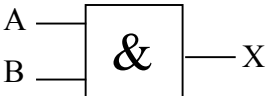
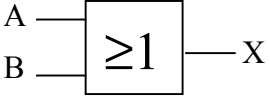


Logična vrata

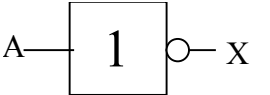
Vrata IN (AND)

Simbol	Zapis	Pravilnostna tabela															
	$X = A \cdot B$	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	A	B	X	0	0	0	0	1	0	1	0	0	1	1	1
A	B	X															
0	0	0															
0	1	0															
1	0	0															
1	1	1															


Vrata ALI (OR)

Simbol	Zapis	Pravilnostna tabela															
	$X = A + B$	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	A	B	X	0	0	0	0	1	1	1	0	1	1	1	1
A	B	X															
0	0	0															
0	1	1															
1	0	1															
1	1	1															

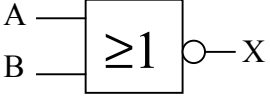
Vrata NE (NOT)

Simbol	Zapis	Pravilnostna tabela						
	$X = \bar{A}$	<table border="1"> <thead> <tr> <th>A</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> </tr> <tr> <td>1</td> <td>0</td> </tr> </tbody> </table>	A	X	0	1	1	0
A	X							
0	1							
1	0							

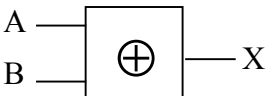
Vrata NEIN (NAND)

Simbol	Zapis	Pravilnostna tabela															
	$X = \overline{A \cdot B}$	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> </tr> </tbody> </table>	A	B	X	0	0	1	0	1	1	1	0	1	1	1	0
A	B	X															
0	0	1															
0	1	1															
1	0	1															
1	1	0															

Vrata NEALI (NOR)

Simbol	Zapis	Pravilnostna tabela															
	$X = \overline{A + B}$	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> </tr> </tbody> </table>	A	B	X	0	0	1	0	1	0	1	0	0	1	1	0
A	B	X															
0	0	1															
0	1	0															
1	0	0															
1	1	0															

Vrata ExALI (XOR)

Simbol	Zapis	Pravilnostna tabela															
	$X = A \oplus B$	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> </tr> </tbody> </table>	A	B	X	0	0	0	0	1	1	1	0	1	1	1	0
A	B	X															
0	0	0															
0	1	1															
1	0	1															
1	1	0															

Pravila Boolove algebre:

1: $A + A = A$

2: $A \cdot A = A$

3: $A + 0 = A$

4: $A \cdot 1 = A$

5: $A \cdot 0 = 0$

6: $A + 1 = 1$

7: $\overline{A + B} = \overline{A} \cdot \overline{B}$

8: $\overline{A \cdot B} = \overline{A} + \overline{B}$

9: $A + A \cdot B = A$

10: $A \cdot (A + B) = A$

11: $A + \overline{A}B = A + B$

12: $\overline{A}(A + \overline{B}) = \overline{A}\overline{B}$

13: $A \cdot B + A \cdot \overline{B} = A$

14: $(\overline{A} + \overline{B}) \cdot (\overline{A} + B) = \overline{A}$

15: $A + \overline{A} = 1$

16: $A \cdot \overline{A} = 0$

17: $A + B = B + A$

18: $A \cdot B = B \cdot A$

19: $A + B \cdot C = (A + B)(A + C)$

20: $A \cdot (B + C) = A \cdot B + A \cdot C$

21: $A + (B + C) = (A + B) + C = A + B + C$

22: $A \cdot (B \cdot C) = (A \cdot B) \cdot C = A \cdot B \cdot C$

23: $\overline{\overline{A}} = A$

Minimizacija

Minimizacija je postopek, s katerim zmanjšamo število logičnih vrat logičnega vezja. Uporabljamo več postopkov, pri čemer upoštevamo **pravila Boolove algebre**.

Prvi postopek je kar direktna uporaba teh pravil, ki poteka podobno kot postopek krajšanja matematičnih enačb.

Za manjše število vhodov uporabljamo posebna orodja, kot je npr. Veitchev diagram.

Veitchev diagram za 3 vhode

	A			
B	$AB\bar{C}$	ABC	$\bar{A}BC$	$\bar{A}\bar{B}C$
	$A\bar{B}\bar{C}$	$A\bar{B}C$	$\bar{A}\bar{B}\bar{C}$	$\bar{A}\bar{B}C$
	C			

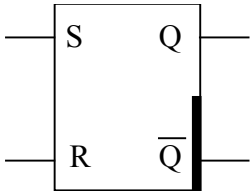
Veitchev diagram za 4 vhode

	A				
B	$AB\bar{C}\bar{D}$	$ABC\bar{D}$	$\bar{A}BC\bar{D}$	$\bar{A}\bar{B}C\bar{D}$	D
	$AB\bar{C}D$	$ABCD$	$\bar{A}BCD$	$\bar{A}\bar{B}CD$	
	$A\bar{B}C\bar{D}$	$A\bar{B}CD$	$\bar{A}\bar{B}C\bar{D}$	$\bar{A}\bar{B}CD$	
	$A\bar{B}C\bar{D}$	$A\bar{B}C\bar{D}$	$\bar{A}\bar{B}C\bar{D}$	$\bar{A}\bar{B}C\bar{D}$	
	C				

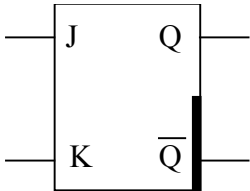
Sekvenčna vezja (Flip - flopi)

Sekvenčna vezja so elementi s spominom.

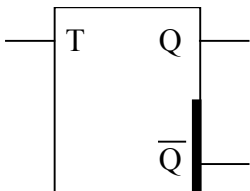
RS flip-flop

Simbol	Zapis	Pravilnostna tabela																																				
	Dominantni R: $Q_{n+1} = \bar{R} + S\bar{Q}_n$ Dominantni S: $Q_{n+1} = \bar{R}Q_n + S$	<table border="1"> <thead> <tr> <th>R</th> <th>S</th> <th>Q_n</th> <th>Q_{n+1}</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>0</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>x</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>x</td></tr> </tbody> </table>	R	S	Q_n	Q_{n+1}	0	0	0	0	0	0	1	1	0	1	0	1	0	1	1	1	1	0	0	0	1	0	1	0	1	1	0	x	1	1	1	x
R	S	Q_n	Q_{n+1}																																			
0	0	0	0																																			
0	0	1	1																																			
0	1	0	1																																			
0	1	1	1																																			
1	0	0	0																																			
1	0	1	0																																			
1	1	0	x																																			
1	1	1	x																																			

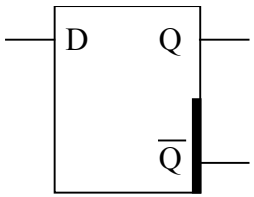
JK flip-flop

Simbol	Zapis	Pravilnostna tabela																																				
	$Q_{n+1} = J\bar{Q} + \bar{K}Q_n$	<table border="1"> <thead> <tr> <th>K</th> <th>J</th> <th>Q_n</th> <th>Q_{n+1}</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>0</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>0</td></tr> </tbody> </table>	K	J	Q_n	Q_{n+1}	0	0	0	0	0	0	1	1	0	1	0	1	0	1	1	1	1	0	0	0	1	0	1	0	1	1	0	1	1	1	1	0
K	J	Q_n	Q_{n+1}																																			
0	0	0	0																																			
0	0	1	1																																			
0	1	0	1																																			
0	1	1	1																																			
1	0	0	0																																			
1	0	1	0																																			
1	1	0	1																																			
1	1	1	0																																			

T flip-flop

Simbol	Zapis	Pravilnostna tabela															
	$Q_{n+1} = T\bar{Q} + \bar{T}Q_n$	<table border="1"> <thead> <tr> <th>T</th> <th>Q_n</th> <th>Q_{n+1}</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>0</td></tr> </tbody> </table>	T	Q_n	Q_{n+1}	0	0	0	0	1	1	1	0	1	1	1	0
T	Q_n	Q_{n+1}															
0	0	0															
0	1	1															
1	0	1															
1	1	0															

D flip-flop

Simbol	Zapis	Pravilnostna tabela															
	$Q_{n+1} = D$	<table border="1"><thead><tr><th>D</th><th>Q_n</th><th>Q_{n+1}</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></tbody></table>	D	Q_n	Q_{n+1}	0	0	0	0	1	0	1	0	1	1	1	1
D	Q_n	Q_{n+1}															
0	0	0															
0	1	0															
1	0	1															
1	1	1															