







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

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

a
ab

baa
aab

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

a^*
 $*a^*b$

$b^*a^*a^*$
 $*a^*a^*b$

$*a^*$
 $*a^*b^*$

\$
*\$

start	1	#	$K + 1$ halt
start <i>1</i>	1	#	halt

i	
1	$i + 1$

i	
$\#$	$i + 1$

$$\begin{array}{c} i \\ i+k \end{array}$$

$$\begin{array}{c} i \\ i-k \end{array}$$

i	$i \quad 1$	$i \quad \#$
$i + 1$	$i + 2$	$i + 3$

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

start	1	#	3 <i>halt</i>	1	2
start 1	1	#	<i>halt</i>	1 2	# 3

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

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

start 11 21# 31# 5# 3# 6 3 4 7

start
start 1

start
start 1

1
1 2

start	
start	1

1	
1	2

start	1	1	2
start 1	1 2	1	# 3

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

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

	?	k
...	k	$N + 1$

	?	k	$N + 1$ <i>halt</i>
...	k	$N + 1$	<i>halt</i>

n
$1 \ n+1$

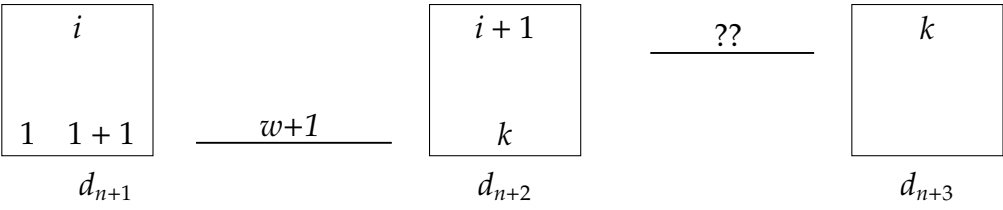
n	1
$n+2$	

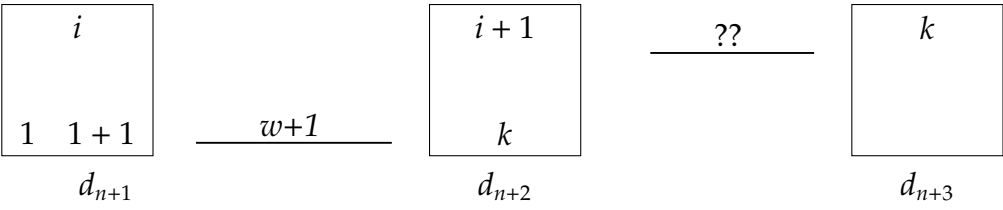
n	$\#$
$n+3$	













i	1
$i+2$	

i	$\#$
$i+3$	



$$\begin{array}{c} i \\ i+1 \end{array}$$



start	1	#
start <i>1</i>	1	#

i	
1	$i + 1$

i	
$\#$	$i + 1$

$$\begin{array}{c} i \\ i+k \end{array}$$

$$\begin{array}{c} i \\ i-k \end{array}$$

i
$i + 1$

$i \quad 1$
$i + 2$

$i \quad \#$
$i + 3$

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

n
$1 \ n+1$

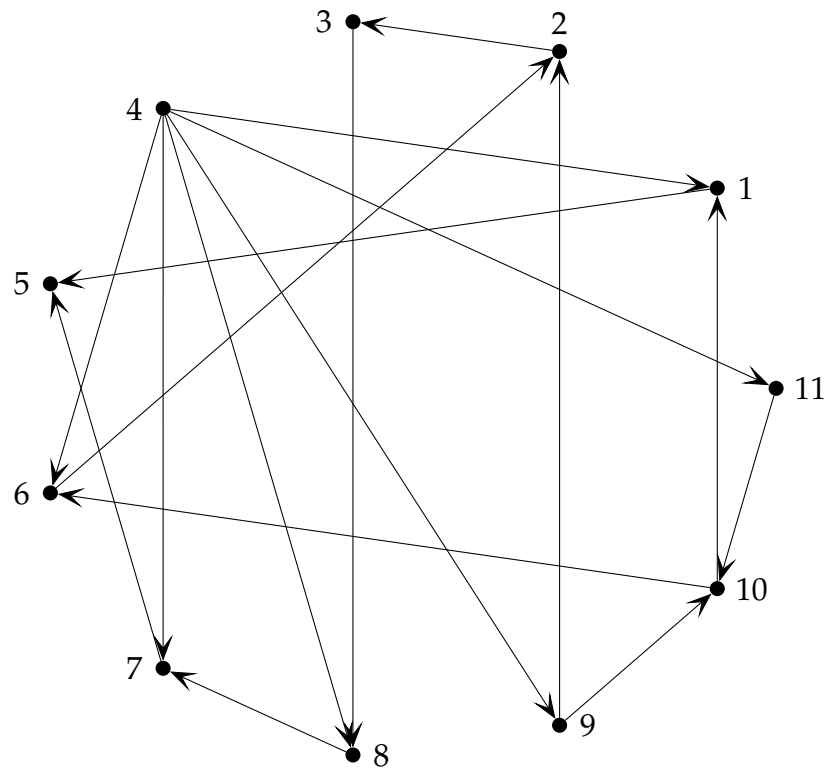
n 1	n #
next(n+2)	next(n+3)

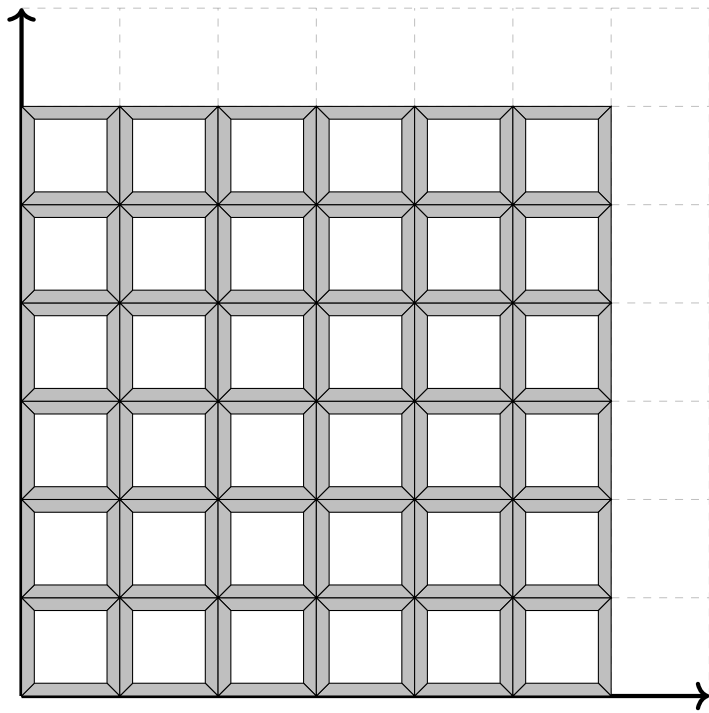


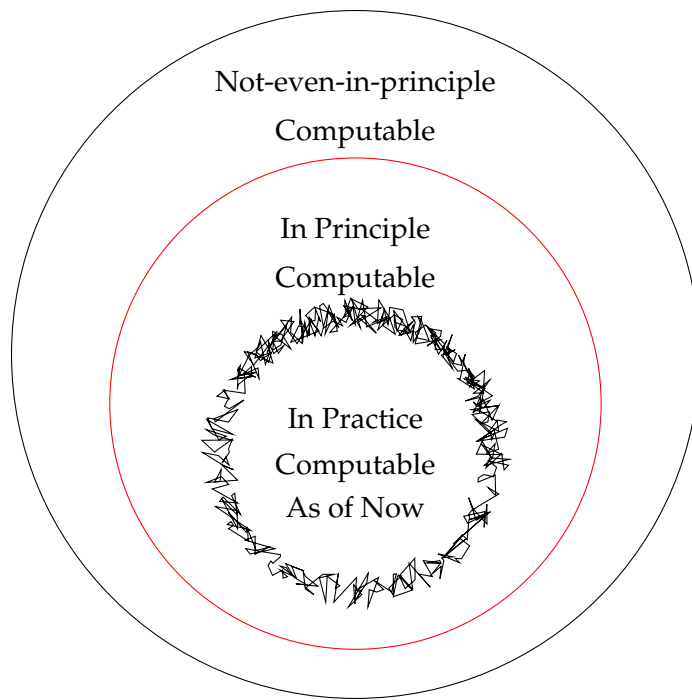
	#	1	x	#	1	1	y
x	#	1	1 y	#	1	1	# z

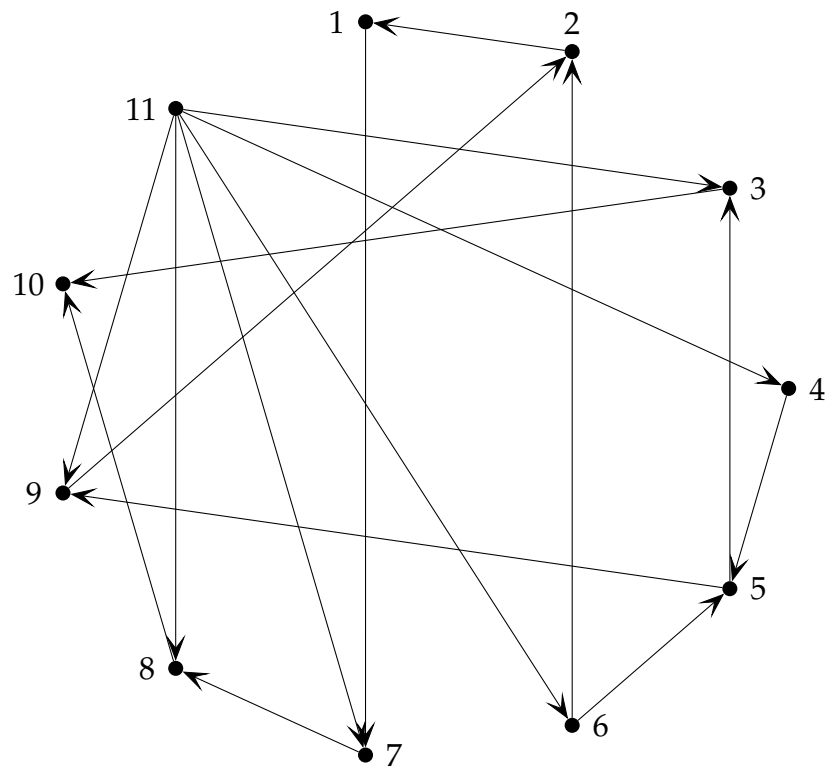


	#	1	x #		y
x	#	1	y	?	1 z









a
ab

baa
aab

$a \blacksquare$
 $\blacksquare a \blacksquare b$

$b \blacksquare a \blacksquare a \blacksquare$
 $\blacksquare a \blacksquare a \blacksquare b$

$\blacksquare a \blacksquare$
 $\blacksquare a \blacksquare b$

$\$$
 $\blacksquare \$$