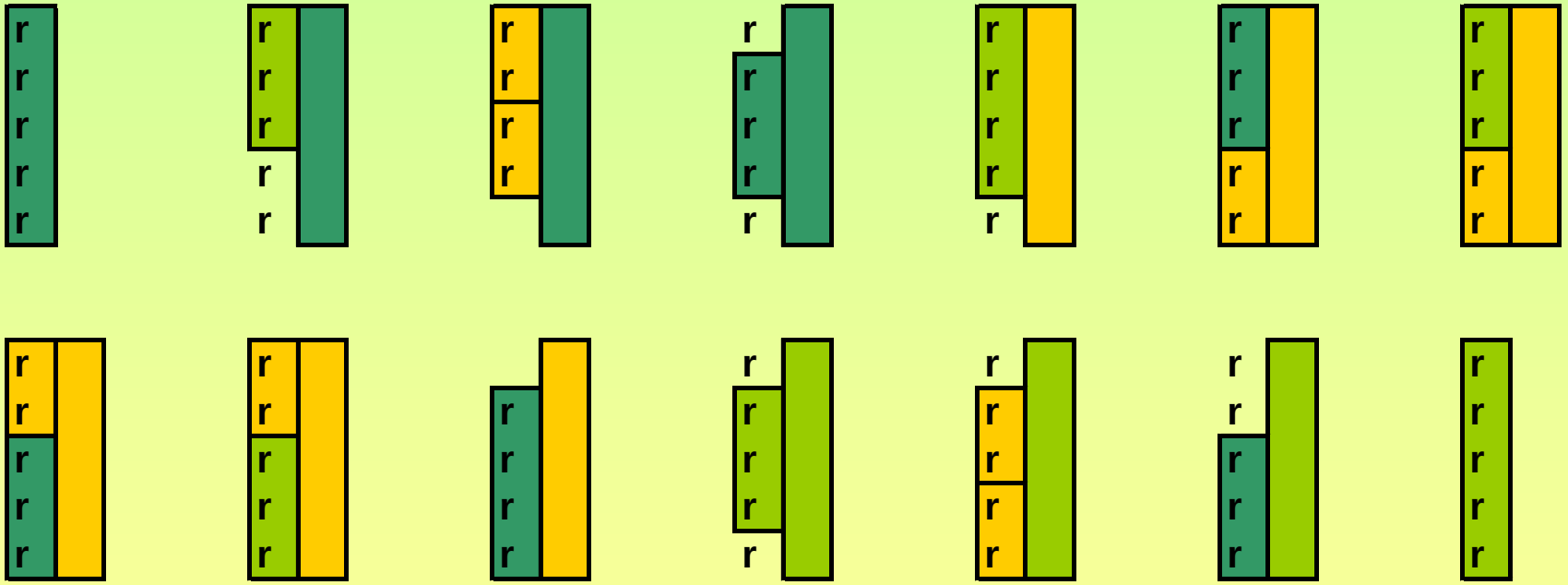
2

5

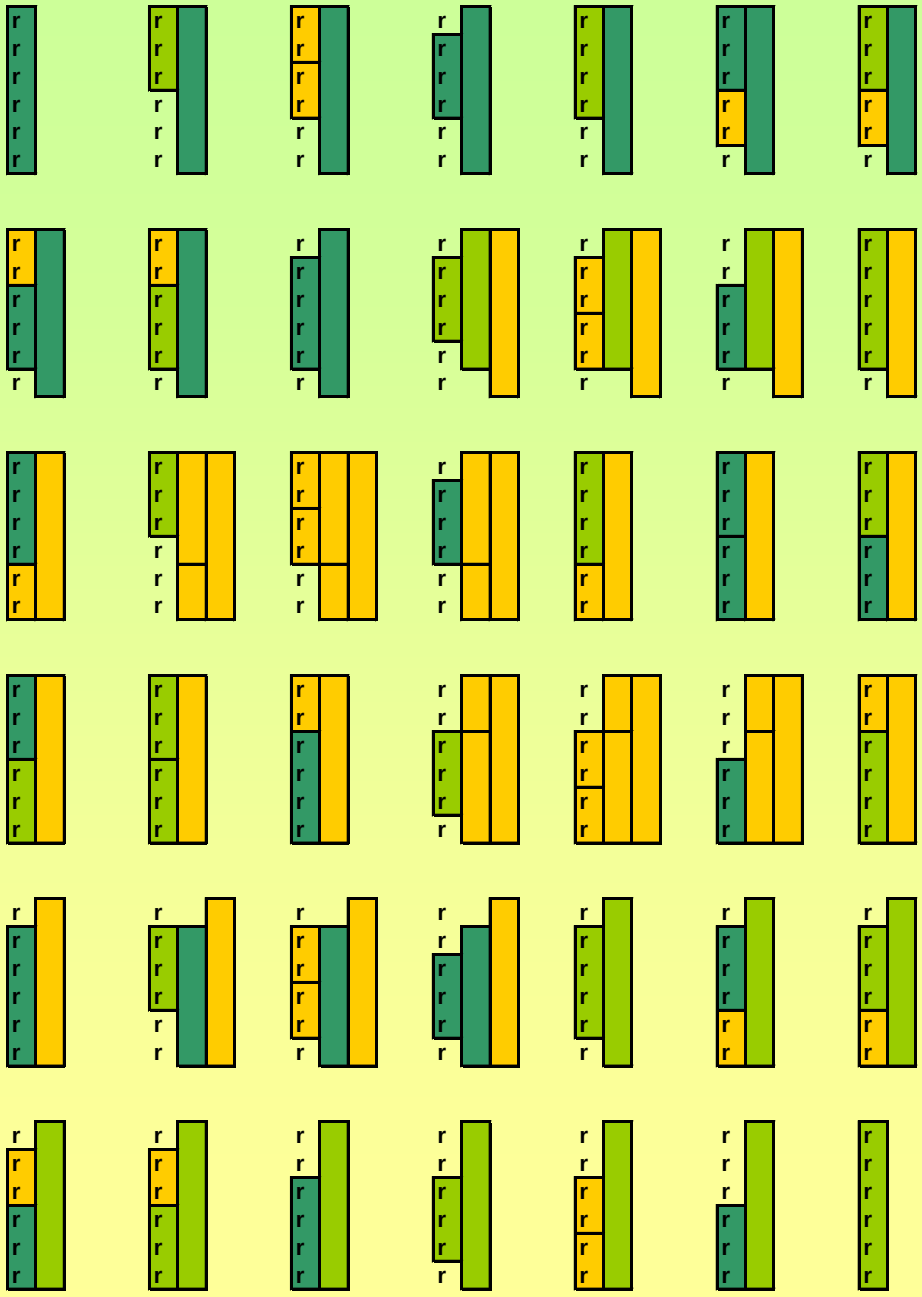
14

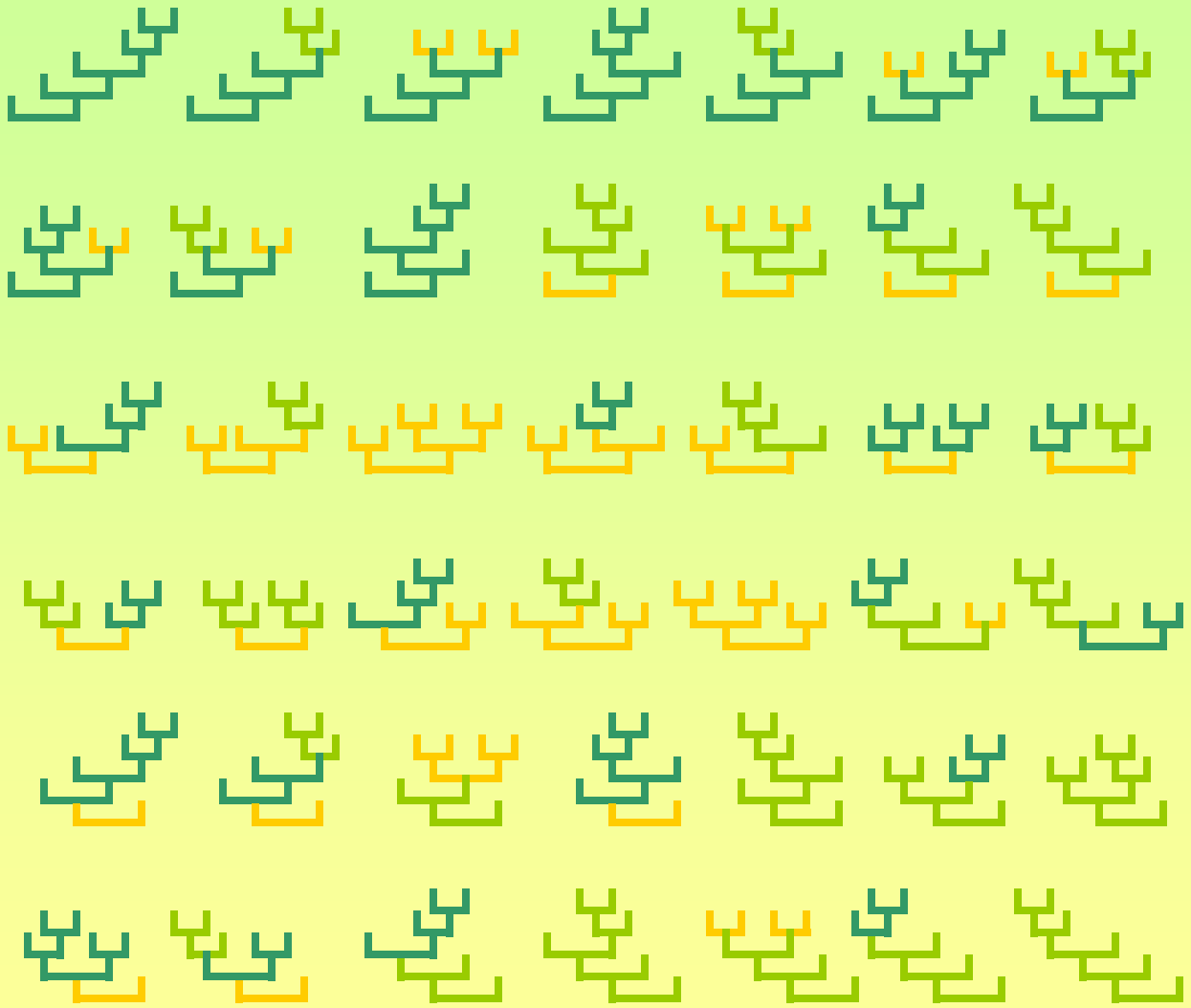


14 binary bracketings on 5 elements



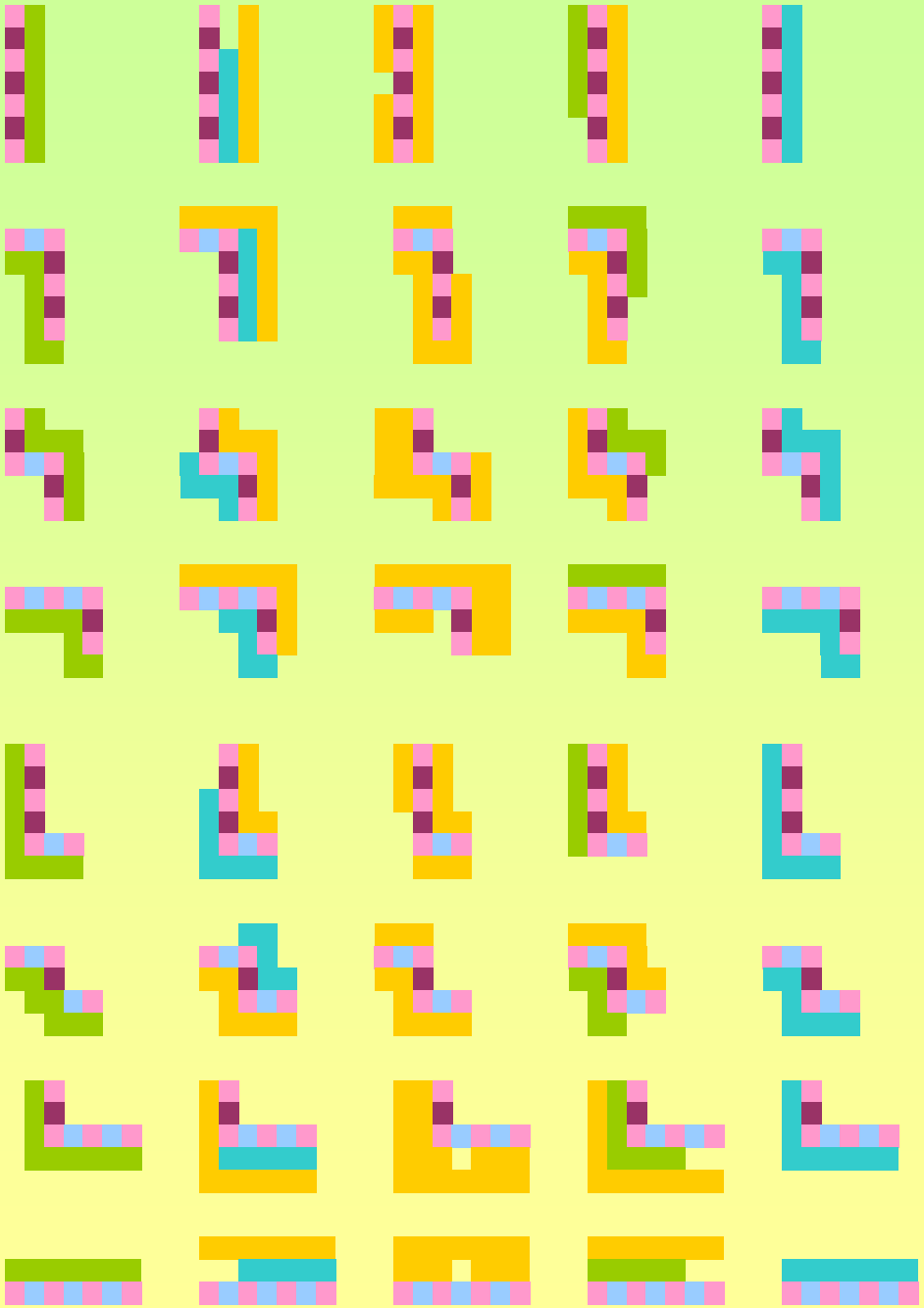
42 binary bracketings on 6 elements



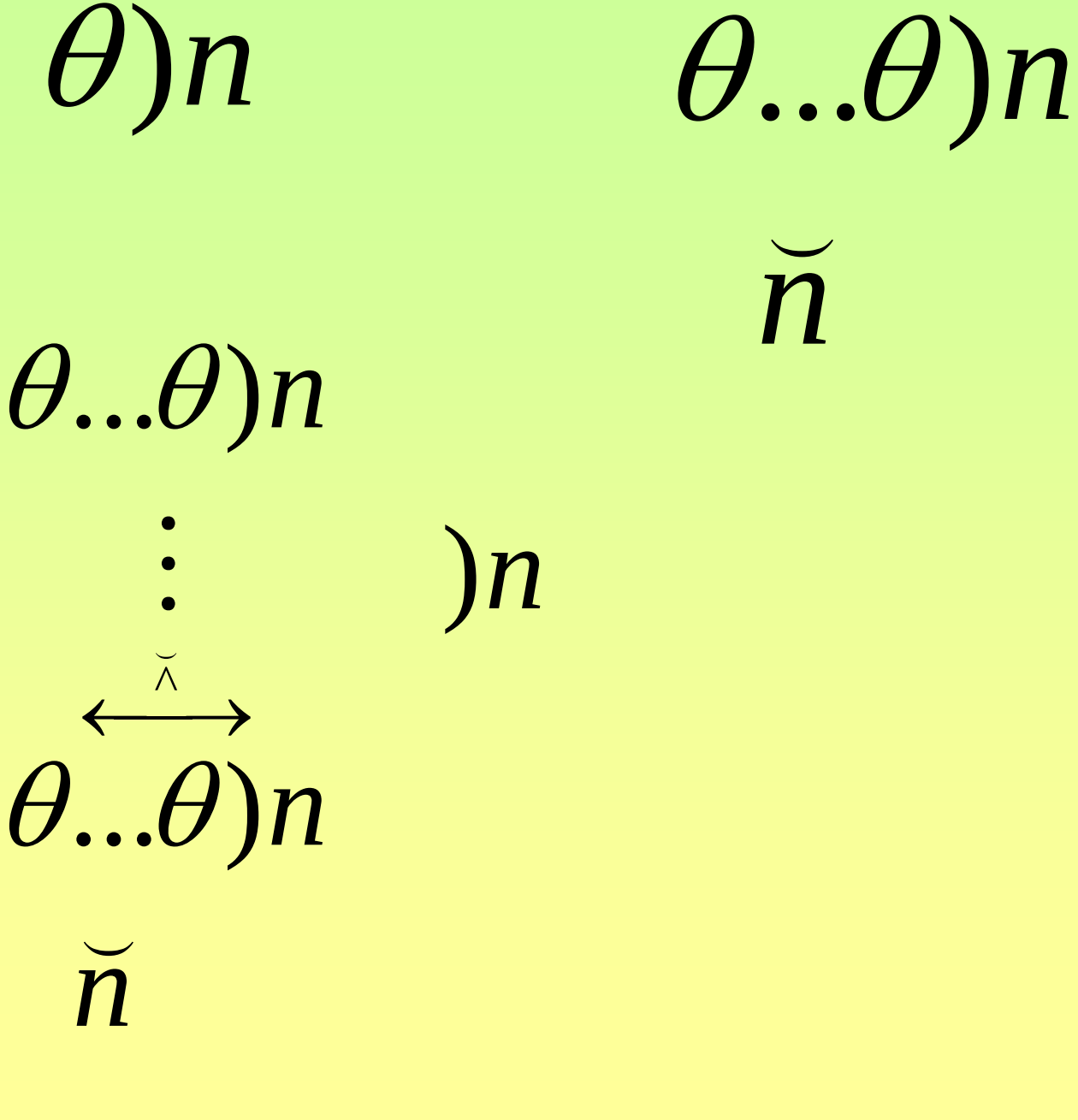


((xx) x) x | (x(xx)) x | (xx)(xx) | x((xx) x) | x(x(xx))
5 binary bracketings on 4 elements

number
bu
exp
td
tet
join

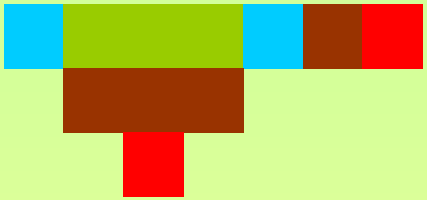



1st number
2nd number
3rd number
parenthesis not included
parenthesis included

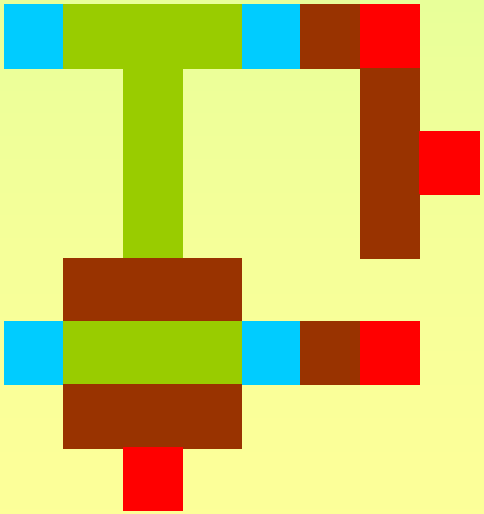

θ)n
θ...θ)n
n
θ...θ)n
)n
θ...θ)n
n

NOPT4

NOPT5



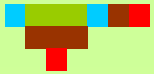
NOPT6



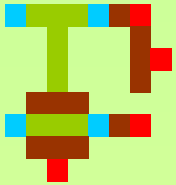
NOPT STRUCTURES IN ABSTRACT COLORED FORM

NOPT4

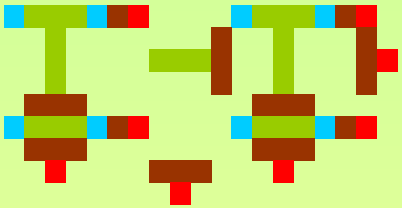
NOPT5



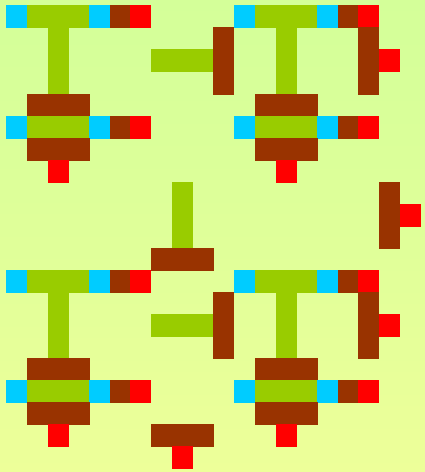
NOPT6



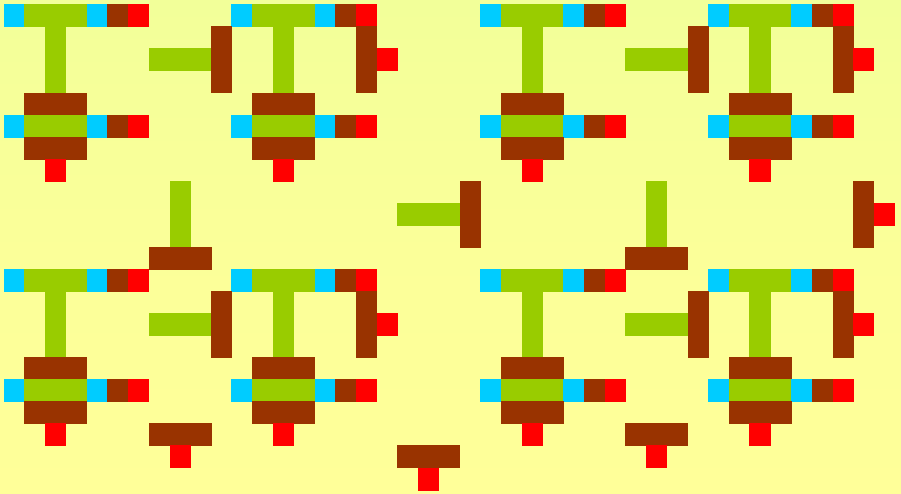
NOPT7



NOPT8

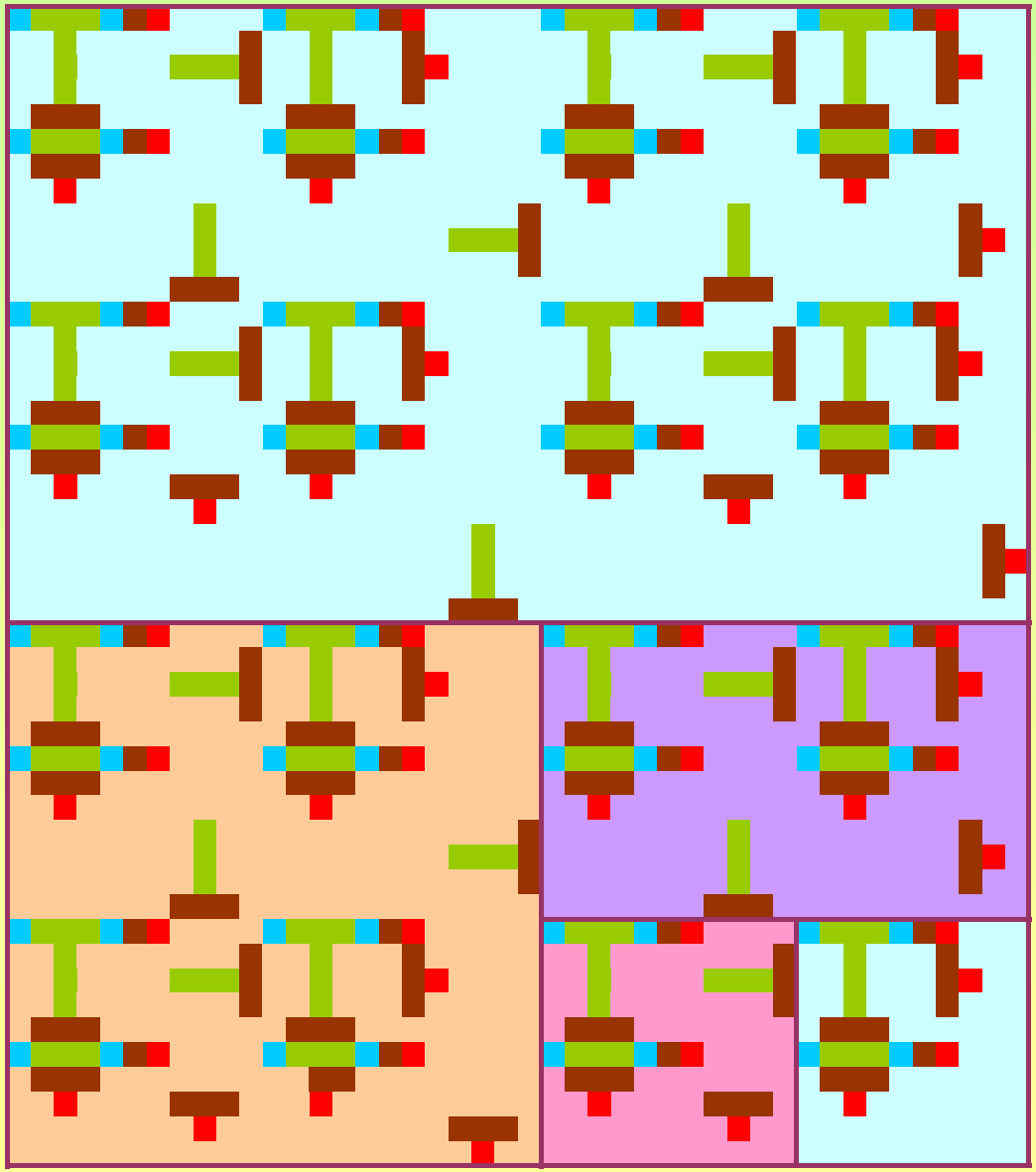


NOPT9



NOPT10 structure with doubling fractal indicating {HYPEROPS = 6,7,8,9,10}

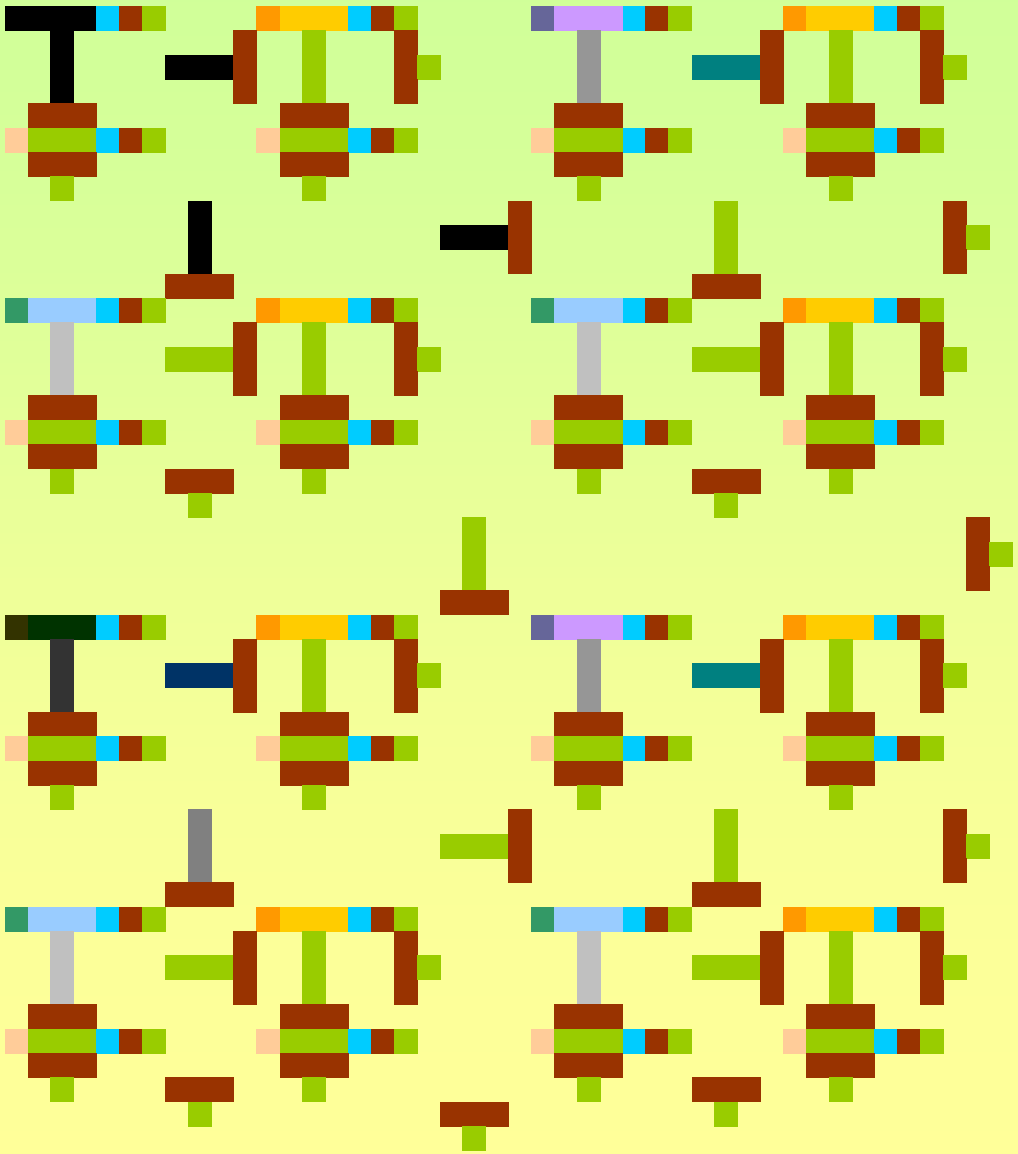
NOPT10



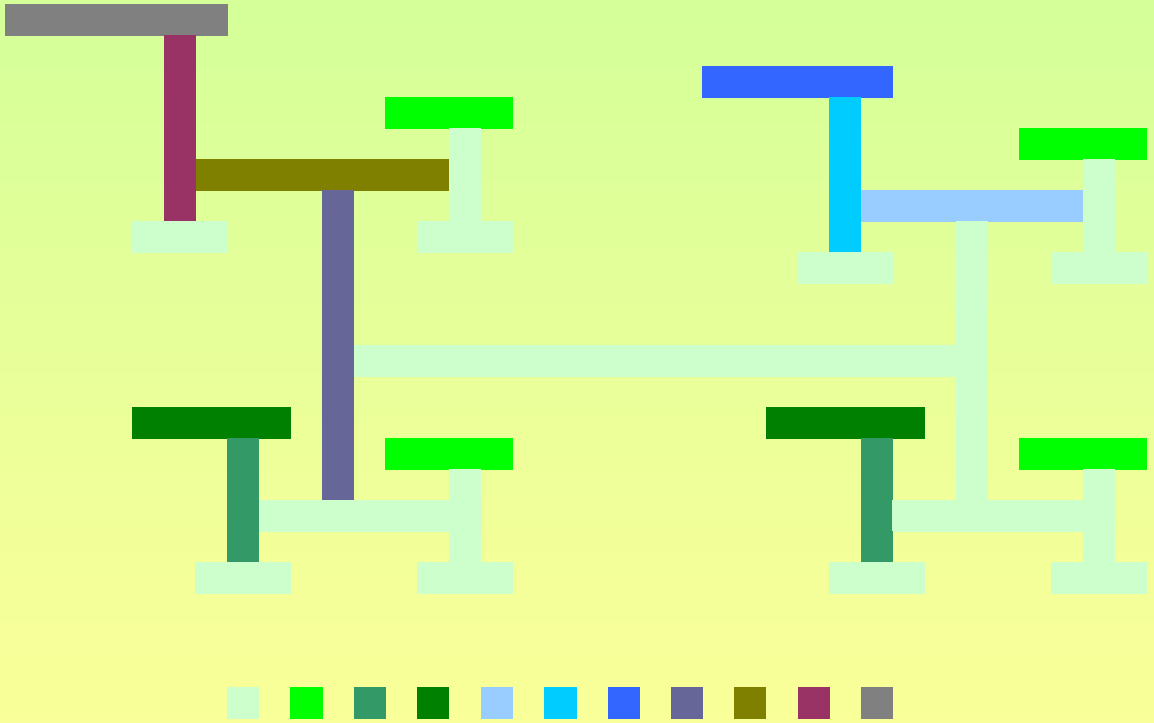
NOPT STRUCTURE IN ABSTRACT COLORED FORM

NOPT10 **KEY:** **PARENTHESIS**

Using colors to order the increases in magnitude:



WONKY H-FRACTAL



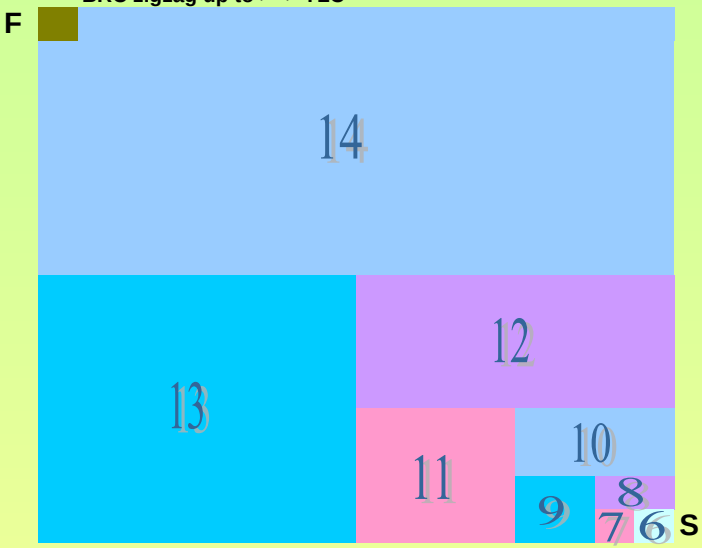
NOPT_9 structure doubling fractal

BRC zigzag up to >--> TLC

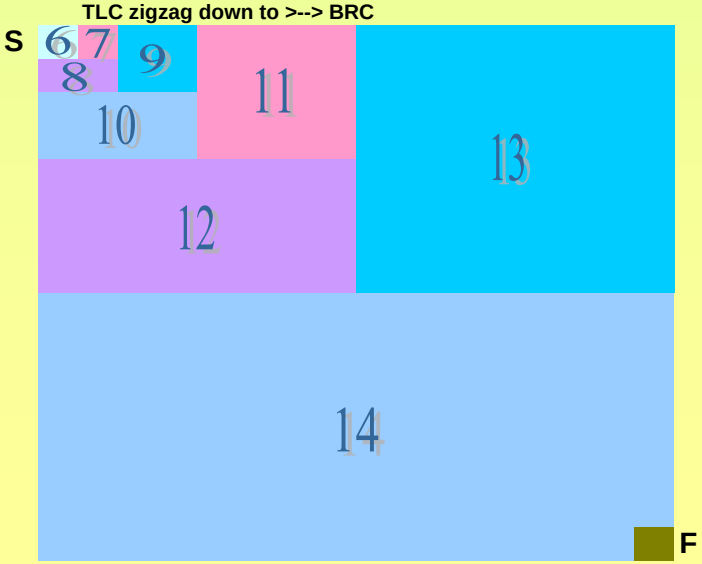
TLC zigzag down to >--> BRC

NOPT_14 structure doubling fractal

BRC zigzag up to >--> TLC

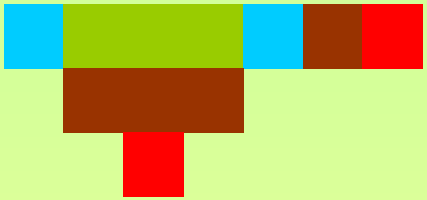


TLC zigzag down to >--> BRC



NOPT4

NOPT5



NOPT6