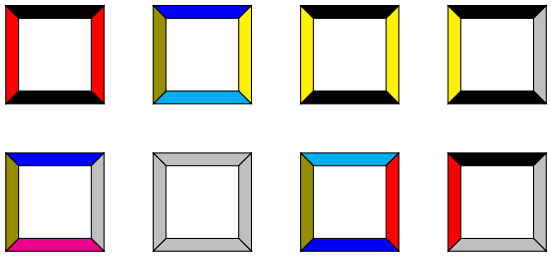
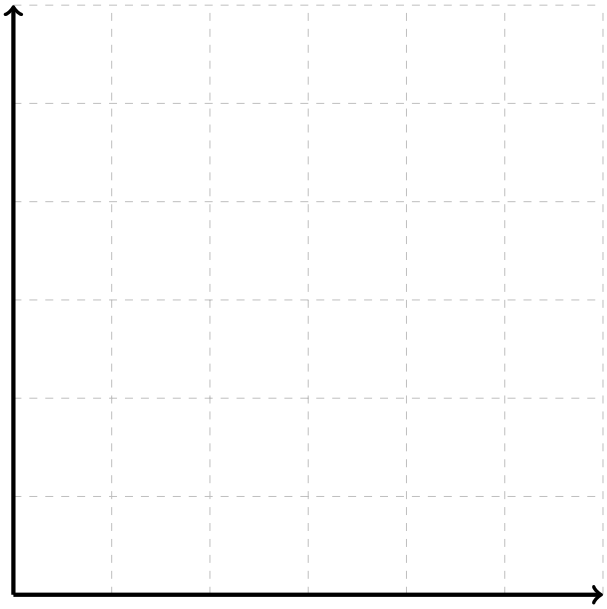
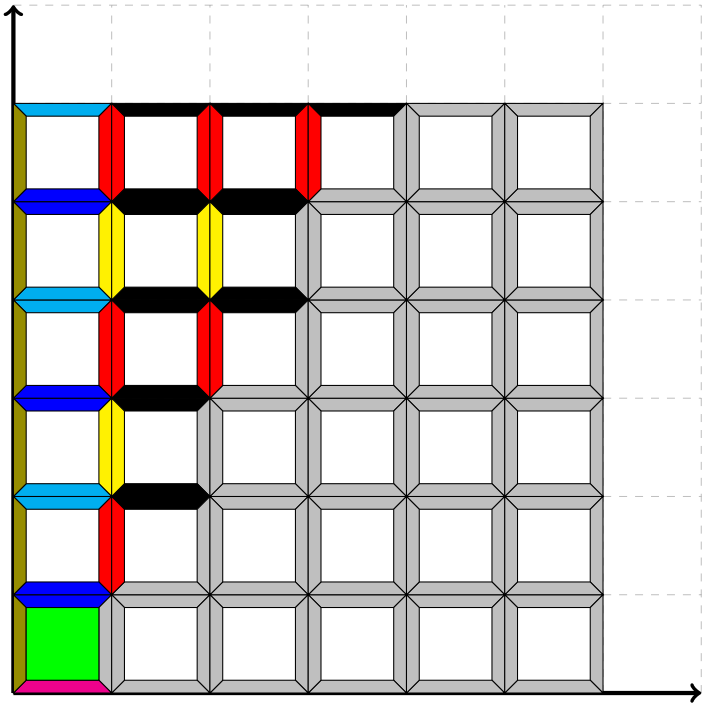
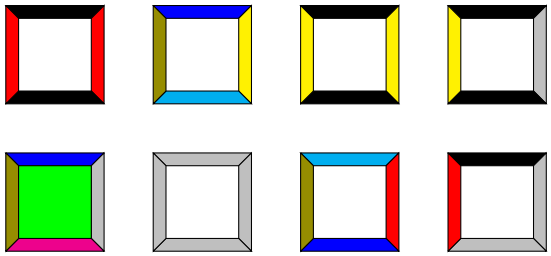
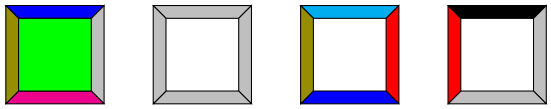








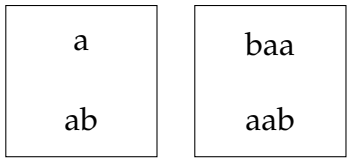


ab *ba*	*aaabbb* *abb*	*aab* *baab*	*ba* *baa*	*abab* *ababaa*	*aa* *a*

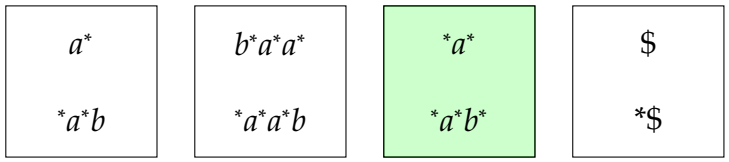
abab *ababaa*	*aaabbb* *abb*	*aab* *baab*	*ba* *baa*	*ab* *ba*	*ab* *ba*	*aa* *a*

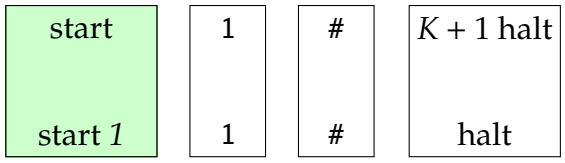
abab ababaa	aaabbb bb	aab baab	ba baa	ab ba	ab ba	aa a

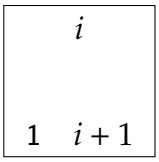
abab ababaa	aaabbb bb	aab baab	ba baa	ab ba	ab ba	aa a

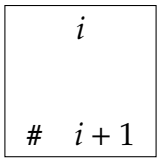


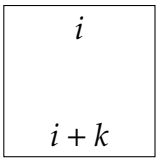
then $f(I)$ would be the *PCP* instance

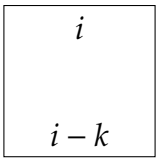


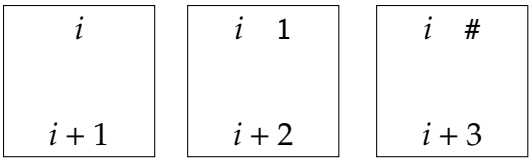

start
start 1
1
1
#
#
K + 1 halt
halt

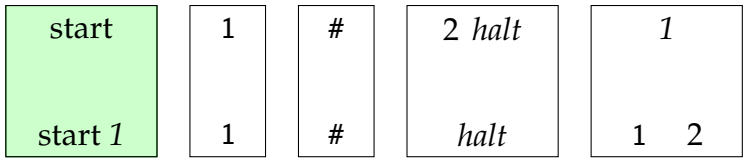

i
1
$i+1$

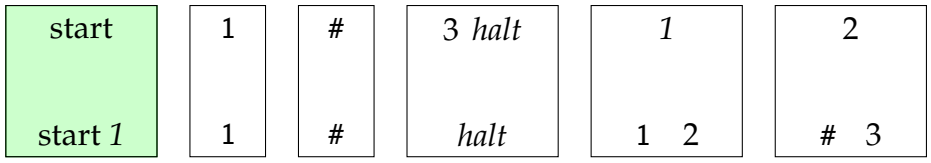

i
#
$i+1$

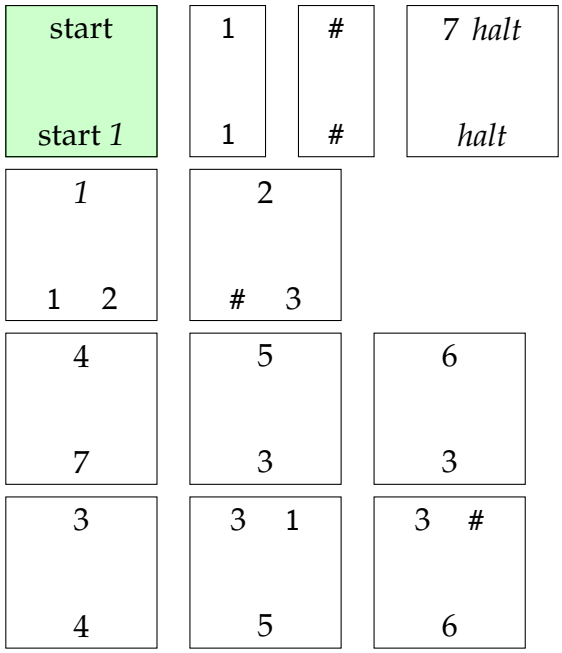

i
$i+k$

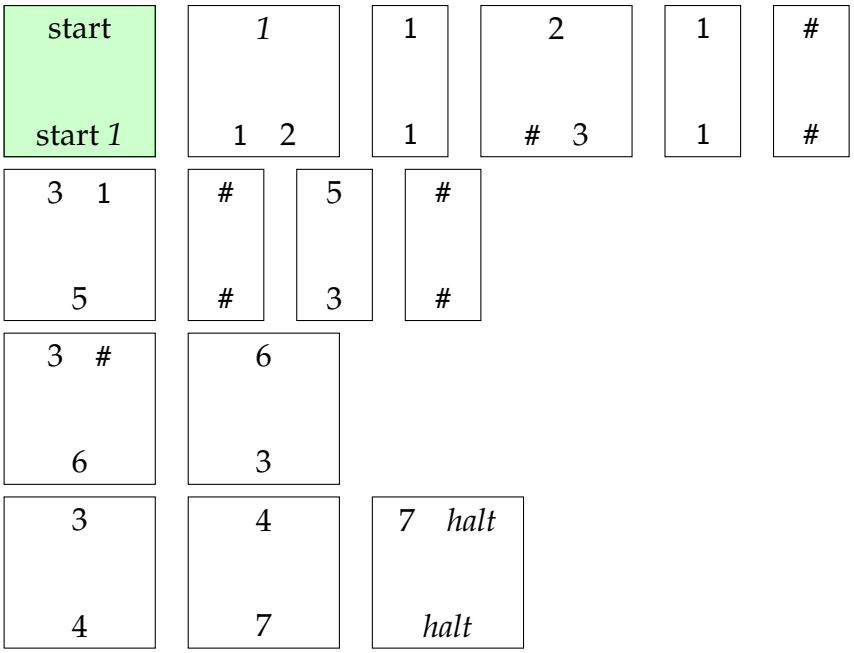

i
$i-k$


i
i + 1
i 1
i + 2
i #
i + 3


start
start 1
1
1
#
#
2 halt
halt
1
1 2

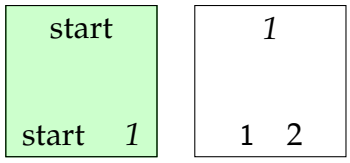

start
start 1
1
1
#
#
3 halt
halt
1
1 2
2
3

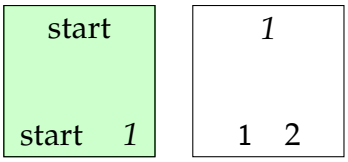

start
start 1
1
1
#
#
7 halt
halt
1
1 2
2
3
4
7
5
3
6
3
3
4
3 1
5
3 #
6

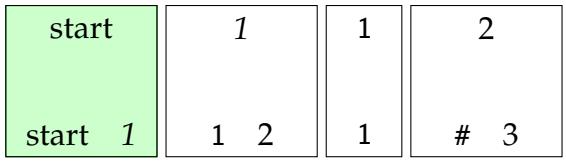

start
start 1
1
1 2
1
1
2
3
1
1
#
#
3 1
5
#
#
5
3
#
#
3 #
6
6
3
3
4
4
7 halt
halt

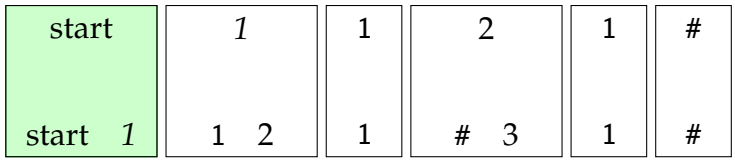
*start 1*1 21# 31# 5# 3# 6 3 4 7

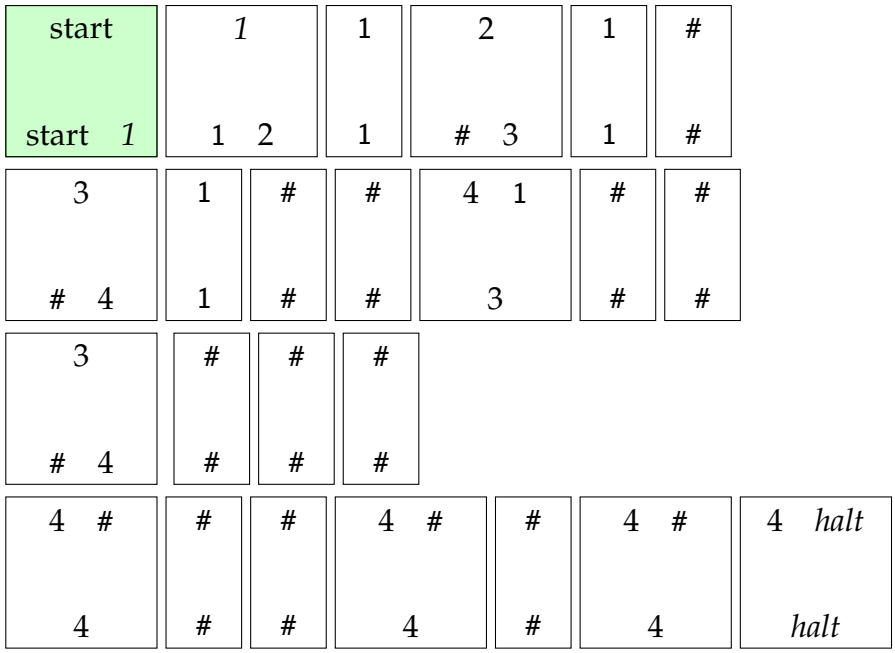
start
start 1

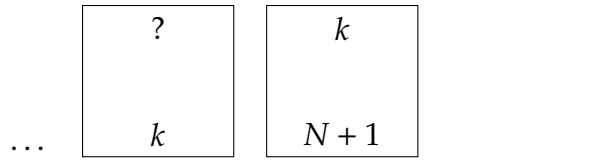

start
start 1
1
1 2

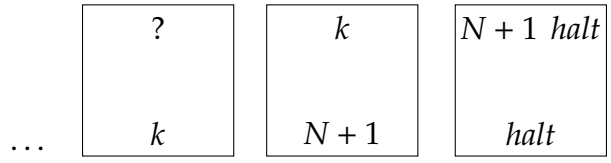

start
start 1
1
1 2

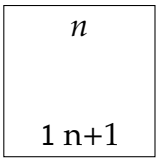

start
start 1
1
1 2
1
1
2
3

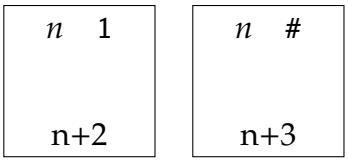

start
start 1
1
1 2
1
1
2
3
1
1
#
#

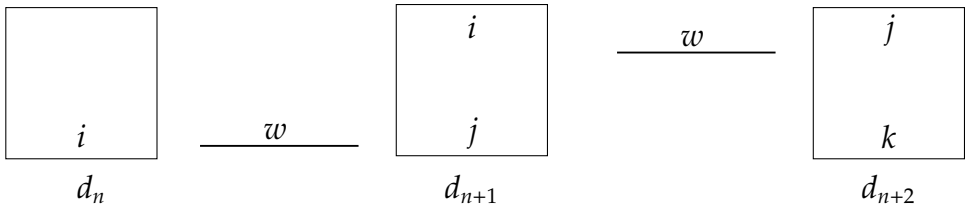

start
start 1
1
1 2
1
1
2
3
1
1
#
#
3
4
1
1
#
#
#
#
4 1
3
#
#
#
#
3
4
#
#
#
#
#
#
4 #
4
#
#
#
#
4 #
4
#
#
4 #
4
4 halt
halt

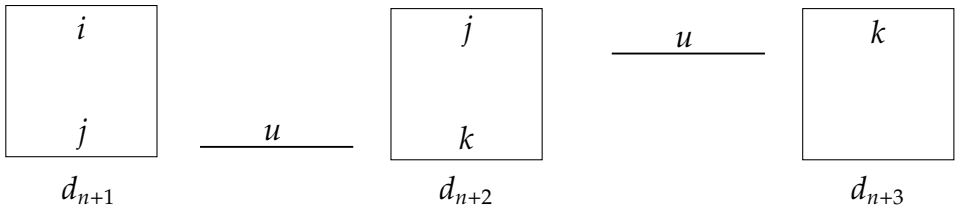

?
k
...
k
N + 1


?
k
N + 1 halt
...
k
N + 1
halt

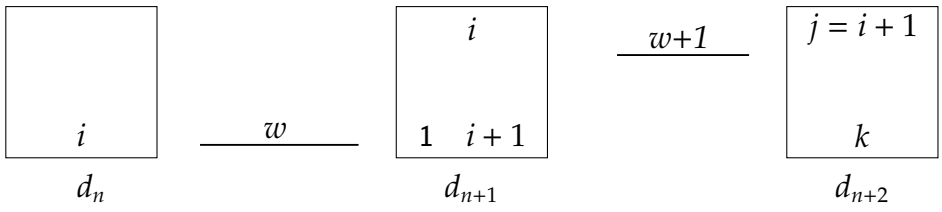

n
1 n+1

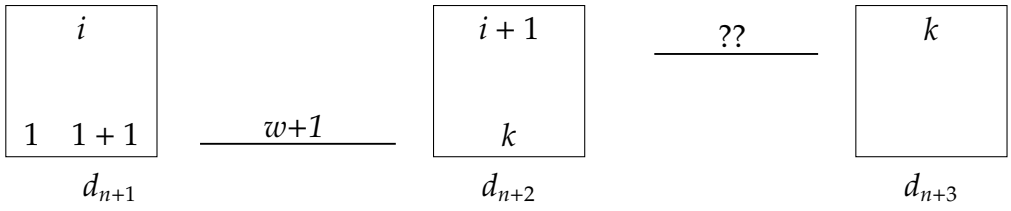

n 1
n+2
n #
n+3

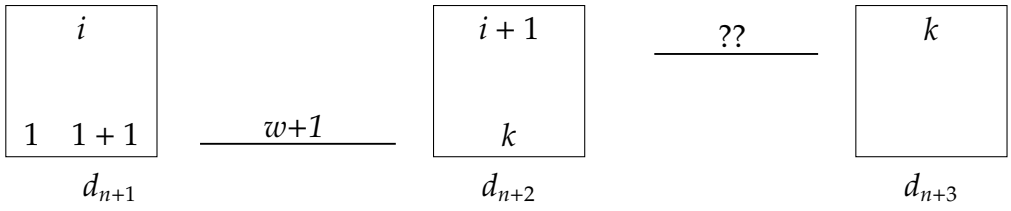

i
w
i
j
w
j
k
d_n
d_{n+1}
d_{n+2}

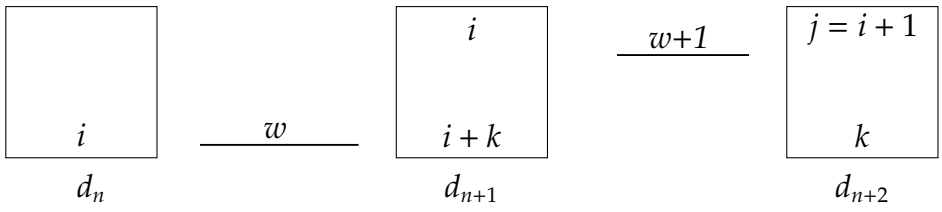


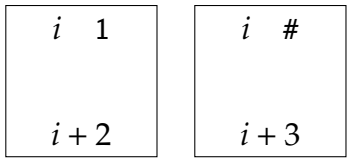
d_{n+1} d_{n+2} d_{n+3}

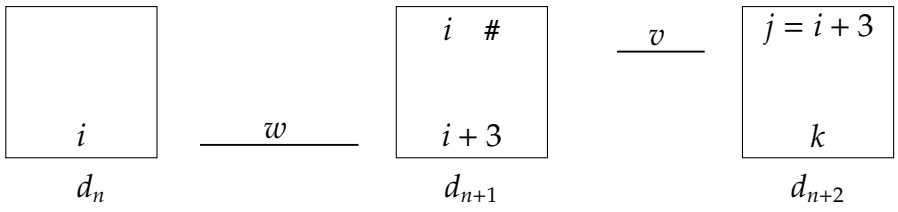

i
w
i
1 i + 1
w+1
j = i + 1
k
d_n
d_{n+1}
d_{n+2}

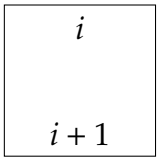

i
1 1 + 1
w+1
i + 1
k
??
k
d_{n+1}
d_{n+2}
d_{n+3}

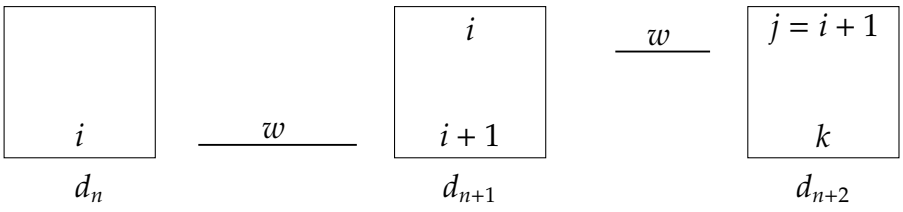

i
1 1 + 1
w+1
i + 1
k
??
k
d_{n+1}
d_{n+2}
d_{n+3}

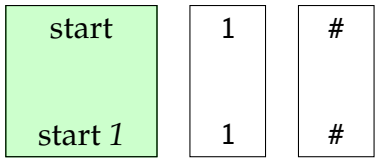

i
w
i + k
w+1
j = i + 1
k
d_n
d_{n+1}
d_{n+2}

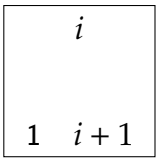

i 1
i + 2
i #
i + 3

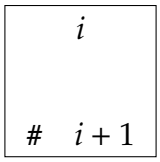

i
w
i # i + 3
v
j = i + 3 k
d_n
d_{n+1}
d_{n+2}

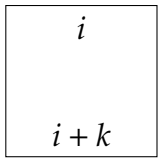

i
$i+1$

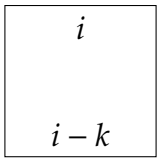

i
w
i + 1
w
j = i + 1
k
d_n
d_{n+1}
d_{n+2}

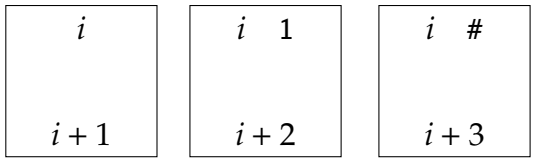

start
start 1
1
1
#
#

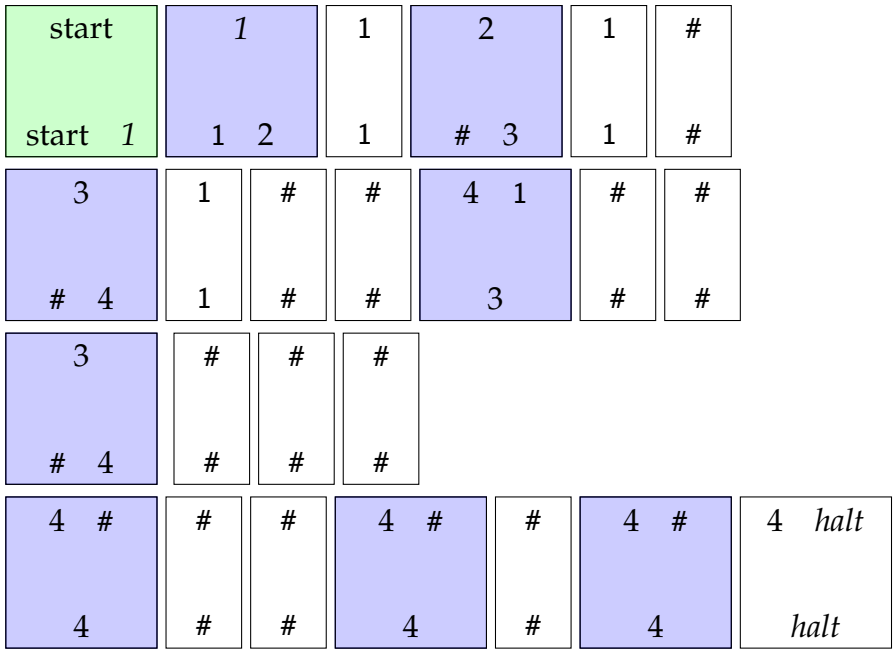

i
1 $i+1$

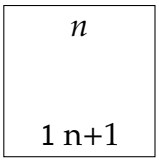

i
$i+1$

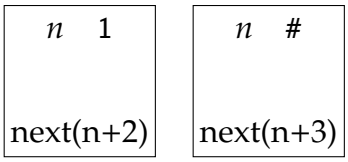

i
$i+k$

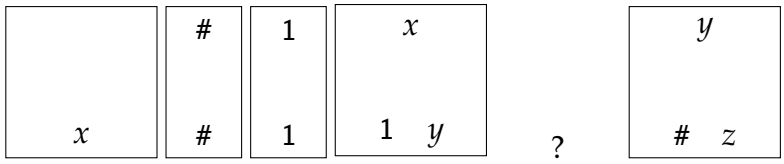

i
$i-k$

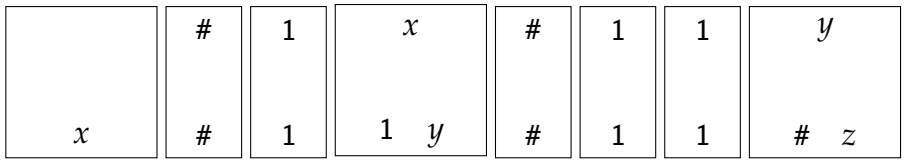

i
i + 1
i 1
i + 2
i #
i + 3


start
start 1
1
1 2
1
1
2
3
1
1
#
#
3
4
1
1
#
#
#
#
4 1
3
#
#
#
#
3
4
#
#
#
#
#
#
4 #
4
#
#
#
#
4 #
4
#
#
4 #
4
4 halt
halt


n
1 n+1


n 1
next(n+2)
n #
next(n+3)


x
#
#
1
1
x
1 y
?
y
z


x
#
#
1
1
x
1 y
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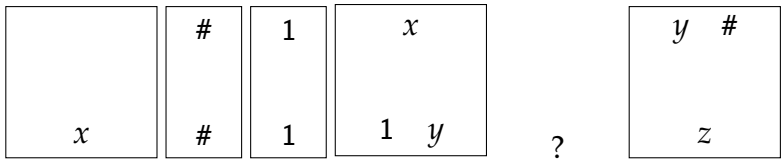
y
z


x
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x
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y #
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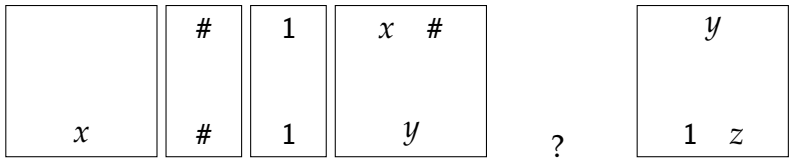
x
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x #
y
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y
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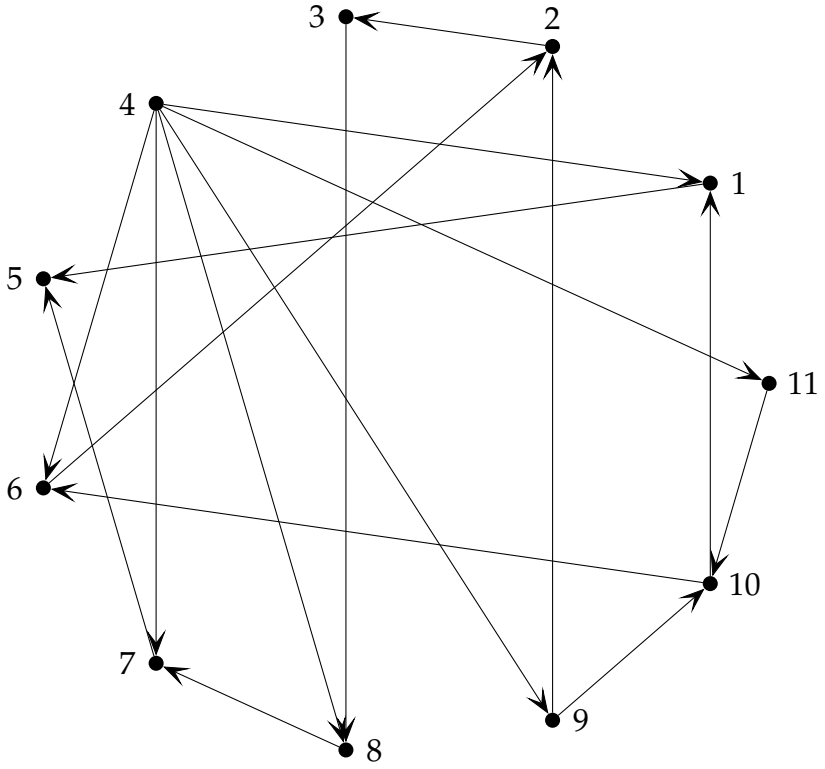
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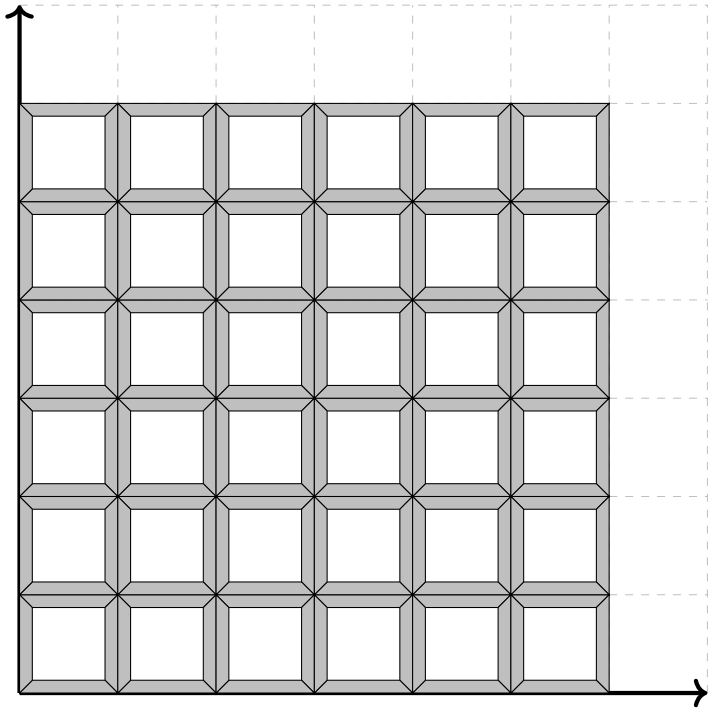
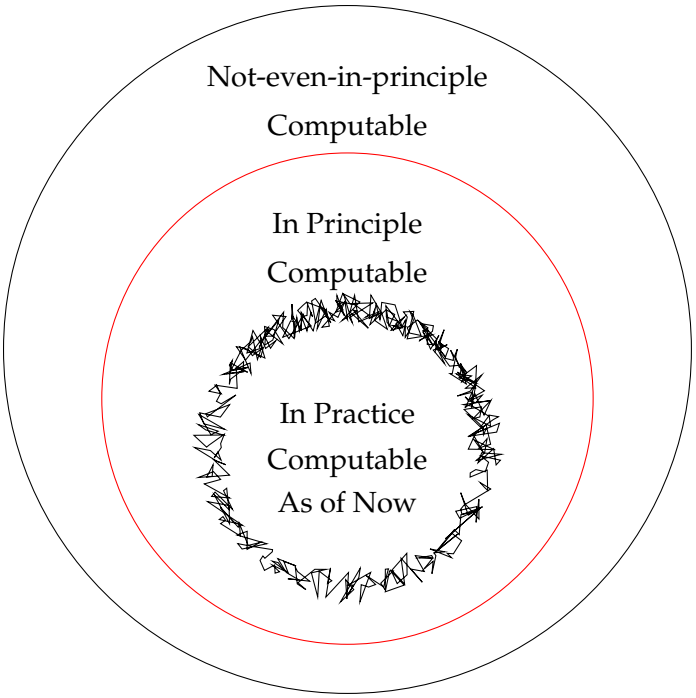
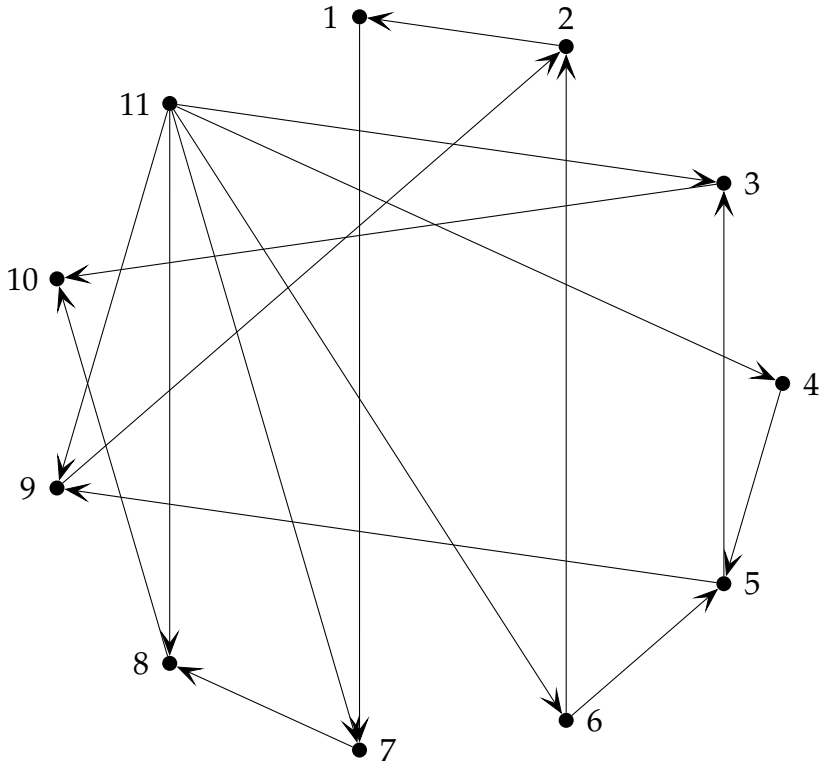
8




Not-even-in-principle
Computable
In Principle
Computable
In Practice
Computable
As of Now


1
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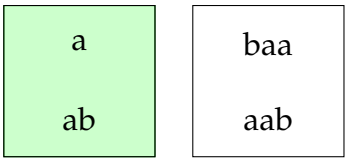
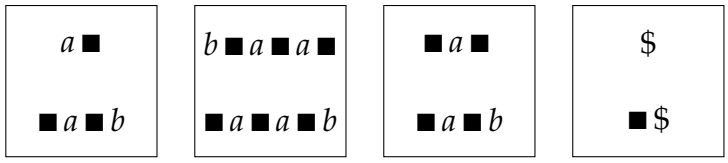

a
ab
baa
aab


a ■
■ a ■ b
b ■ a ■ a ■
■ a ■ a ■ b
■ a ■
■ a ■ b
$
■ $