REDUKCIJA ŠTEVILA LOGIČNIH OPERATORJEV ZA QCA

1. seminar pri predmetu Nekonvencionalne platforme in metode procesiranja,
Fakulteta za računalništvo in informatiko

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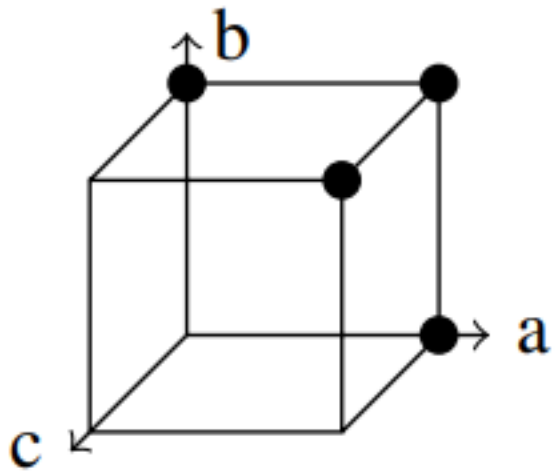
Funkcije treh spremenljivk

- funkcijo zapišemo kot disjunkcijo mintermov
- vsak minterm predstavlja eno oglišče enotske kocke
- iščemo najmanjše pokritje množice ogljišč

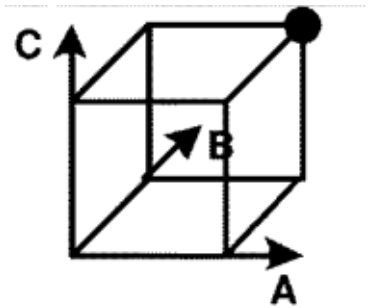
a	b	c	$minterm$
0	0	0	$\bar{a}\bar{b}\bar{c}$
0	0	1	$\bar{a}\bar{b}c$
0	1	0	$\bar{a}b\bar{c}$
0	1	1	$\bar{a}bc$
1	0	0	$a\bar{b}\bar{c}$
1	0	1	$a\bar{b}c$
1	1	0	$ab\bar{c}$
1	1	1	abc

Primer: $f(a,b,c) = \bar{a}b\bar{c} \vee a\bar{b}\bar{c} \vee ab\bar{c} \vee abc$

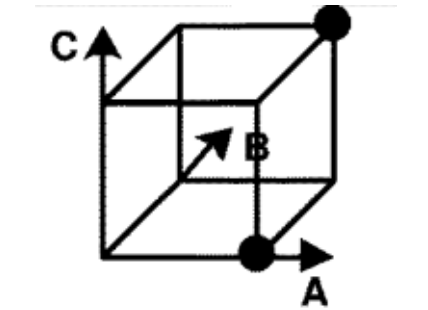
a	b	c	$f(a,b,c)$
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1



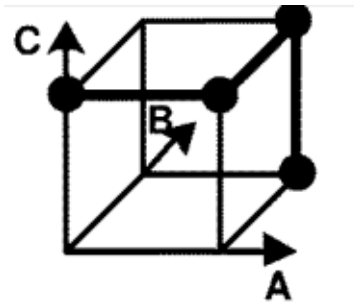
- uporabimo 13 standardnih funkcij, ki omogočajo izvedbo vseh funkcij treh spremenljivk
- primeri:



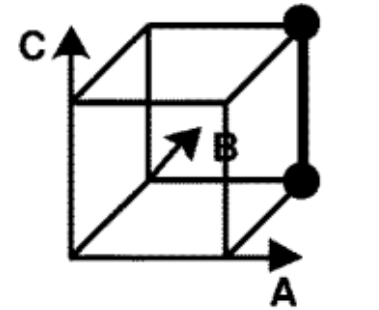
$F = ABC$



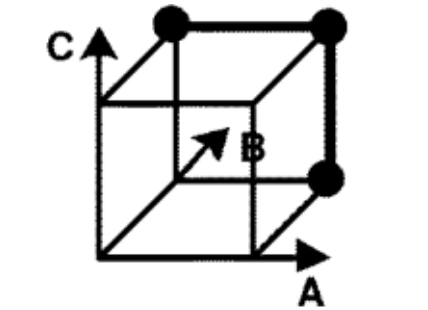
$F = ABC + A\bar{B}\bar{C}$



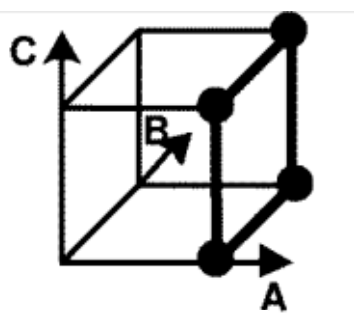
$F = AB + \bar{B}C$



$F = AB$



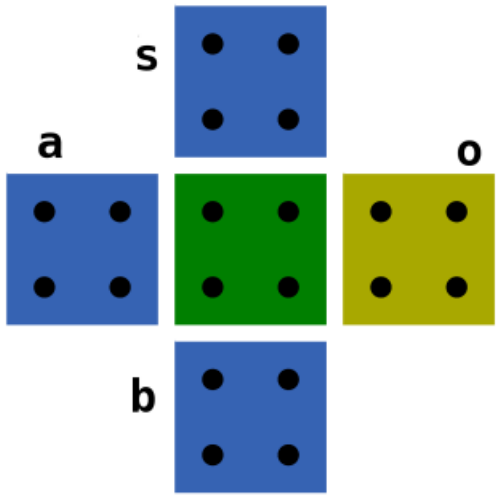
$F = AB + BC$



$F = A$

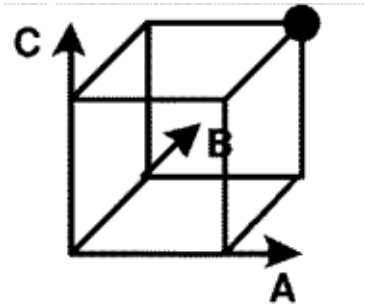
QCA majoritetna vrata

$$M(a,b,c) = ab \vee bc \vee ac$$

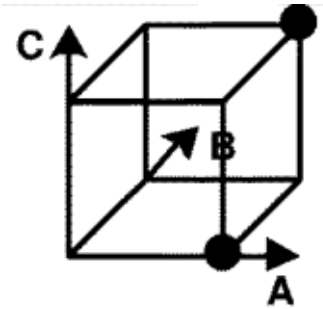


s	a	b	o
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

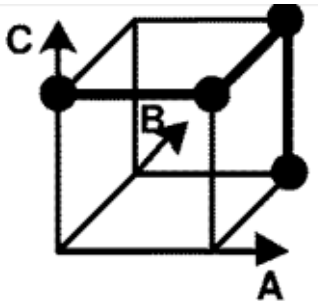
Ker lahko izvaja konjunkcijo ali disjunkcijo dveh vhodnih spremenljivk, lahko poenostavimo standardne funkcije →



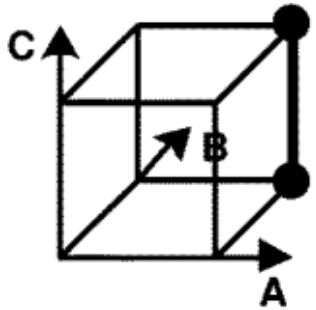
$$f_1(a,b,c) = abc =$$
$$= M(M(a,b,0),c,0)$$



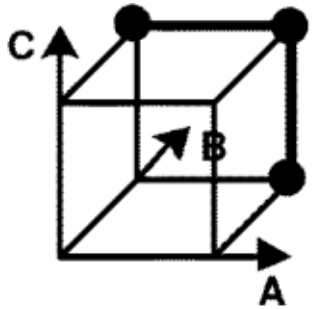
$$f_3(a,b,c) = abc \vee a\bar{b}\bar{c} =$$
$$= M(M(a,b,\bar{c}),M(a,\bar{b},c),0)$$



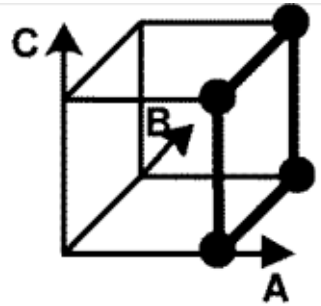
$$f_{10}(a,b,c) = ab \vee \bar{b}c =$$
$$= M(M(a,b,0),M(\bar{b},c,0),1)$$



$$f_2(a,b,c) = ab =$$
$$= M(a,b,0)$$



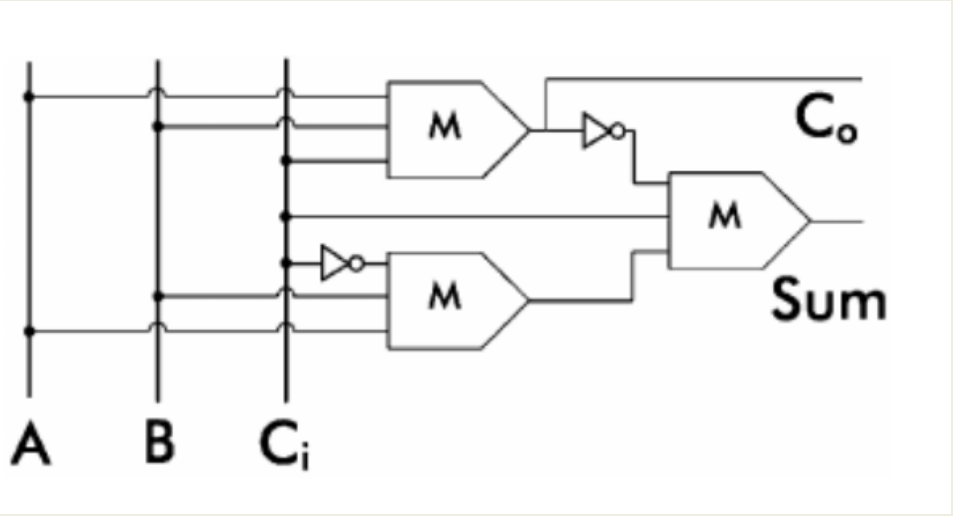
$$f_5(a,b,c) = ab \vee bc =$$
$$= M(b,M(a,c,1),0)$$

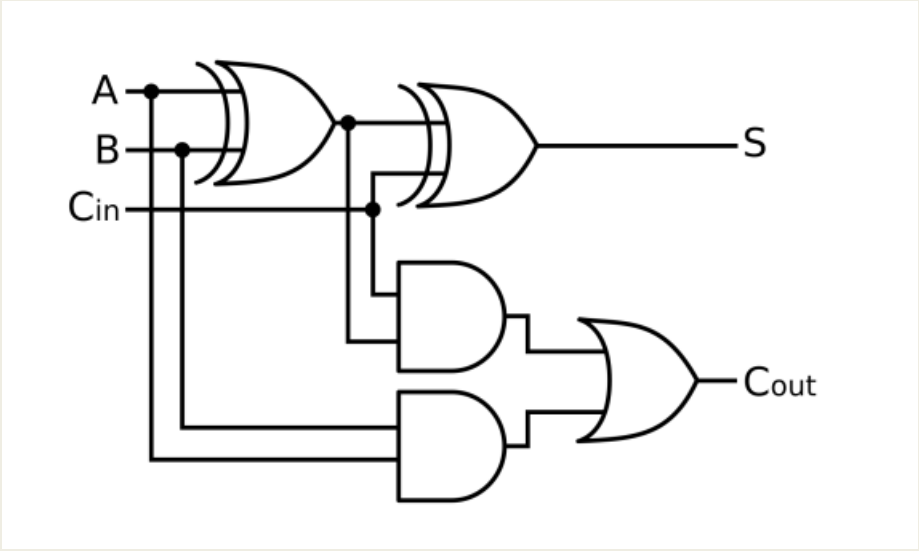


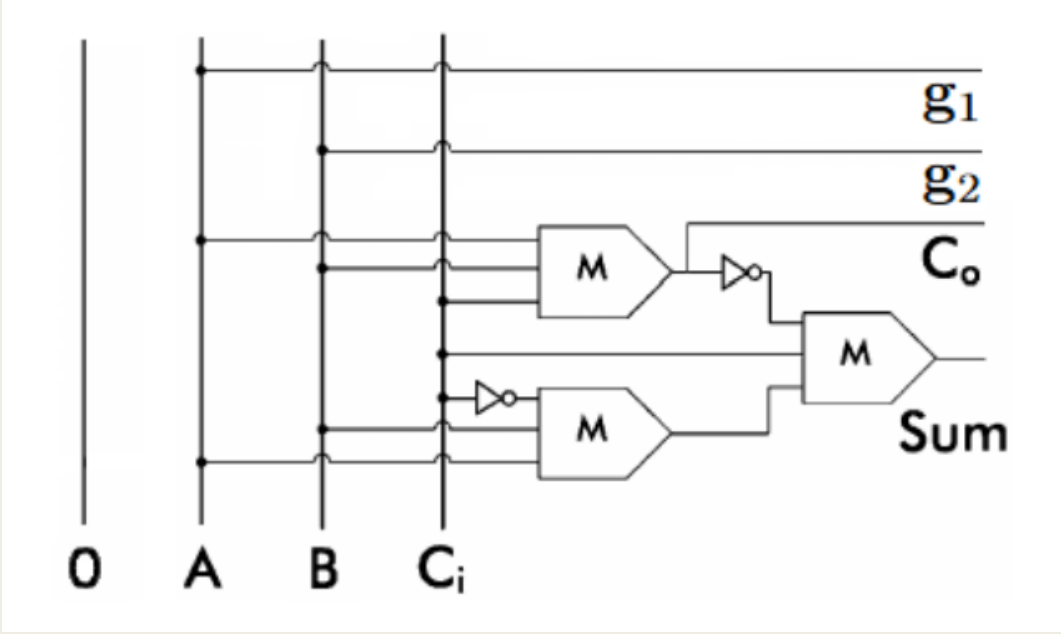
$$f_8(a,b,c) = a = M(a,0,1)$$

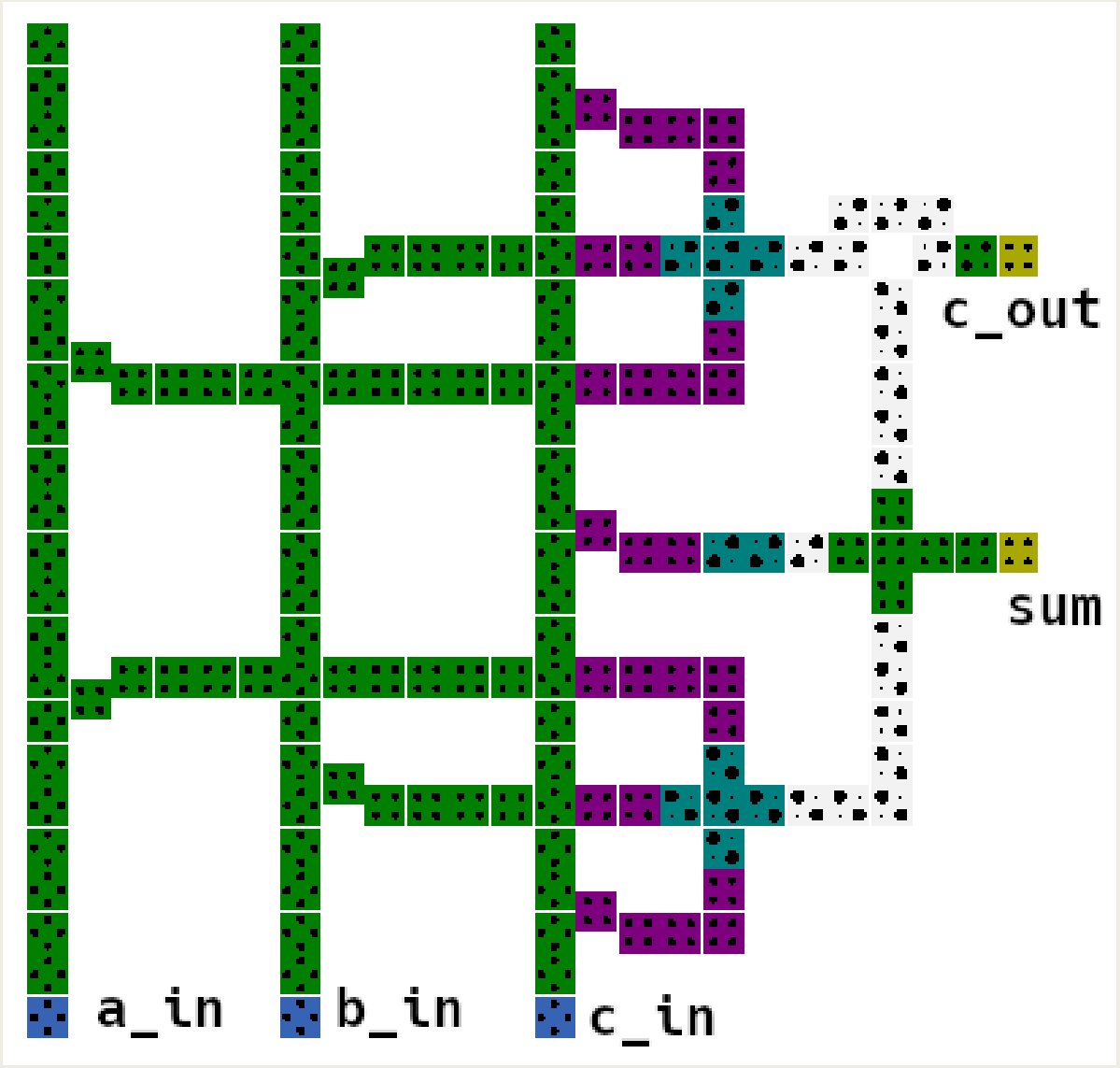
Polni seštevalnik

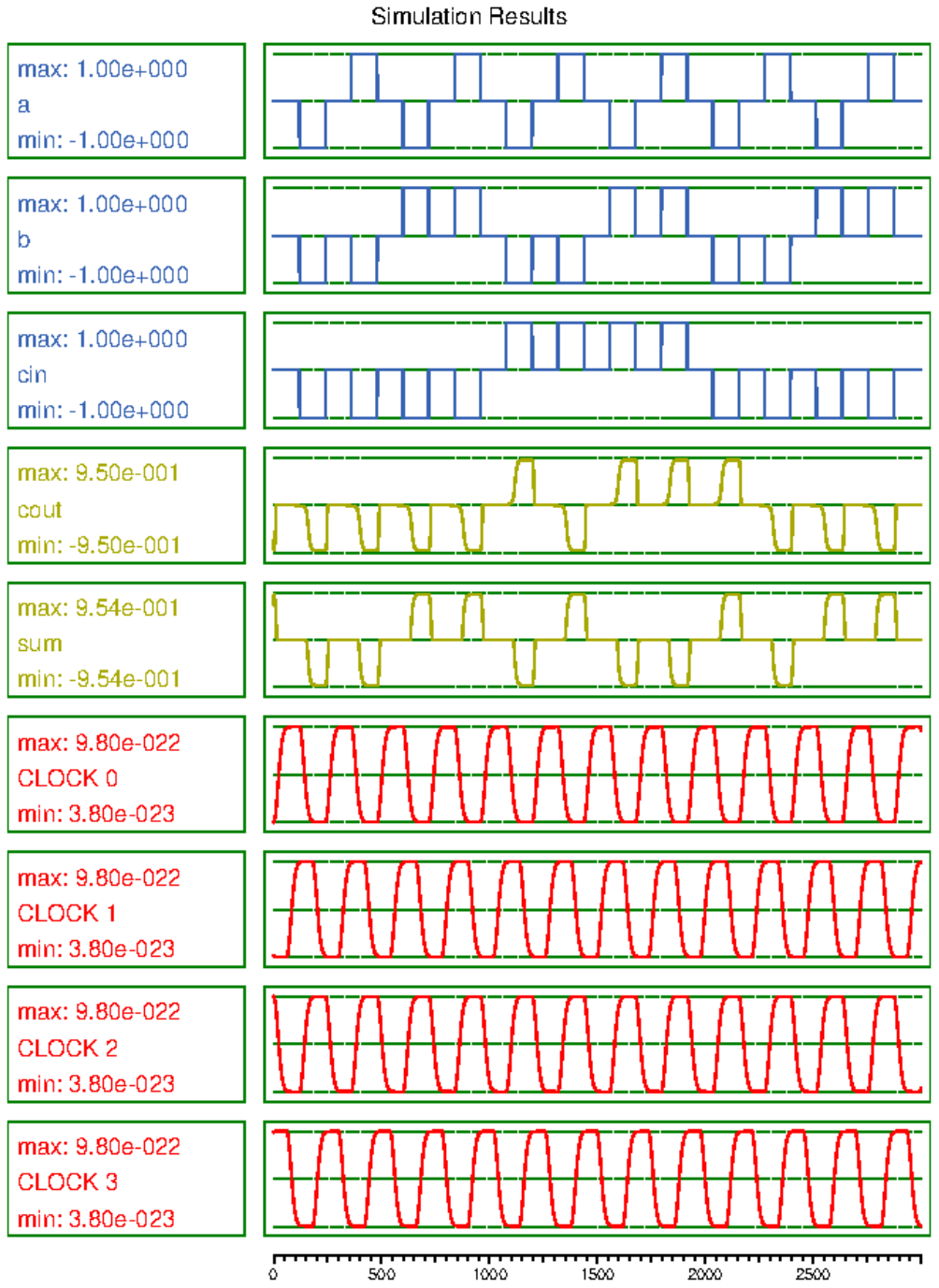
a	b	c_{in}	c_{out}	sum
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

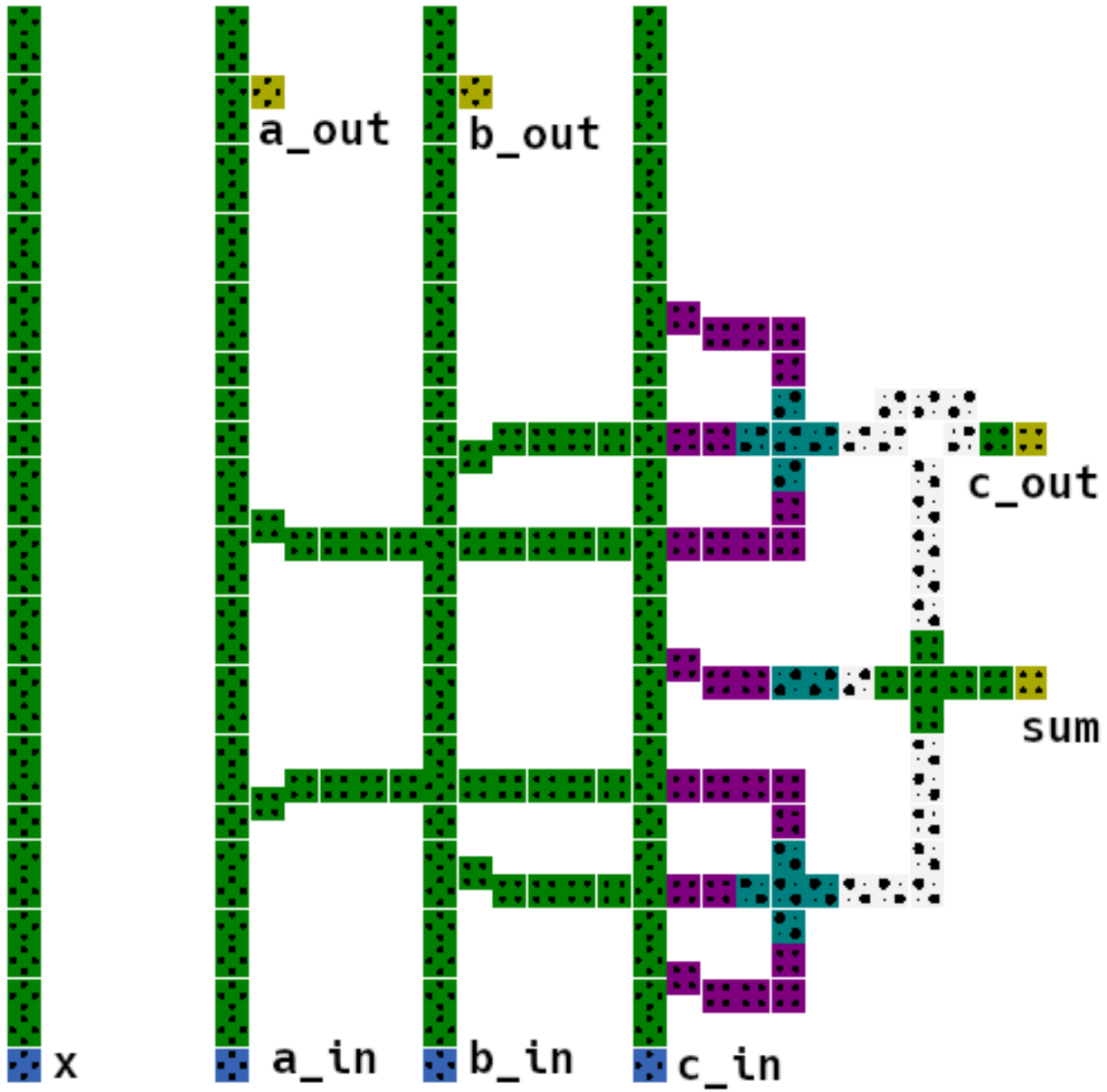







c_out
sum
a_in
b_in
c_in


Simulation Results
max: 1.00e+000
a
min: -1.00e+000
max: 1.00e+000
b
min: -1.00e+000
max: 1.00e+000
cin
min: -1.00e+000
max: 9.50e-001
cout
min: -9.50e-001
max: 9.54e-001
sum
min: -9.54e-001
max: 9.80e-022
CLOCK 0
min: 3.80e-023
max: 9.80e-022
CLOCK 1
min: 3.80e-023
max: 9.80e-022
CLOCK 2
min: 3.80e-023
max: 9.80e-022
CLOCK 3
min: 3.80e-023
0
500
1000
1500
2000
2500


a_out
b_out
c_out
sum
x
a_in
b_in
c_in