

Megoldások

1.1.1.

$z_{11} = 2 \text{ k}\Omega$	$z_{12} = 1 \text{ k}\Omega$	$z_{21} = 1 \text{ k}\Omega$	$z_{22} = 2 \text{ k}\Omega$
$y_{11} = 666,6 \text{ }\mu\text{S}$	$y_{12} = -333,3 \text{ }\mu\text{S}$	$y_{21} = -333,3 \text{ }\mu\text{S}$	$y_{22} = 666,6 \text{ }\mu\text{S}$
$h_{11} = 1,5 \text{ k}\Omega$	$h_{12} = 0,5$	$h_{21} = -0,5$	$h_{22} = 500 \text{ }\mu\text{S}$
$d_{11} = 500 \text{ }\mu\text{S}$	$d_{12} = -0,5$	$d_{21} = 0,5$	$d_{22} = 1,5 \text{ k}\Omega$

1.1.2.

$z_{11} = 666,6 \text{ }\Omega$	$z_{12} = 333,3 \text{ }\Omega$	$z_{21} = 333,3 \text{ }\Omega$	$z_{22} = 666,6 \text{ }\Omega$
$y_{11} = 2 \text{ mS}$	$y_{12} = -1 \text{ mS}$	$y_{21} = -1 \text{ mS}$	$y_{22} = 2 \text{ mS}$
$h_{11} = 500 \text{ }\Omega$	$h_{12} = 0,5$	$h_{21} = -0,5$	$h_{22} = 1,5 \text{ mS}$
$d_{11} = 1,5 \text{ mS}$	$d_{12} = -0,5$	$d_{21} = 0,5$	$d_{22} = 500 \text{ }\Omega$

1.1.3.

$z_{11} = 3 \text{ k}\Omega$	$z_{12} = 2 \text{ k}\Omega$	$z_{21} = 2 \text{ k}\Omega$	$z_{22} = 3 \text{ k}\Omega$
$y_{11} = 600 \text{ }\mu\text{S}$	$y_{12} = -400 \text{ }\mu\text{S}$	$y_{21} = -400 \text{ }\mu\text{S}$	$y_{22} = 600 \text{ }\mu\text{S}$
$h_{11} = 1,67 \text{ k}\Omega$	$h_{12} = 0,6666$	$h_{21} = -0,6666$	$h_{22} = 333,3 \text{ }\mu\text{S}$
$d_{11} = 333,3 \text{ }\mu\text{S}$	$d_{12} = -0,6666$	$d_{21} = 0,6666$	$d_{22} = 1,67 \text{ k}\Omega$

1.1.4.

$z_{11} = 750 \text{ }\Omega$	$z_{12} = 250 \text{ }\Omega$	$z_{21} = 250 \text{ }\Omega$	$z_{22} = 750 \text{ }\Omega$
$y_{11} = 1,5 \text{ mS}$	$y_{12} = -0,5 \text{ mS}$	$y_{21} = -500 \text{ }\mu\text{S}$	$y_{22} = 1,5 \text{ mS}$
$h_{11} = 666,6 \text{ }\Omega$	$h_{12} = 0,3333$	$h_{21} = -0,3333$	$h_{22} = 1,333 \text{ mS}$
$d_{11} = 1,333 \text{ mS}$	$d_{12} = -0,3333$	$d_{21} = 0,3333$	$d_{22} = 666,6 \text{ }\Omega$

1.1.5.

$z_{11} = 666,6 \text{ }\Omega$	$z_{12} = 333,3 \text{ }\Omega$	$z_{21} = 333,3 \text{ }\Omega$	$z_{22} = 1,67 \text{ k}\Omega$
$y_{11} = 1,67 \text{ mS}$	$y_{12} = -333,3 \text{ }\mu\text{S}$	$y_{21} = -333,3 \text{ }\mu\text{S}$	$y_{22} = 666,6 \text{ }\mu\text{S}$
$h_{11} = 600 \text{ }\Omega$	$h_{12} = 0,2$	$h_{21} = -0,2$	$h_{22} = 600 \text{ }\mu\text{S}$
$d_{11} = 1,5 \text{ mS}$	$d_{12} = -0,5$	$d_{21} = 0,5$	$d_{22} = 1,5 \text{ k}\Omega$

1.1.6.

$z_{11} = 2,2 \text{ k}\Omega$	$z_{12} = 800 \text{ }\Omega$	$z_{21} = 800 \text{ }\Omega$	$z_{22} = 2,2 \text{ k}\Omega$
$y_{11} = 523,8 \text{ }\mu\text{S}$	$y_{12} = -190,4 \text{ }\mu\text{S}$	$y_{21} = -190,4 \text{ }\mu\text{S}$	$y_{22} = 523,8 \text{ }\mu\text{S}$
$h_{11} = 1,91 \text{ k}\Omega$	$h_{12} = 0,3636$	$h_{21} = -0,3636$	$h_{22} = 454,5 \text{ }\mu\text{S}$
$d_{11} = 454,5 \text{ }\mu\text{S}$	$d_{12} = -0,3636$	$d_{21} = 0,3636$	$d_{22} = 1,91 \text{ k}\Omega$

1.1.7.

$$Z_{0be} = 4,123 \text{ k}\Omega$$

$$Z_{0ki} = 8,246 \text{ k}\Omega$$

1.1.8.

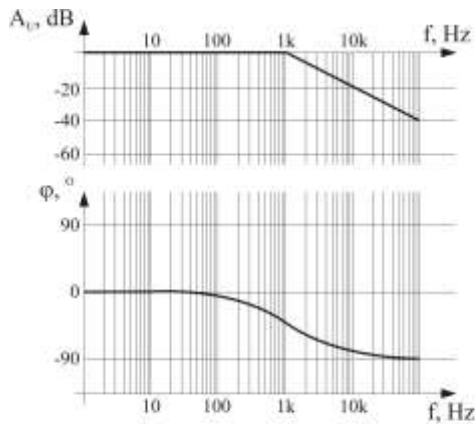
a,) $Z_{0be} = 858,3 \Omega$

$Z_{0ki} = 465,1 \Omega$

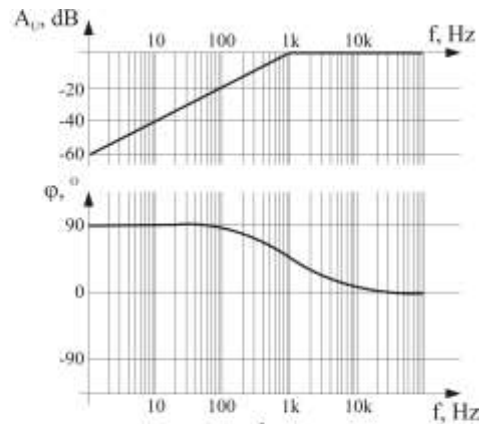
b,) $Z_{0be} = 182,9 \Omega$

$Z_{0ki} = 179,9 \Omega$

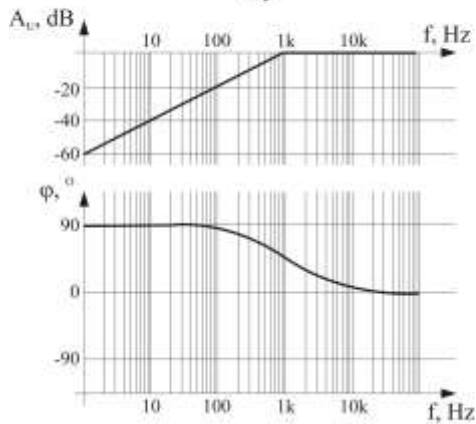
1.1.9.



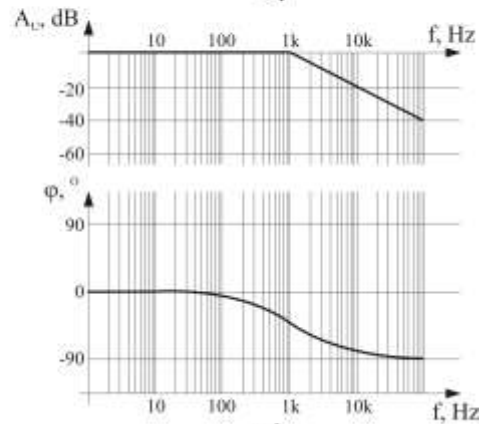
a,



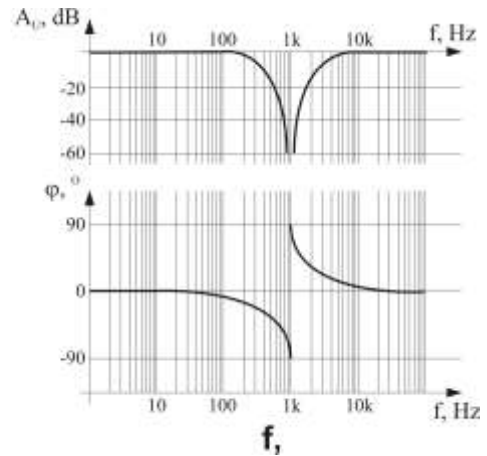
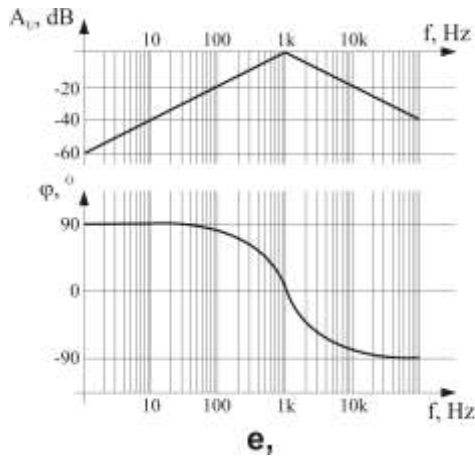
b,



c,



d,



1.2.1.

$$R_{be} = 10 \text{ k}\Omega \quad A_u = 50 \quad a_u = 33,98 \text{ dB}$$

1.2.2.

$$A_i = 500 \quad a_i = 53,98 \text{ dB} \quad A_p = 25000 \quad a_p = 43,98 \text{ dB}$$

1.2.3.

$$A_i = 5000 \quad i_{be} = 70 \text{ nA}$$

1.2.4.

$$u_t = 1 \text{ V} \quad u_{be} = 10 \text{ mV} \quad R_{be} = 250 \text{ }\Omega$$

1.2.5.

$$R_{ki} = 5 \text{ k}\Omega$$

1.2.6.

$$R_{ki} = 12 \text{ k}\Omega$$

1.2.7.

$$\begin{aligned} u_{Rt} = 10 \text{ V} & \quad i_{ki} = 1 \text{ mA} & \quad u_{be} = 9 \text{ mV} & \quad i_{be} = 750 \text{ nA} \\ A_i = 1,333 & \quad A_u = 1111 & \quad A_p = 1,481 \cdot 10^6 & \end{aligned}$$

1.2.8.

$$A_u = 20000$$

1.2.9.

$$R_g = 100 \text{ }\Omega \quad A_{u1} = 10 \quad A_{u2} = 50 \quad A_{u10} = 20$$

$$A_{u20} = 100$$

$$A_i = 500$$

$$i_g = 100 \mu\text{A}$$

$$A_p = 250000$$

$$i_{Rt} = 50 \text{ mA}$$

$$A_u = 500$$

1.2.10.

$$u_{Rt} \cong 5 \text{ V}$$

1.2.11.

a,) $A_u \cong 3 \cdot 10^6$

b,) $A_u \cong 30000$

c,) $A_u \cong 22$

2.5.

$$R_e = 390 \Omega$$

$$P_b = 180 \text{ mW}$$

$$\eta = 2,667 \%$$

2.6.

$$R_e = 15,71 \Omega$$

$$P_e = 1,925 \text{ W}$$

$$\eta = 7,778 \%$$

2.7.

$$R_{FB} = 0,5 \Omega$$

2.8.

$$U_k \cong 2,8 \text{ V}$$

$$P_{Rg} \cong 1,4 \text{ W}$$

2.9.

a,) $R \cong 240 \Omega$

$r \cong 100 \Omega$

b,) $R \cong 150 \Omega$

$r \cong 50 \Omega$

c,) $R \cong 90 \Omega$

$r \cong 20 \Omega$

2.10.

$$R_e = 66,66 \Omega$$

$$\eta_{10V} = 47,42 \%$$

$$\eta_{12V} = 27,17 \%$$

2.11.

$$R_{\min} = 26,04 \Omega$$

$$R_{\max} = 80 \Omega$$

2.12.

$$R_e = 24,64 \Omega$$

$$P_{Re} = 785,7 \text{ mW}$$

2.13.

a,) B + táp

II. – táp

b,) D + táp

III. – táp

c,) A + táp

IV. – táp

d,) B és C + táp

I. – táp

3.1.1.

a.) $R_1 = 1,48 \text{ k}\Omega$	$R_2 = 1,022 \text{ k}\Omega$	$R_C = 40 \text{ }\Omega$	$R_E = 40 \text{ }\Omega$
b.) $R_1 = 4,56 \text{ k}\Omega$	$R_2 = 1,6 \text{ k}\Omega$	$R_C = 120 \text{ }\Omega$	$R_E = 60 \text{ }\Omega$

3.1.2.

a.) $R_B = 14,8 \text{ k}\Omega$	$R_C = 40 \text{ }\Omega$	$R_E = 40 \text{ }\Omega$
b.) $R_B = 59,2 \text{ k}\Omega$	$R_C = 200 \text{ }\Omega$	$R_E = 80 \text{ }\Omega$

3.1.3.

$$U_{CE} = 6,361 \text{ V}$$

3.1.4.

$$B \cong 180 \quad U_B = 6,47 \text{ V}$$

3.1.5.

$r_{be} \cong 5 \text{ k}\Omega$	$r_{ki} = 5,638 \text{ k}\Omega$	$A_u = -105,9$	$a_u = 40,5 \text{ dB}$
$A_i = -105,9$	$a_i = 40,5 \text{ dB}$	$u_{ki} = -88,25 \text{ mV}$	

3.1.6.

$r_{be} = 4,081 \text{ k}\Omega$	$r_{ki} = 3,048 \text{ k}\Omega$	$A_u = -73,96$	$A_{u0} = -121,9$
$A_i = -63,38$	$A_p = 4688$	$u_{ki} = -297 \text{ mV}$	

3.1.7.

$r_{be} = 2,541 \text{ k}\Omega$	$r_{ki} = 14,19 \text{ k}\Omega$	
a.) $C_{be} = 2,248 \text{ }\mu\text{F}$	$C_{ki} = 329,1 \text{ nF}$	$C_E = 11,7 \text{ }\mu\text{F}$
b.) $C_{be} = 449,6 \text{ nF}$	$C_{ki} = 65,83 \text{ nF}$	$C_E = 2,342 \text{ }\mu\text{F}$
c.) $C_{be} = 44,96 \text{ nF}$	$C_{ki} = 6,583 \text{ nF}$	$C_E = 234,2 \text{ nF}$

3.1.8.

$f_0 = 160 \text{ kHz}$	$R_V = 20 \text{ k}\Omega$	$r_{be} = 4,258 \text{ k}\Omega$	
$r_{ki} = 13,33 \text{ k}\Omega$	$A_u = -228$	$A_i = -114$	$B = 1,6 \text{ kHz}$

3.2.1.

a.) $R_D = 150 \text{ }\Omega$	$R_S = 100 \text{ }\Omega$
b.) $R_D = 200 \text{ }\Omega$	$R_S = 100 \text{ }\Omega$
c.) $R_D = 350 \text{ }\Omega$	$R_S = 100 \text{ }\Omega$

3.2.2.

$$r_{be} = 100 \text{ k}\Omega \quad r_{ki} = 8 \text{ k}\Omega \quad A_u = -61,53 \quad A_i = -1231$$

$$A_p = 75729$$

3.2.3.

$$r_{be} = 100 \text{ k}\Omega \quad r_{ki} = 4,545 \text{ k}\Omega \quad A_u = -13,89 \quad A_i = -694,5$$

$$A_p = 9647 \quad P_{tr.} = 6 \text{ mW}$$

3.2.4.

$$a_u = 23,35 \text{ dB} \quad a_i = 57,5 \text{ dB} \quad R_S = 1 \text{ k}\Omega \quad R_D = 2 \text{ k}\Omega$$

$$u_{ki} = 668,1 \text{ mV} \quad C_{be} = 144,7 \text{ nF} \quad C_{ki} = 3,98 \text{ nF} \quad C_E = 159,2 \text{ nF}$$

4.1.1.

$$a,) U_{ki} = -1 \text{ V} \quad b,) U_{ki} = -3 \text{ V} \quad c,) U_{ki} = -0,5 \text{ V}$$

4.1.2.

$$a,) U_{ki} = 2 \text{ V} \quad b,) U_{ki} = 5 \text{ V} \quad c,) U_{ki} = 1,5 \text{ V}$$

4.1.3.

$$a,) U_{ki} = -3 \text{ V} \quad b,) U_{ki} = -2,5 \text{ V}$$

4.1.4.

$$a,) U_{ki} = 2 \text{ V} \quad b,) U_{ki} = 3 \text{ V}$$

4.1.5.

$$a,) U_{ki} = 2 \text{ V} \quad b,) U_{ki} = 1,5 \text{ V}$$

4.1.6.

$$a,) U_{ki} = 2 \text{ V} \quad I_3 = 200 \text{ }\mu\text{A} \quad b,) U_{ki} = 1,5 \text{ V} \quad I_3 = 100 \text{ }\mu\text{A}$$

4.1.7.

$$a,) U_{ki} = -3 \text{ V} \quad I_4 = -100 \text{ }\mu\text{A} \quad b,) U_{ki} = -2,5 \text{ V} \quad I_3 = -50 \text{ }\mu\text{A}$$

4.1.8.

$$a,) I_{ki} = -300 \text{ }\mu\text{A} \quad b,) I_{ki} = -200 \text{ }\mu\text{A}$$

4.1.9.

$$a,) U_{ki} = 2 \text{ V} \quad b,) U_{ki} = 3 \text{ V}$$

4.1.10.

$$a,) U_{ki} = -5 \text{ V} \quad b,) U_{ki} = -10 \text{ V}$$

4.1.11.

a,) $U_{ki} = 1 \text{ V}$ b,) $U_{ki} = -1 \text{ V}$

4.1.12.

a,) $U_{ki} = 7,5 \text{ V}$ b,) $U_{ki} = -2,5 \text{ V}$

4.1.13.

a,) $U_{ki} = 8 \text{ V}$ b,) $U_{ki} = -2 \text{ V}$

4.2.1.

$$R_1 = 9,75 \text{ k}\Omega \quad R_3 = 390 \text{ k}\Omega \quad R_{be} = 9,75 \text{ k}\Omega \quad U_{be} = 18,14 \text{ mV}$$

$$U_{ki} = 725,5 \text{ mV}$$

4.2.2.

$$A_u = -25 \quad R_{be} = 20 \text{ k}\Omega \quad R_3 = 500 \text{ k}\Omega \quad P_{kimax} = 56,18 \text{ mW}$$

$$U_{kimax} = 8,485 \text{ V} \quad U_{bemax} = 339,4 \text{ mV}$$

4.2.3.

$$R_2 = 100 \text{ k}\Omega \quad R_3 = 100 \text{ k}\Omega \quad R_{be} = 1 \text{ k}\Omega \quad C_{be} = 7,962 \text{ }\mu\text{F}$$

$$C_{ki} = 7,962 \text{ }\mu\text{F}$$

4.2.4.

$$A_u = -9,4 \quad a_u = 19,46 \text{ dB} \quad A_p = 2209 \quad a_p = 33,44 \text{ dB}$$

$$P_t = 76,67 \text{ }\mu\text{W} \quad C_1 = 530,7 \text{ nF} \quad R_3 = 470 \text{ k}\Omega$$

4.2.5.

$$R_2 = 200 \text{ k}\Omega \quad R_3 = 200 \text{ k}\Omega \quad f_f = 500 \text{ kHz} \quad U_{bemax} = 530,3 \text{ mV}$$

$$f_{abe} = 5,308 \text{ Hz} \quad f_{aki} = 3,981 \text{ Hz}$$

4.2.6.

$$R_2 = 300 \text{ k}\Omega \quad R_{be} = 10 \text{ k}\Omega \quad A_{u1} = -30 \quad A_{u2} = 31$$

$$A_u = -930 \quad a_u = 59,37 \text{ dB} \quad U_{ki} = 4,227 \text{ V}$$

4.2.7.

$$R_3 = 243 \text{ k}\Omega \quad f_f = 70,8 \text{ kHz}$$

5.1.1.

dec		bináris		hex
136		1 0 0 0 1 0 0 0		8 8
64		0 1 0 0 0 0 0 0		4 0
201		1 1 0 0 1 0 0 1		C 9
48		0 0 1 1 0 0 0 0		3 0
156		1 0 0 1 1 1 0 0		9 C
65		0 1 0 0 0 0 0 1		4 1
225		1 1 1 0 0 0 0 1		E 1
206		1 1 0 0 1 1 1 0		C E
90		0 1 0 1 1 0 1 0		5 A
131		1 0 0 0 0 0 1 1		8 3

5.1.2.

dec		bináris		hex
89		0 1 0 1 1 0 0 1		5 9
194		1 1 0 0 0 0 1 0		C 2
131		1 0 0 0 0 0 1 1		8 3
44		0 0 1 0 1 1 0 0		2 C
165		1 0 1 0 0 1 0 1		A 5
102		0 1 1 0 0 1 1 0		6 6
172		1 0 1 0 1 1 0 0		A C
49		0 0 1 1 0 0 0 1		3 1
202		1 1 0 0 1 0 1 0		C A
161		1 0 1 0 0 0 0 1		A 1

5.1.3.

dec		bináris		hex
70		0 1 0 0 0 1 1 0		4 6
19		0 0 0 1 0 0 1 1		1 3
93		0 1 0 1 1 1 0 1		5 D
244		1 1 1 1 0 1 0 0		F 4
238		1 1 1 0 1 1 1 0		E E
213		1 1 0 1 0 1 0 1		D 5
246		1 1 1 1 0 1 1 0		F 6
47		0 0 1 0 1 1 1 1		2 F
41		0 0 1 0 1 0 0 1		2 9
53		0 0 1 1 0 1 0 1		3 5

5.1.4.

dec	előjeles bináris	1'komplement	2'komplement
74	0 1 0 0 1 0 1 0	0 1 0 0 1 0 1 0	0 1 0 0 1 0 1 0
-48	1 0 1 1 0 0 0 0	1 1 0 0 1 1 1 1	1 1 0 1 0 0 0 0
-80	1 1 0 1 0 0 0 0	1 0 1 0 1 1 1 1	1 0 1 1 0 0 0 0
81	0 1 0 1 0 0 0 1	0 1 0 1 0 0 0 1	0 1 0 1 0 0 0 1
-105	1 1 1 0 1 0 0 1	1 0 0 1 0 1 1 0	1 0 0 1 0 1 1 1
-59	1 0 1 1 1 0 1 1	1 1 0 0 0 1 0 0	1 1 0 0 0 1 0 1
-38	1 0 1 0 0 1 1 0	1 1 0 1 1 0 0 1	1 1 0 1 1 0 1 0
-125	1 1 1 1 1 1 0 1	1 0 0 0 0 0 1 0	1 0 0 0 0 0 1 1
33	0 0 1 0 0 0 0 1	0 0 1 0 0 0 0 1	0 0 1 0 0 0 0 1
-116	1 1 1 1 0 1 0 0	1 0 0 0 1 0 1 1	1 0 0 0 1 1 0 0

5.1.5.

dec	előjeles bináris	1'komplement	2'komplement
81	0 1 0 1 0 0 0 1	0 1 0 1 0 0 0 1	0 1 0 1 0 0 0 1
-59	1 0 1 1 1 0 1 1	1 1 0 0 0 1 0 0	1 1 0 0 0 1 0 1
-52	1 0 1 1 0 1 0 0	1 1 0 0 1 0 1 1	1 1 0 0 1 1 0 0
54	0 0 1 1 0 1 1 0	0 0 1 1 0 1 1 0	0 0 1 1 0 1 1 0
99	0 1 1 0 0 0 1 1	0 1 1 0 0 0 1 1	0 1 1 0 0 0 1 1
-72	1 1 0 0 1 0 0 0	1 0 1 1 0 1 1 1	1 0 1 1 1 0 0 0
-124	1 1 1 1 1 1 0 0	1 0 0 0 0 0 1 1	1 0 0 0 0 1 0 0
119	0 1 1 1 0 1 1 1	0 1 1 1 0 1 1 1	0 1 1 1 0 1 1 1
-96	1 1 1 0 0 0 0 0	1 0 0 1 1 1 1 1	1 0 1 0 0 0 0 0
-119	1 1 1 1 0 1 1 1	1 0 0 0 1 0 0 0	1 0 0 0 1 0 0 1

5.1.6.

dec	előjeles bináris	1'komplement	2'komplement
-110	1 1 1 0 1 1 1 0	1 0 0 1 0 0 0 1	1 0 0 1 0 0 1 0
-63	1 0 1 1 1 1 1 1	1 1 0 0 0 0 0 0	1 1 0 0 0 0 0 1
-34	1 0 1 0 0 0 1 0	1 1 0 1 1 1 0 1	1 1 0 1 1 1 1 0
84	0 1 0 1 0 1 0 0	0 1 0 1 0 1 0 0	0 1 0 1 0 1 0 0
-81	1 1 0 1 0 0 0 1	1 0 1 0 1 1 1 0	1 0 1 0 1 1 1 1
60	0 0 1 1 1 1 0 0	0 0 1 1 1 1 0 0	0 0 1 1 1 1 0 0
28	0 0 0 1 1 1 0 0	0 0 0 1 1 1 0 0	0 0 0 1 1 1 0 0
-58	1 0 1 1 1 0 1 0	1 1 0 0 0 1 0 1	1 1 0 0 0 1 1 0
-87	1 1 0 1 0 1 1 1	1 0 1 0 1 0 0 0	1 0 1 0 1 0 0 1
61	0 0 1 1 1 1 0 1	0 0 1 1 1 1 0 1	0 0 1 1 1 1 0 1

5.1.7.

dec	előjeles bináris	1'komplement	2'komplement
-62	1 0 1 1 1 1 1 0	1 1 0 0 0 0 0 1	1 1 0 0 0 0 1 0
-127	1 1 1 1 1 1 1 1	1 0 0 0 0 0 0 0	1 0 0 0 0 0 0 1
-50	1 0 1 1 0 0 1 0	1 1 0 0 1 1 0 1	1 1 0 0 1 1 1 0
41	0 0 1 0 1 0 0 1	0 0 1 0 1 0 0 1	0 0 1 0 1 0 0 1
72	0 1 0 0 1 0 0 0	0 1 0 0 1 0 0 0	0 1 0 0 1 0 0 0
-37	1 0 1 0 0 1 0 1	1 1 0 1 1 0 1 0	1 1 0 1 1 0 1 1
49	0 0 1 1 0 0 0 1	0 0 1 1 0 0 0 1	0 0 1 1 0 0 0 1
-96	1 1 1 0 0 0 0 0	1 0 0 1 1 1 1 1	1 0 1 0 0 0 0 0
36	0 0 1 0 0 1 0 0	0 0 1 0 0 1 0 0	0 0 1 0 0 1 0 0
21	0 0 0 1 0 1 0 1	0 0 0 1 0 1 0 1	0 0 0 1 0 1 0 1

5.1.8.

dec	előjeles bináris	1'komplement	2'komplement
40	0 0 1 0 1 0 0 0	0 0 1 0 1 0 0 0	0 0 1 0 1 0 0 0
121	0 1 1 1 1 0 0 1	0 1 1 1 1 0 0 1	0 1 1 1 1 0 0 1
21	0 0 0 1 0 1 0 1	0 0 0 1 0 1 0 1	0 0 0 1 0 1 0 1
124	0 1 1 1 1 1 0 0	0 1 1 1 1 1 0 0	0 1 1 1 1 1 0 0
-122	1 1 1 1 1 0 1 0	1 0 0 0 0 1 0 1	1 0 0 0 0 1 1 0
-117	1 1 1 1 0 1 0 1	1 0 0 0 1 0 1 0	1 0 0 0 1 0 1 1
62	0 0 1 1 1 1 1 0	0 0 1 1 1 1 1 0	0 0 1 1 1 1 1 0
-101	1 1 1 0 0 1 0 1	1 0 0 1 1 0 1 0	1 0 0 1 1 0 1 1
-2	1 0 0 0 0 0 1 0	1 1 1 1 1 1 0 1	1 1 1 1 1 1 1 0
81	0 1 0 1 0 0 0 1	0 1 0 1 0 0 0 1	0 1 0 1 0 0 0 1
-35	1 0 1 0 0 0 1 1	1 1 0 1 1 1 0 0	1 1 0 1 1 1 0 1
25	0 0 0 1 1 0 0 1	0 0 0 1 1 0 0 1	0 0 0 1 1 0 0 1
21	0 0 0 1 0 1 0 1	0 0 0 1 0 1 0 1	0 0 0 1 0 1 0 1
-13	1 0 0 0 1 1 0 1	1 1 1 1 0 0 1 0	1 1 1 1 0 0 1 1
-113	1 1 1 1 0 0 0 1	1 0 0 0 1 1 1 0	1 0 0 0 1 1 1 1
97	0 1 1 0 0 0 0 1	0 1 1 0 0 0 0 1	0 1 1 0 0 0 0 1
85	0 1 0 1 0 1 0 1	0 1 0 1 0 1 0 1	0 1 0 1 0 1 0 1
-85	1 1 0 1 0 1 0 1	1 0 1 0 1 0 1 0	1 0 1 0 1 0 1 1
-32	1 0 1 0 0 0 0 0	1 1 0 1 1 1 1 1	1 1 1 0 0 0 0 0
70	0 1 0 0 0 1 1 0	0 1 0 0 0 1 1 0	0 1 0 0 0 1 1 0

5.2.1.

$\begin{array}{r} 00110001 \\ + 10110110 \\ \hline 11100111 \end{array}$	$\begin{array}{r} 00010011 \\ + 10000111 \\ \hline 10011010 \end{array}$
$\begin{array}{r} 10111010 \\ + 00001101 \\ \hline 11000111 \end{array}$	$\begin{array}{r} 01011011 \\ + 11010001 \\ \hline 100101100 \text{ carry} \end{array}$
$\begin{array}{r} 11101011 \\ + 00100110 \\ \hline 100010001 \text{ carry} \end{array}$	$\begin{array}{r} 11110100 \\ + 00000101 \\ \hline 11111001 \end{array}$
$\begin{array}{r} 01011110 \\ + 00010100 \\ \hline 01110010 \end{array}$	$\begin{array}{r} 10111111 \\ + 01111001 \\ \hline 100111000 \text{ carry} \end{array}$
$\begin{array}{r} 11101010 \\ + 10100101 \\ \hline 110001111 \text{ carry} \end{array}$	$\begin{array}{r} 11101000 \\ + 01000000 \\ \hline 100101000 \text{ carry} \end{array}$
$\begin{array}{r} 10110101 \\ + 00011110 \\ \hline 11010011 \end{array}$	$\begin{array}{r} 00000110 \\ + 10111001 \\ \hline 10111111 \end{array}$

5.2.2.

$\begin{array}{r} 00101011 \\ + 00010000 \\ \hline 00111011 \end{array}$	$\begin{array}{r} 01000111 \\ + 01001110 \\ \hline 10010101 \text{ overflow} \end{array}$
$\begin{array}{r} 00001011 \\ + 11101011 \\ \hline 11110110 \end{array}$	$\begin{array}{r} 01011101 \\ + 00010011 \\ \hline 01110000 \end{array}$
$\begin{array}{r} 01000010 \\ + 01001100 \\ \hline 10001110 \text{ overflow} \end{array}$	$\begin{array}{r} 10001110 \\ + 01111100 \\ \hline 100001010 \end{array}$
$\begin{array}{r} 11111011 \\ + 10001101 \\ \hline 110001000 \end{array}$	$\begin{array}{r} 01101100 \\ + 10011000 \\ \hline 100000100 \end{array}$
$\begin{array}{r} 11011001 \\ + 10010110 \\ \hline 101101111 \text{ overflow} \end{array}$	$\begin{array}{r} 01001110 \\ + 10000001 \\ \hline 11001111 \end{array}$
$\begin{array}{r} 10001100 \\ + 00000110 \\ \hline 10010010 \end{array}$	$\begin{array}{r} 10111110 \\ + 10101011 \\ \hline 101101001 \text{ overflow} \end{array}$

5.2.3.

$\begin{array}{r} 1\ 1\ 1\ 0\ 0\ 0\ 0\ 0 \\ -\ 0\ 0\ 1\ 0\ 1\ 1\ 0\ 1 \\ \hline 1\ 1\ 0\ 1\ 1\ 0\ 0\ 1\ 1 \end{array}$	$\begin{array}{r} 1\ 0\ 1\ 1\ 0\ 0\ 1\ 1 \\ -\ 0\ 0\ 0\ 0\ 1\ 1\ 1\ 1 \\ \hline 1\ 1\ 0\ 1\ 0\ 0\ 1\ 0\ 0 \end{array}$
$\begin{array}{r} 1\ 0\ 1\ 0\ 0\ 0\ 0\ 1 \\ -\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 1 \\ \hline 1\ 1\ 0\ 0\ 0\ 1\ 1\ 0\ 0 \end{array}$	$\begin{array}{r} 0\ 0\ 1\ 0\ 1\ 0\ 0\ 1 \\ -\ 0\ 0\ 1\ 1\ 0\ 0\ 0\ 0 \\ \hline 1\ 1\ 1\ 1\ 1\ 0\ 0\ 1 \end{array}$
$\begin{array}{r} 0\ 1\ 1\ 1\ 0\ 1\ 0\ 1 \\ -\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 1 \\ \hline 1\ 0\ 0\ 1\ 0\ 0\ 1\ 0\ 0 \end{array}$	$\begin{array}{r} 0\ 1\ 0\ 1\ 1\ 1\ 1\ 1 \\ -\ 0\ 0\ 1\ 1\ 1\ 0\ 1\ 0 \\ \hline 1\ 0\ 0\ 1\ 0\ 0\ 1\ 0\ 1 \end{array}$
$\begin{array}{r} 0\ 0\ 1\ 0\ 0\ 0\ 0\ 1 \\ -\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 0 \\ \hline 1\ 1\ 0\ 0\ 0\ 0\ 0\ 1 \end{array}$	$\begin{array}{r} 0\ 1\ 0\ 1\ 0\ 1\ 1\ 1 \\ -\ 0\ 0\ 1\ 0\ 1\ 0\ 1\ 1 \\ \hline 1\ 0\ 0\ 1\ 0\ 1\ 1\ 0\ 0 \end{array}$
$\begin{array}{r} 0\ 0\ 1\ 1\ 1\ 0\ 0\ 1 \\ -\ 0\ 0\ 1\ 0\ 1\ 1\ 1\ 1 \\ \hline 1\ 0\ 0\ 0\ 0\ 1\ 0\ 1\ 0 \end{array}$	$\begin{array}{r} 0\ 0\ 0\ 1\ 0\ 0\ 0\ 1 \\ -\ 0\ 1\ 1\ 0\ 1\ 0\ 0\ 0 \\ \hline 1\ 0\ 1\ 0\ 1\ 0\ 0\ 1 \end{array}$
$\begin{array}{r} 1\ 1\ 0\ 1\ 0\ 1\ 1\ 0 \\ -\ 0\ 1\ 1\ 1\ 1\ 1\ 0\ 1 \\ \hline 1\ 0\ 1\ 0\ 1\ 1\ 0\ 0\ 1 \end{array}$	$\begin{array}{r} 1\ 0\ 1\ 0\ 0\ 1\ 0\ 1 \\ -\ 0\ 1\ 0\ 1\ 0\ 1\ 1\ 0 \\ \hline 1\ 0\ 1\ 0\ 0\ 1\ 1\ 1\ 1 \end{array}$
<p>1 0 1 0 1 1 0 0 1 overflow</p>	<p>1 0 1 0 0 1 1 1 1 overflow</p>

5.2.4.

62	0 0 1 1 1 1 1 0	21	0 0 0 1 0 1 0 1
16	+ 0 0 0 1 0 0 0 0	-123	+ 1 0 0 0 0 1 0 1
78	<u>0 1 0 0 1 1 1 0</u>	-102	<u>1 0 0 1 1 0 1 0</u>
44	0 0 1 0 1 1 0 0	-94	1 0 1 0 0 0 1 0
92	+ 0 1 0 1 1 1 0 0	92	+ 0 1 0 1 1 1 0 0
-120	<u>1 0 0 0 1 0 0 0</u> overflow	-2	<u>1 1 1 1 1 1 1 0</u>
-68	1 0 1 1 1 1 0 0	-68	1 0 1 1 1 1 0 0
119	+ 0 1 1 1 0 1 1 1	47	+ 0 0 1 0 1 1 1 1
51	<u>1 0 0 1 1 0 0 1 1</u>	-21	<u>1 1 1 0 1 0 1 1</u>
113	0 1 1 1 0 0 0 1	59	0 0 1 1 1 0 1 1
103	+ 0 1 1 0 0 1 1 1	44	+ 0 0 1 0 1 1 0 0
-40	<u>1 1 0 1 1 0 0 0</u> overflow	103	<u>0 1 1 0 0 1 1 1</u>
-11	1 1 1 1 0 1 0 1	-126	1 0 0 0 0 0 1 0
79	+ 0 1 0 0 1 1 1 1	118	+ 0 1 1 1 0 1 1 0
68	<u>1 0 1 0 0 0 1 0 0</u>	-8	<u>1 1 1 1 1 0 0 0</u>
34	0 0 1 0 0 0 1 0	31	0 0 0 1 1 1 1 1
-41	+ 1 1 0 1 0 1 1 1	122	+ 0 1 1 1 1 0 1 0
7	<u>1 1 1 1 1 0 0 1</u>	-103	<u>1 0 0 1 1 0 0 1</u> overflow

6.1.1.

a) $F^3 = \bar{B}$

b) $F^3 = \bar{A}$

c) $F^3 = A \cdot C$

d) $F^3 = \bar{A} \cdot C$

e) $F^3 = \bar{B} \cdot C$

f) $F^3 = C$

g) $F^3 = B$

h) $F^3 = A$

6.1.2.

a) $F^3 = \bar{B}$

b) $F^3 = \bar{C}$

c) $F^3 = \bar{A} + \bar{C}$

d) $F^3 = A + \bar{B}$

e) $F^3 = A + B$

f) $F^3 = A$

g) $F^3 = C$

h) $F^3 = B$

6.1.3.

a) $F^3 = \bar{B}$

b) $F^3 = \bar{A}$

c) $F^3 = A$

d) $F^3 = B$

e) $F^3 = C$

f) $F^3 = \bar{C}$

g) $F^3 = \bar{A} \cdot \bar{B} + A \cdot C$

h) $F^3 = 1$

6.1.4.

a) $F^3 = B$

b) $F^3 = A$

c) $F^3 = \bar{A}$

d) $F^3 = \bar{B}$

e) $F^3 = \bar{C}$

f) $F^3 = C$

g) $F^3 = (A + B) \cdot (\bar{A} + \bar{C})$

h) $F^3 = 0$

6.1.5.

a) $F^3 = \bar{B} \cdot (\bar{A} + C)$

b) $F^3 = \bar{A} \cdot (B + C)$

c) $F^3 = C \cdot (A + B)$

d) $F^3 = A \cdot (B + C)$

e) $F^3 = B \cdot C + A \cdot B + A \cdot C$

f) $F^3 = \bar{A} \cdot \bar{B} + \bar{A} \cdot C + \bar{B} \cdot C$

6.1.6.

a) $F^3 = A + (B \cdot \bar{C})$

b) $F^3 = \bar{B} + (A \cdot \bar{C})$

c) $F^3 = \bar{A} + (\bar{B} \cdot \bar{C})$

d) $F^3 = \bar{C} + (A \cdot \bar{B})$

e) $F^3 = (B \cdot \bar{C}) + (\bar{A} \cdot B) + (\bar{A} \cdot \bar{C})$

f) $F^3 = (B \cdot \bar{C}) + (A \cdot B) + (A \cdot \bar{C})$

6.1.7.

a) $F^3 = B$

b) $F^3 = C$

c) $F^3 = \bar{B}$

d) $F^3 = C$

e) $F^3 = \bar{C}$

f) $F^3 = \bar{A}$

g) $F^3 = B$

h) $F^3 = 1$

i) $F^3 = \bar{B}$

j) $F^3 = 1$

6.2.1

a,) $F^3 = \sum^3(1,3,5,7)$

$F^3 = \prod^3(1,3,5,7)$

b,) $F^3 = \sum^3(2,3,4,5,7)$

$F^3 = \prod^3(1,6,7)$

c,) $F^3 = \sum^3(0,1,3,6)$

$F^3 = \prod^3(0,2,3,5)$

d,) $F^3 = \sum^3(2,4,5,6)$

$F^3 = \prod^3(0,4,6,7)$

6.2.2.

a,) $F^4 = \prod^4(1,3,4,6,7,9,10,11,12,13)$

b,) $F^4 = \prod^4(0,3,5,6,9,10,12,15)$

	C			
	1	1		
			1	
A		1	1	
				1
	D			

minterm

	C			
			1	1
A	1	1		1
	1			1
	1	1	1	
	D			D

Maxterm

	C			
		1		1
	1		1	
A		1		1
	1			1
	D			

minterm

	C			
	1		1	
A	1			1
	1			1
		1		1
	D			D

Maxterm

c,) $F^4 = \prod^4(0,1,3,5,6,7,10,13,15)$

d,) $F^4 = \prod^4(0,3,5,6,7,9,13,14,15)$

	C			
		1	1	
	1		1	1
A		1		
			1	
	D			

minterm

	C			
	1			1
A		1		
	1		1	1
	1	1		1
	D			D

Maxterm

	C			
			1	
	1	1	1	
A		1		1
			1	
	D			

minterm

	C			
	1	1		1
A				1
	1		1	
	1	1		1
	D			D

Maxterm

e,) $F^4 = \sum^4(0,3,5,6,9,10,12,15)$

f,) $F^4 = \sum^4(2,3,6,7,8,9,12,14)$

	C			
	1		1	
		1		1
A	1		1	
		1		1
	D			

minterm

	C			
		1		1
A	1		1	
		1		1
	1		1	
	D			D

Maxterm

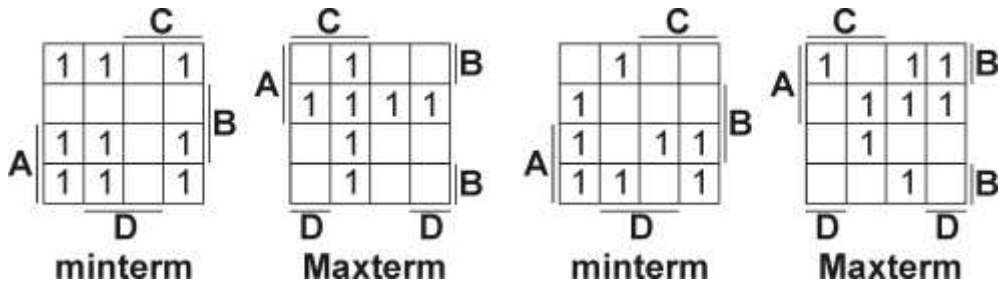
	C			
			1	1
			1	1
A	1			1
	1	1		
	D			

minterm

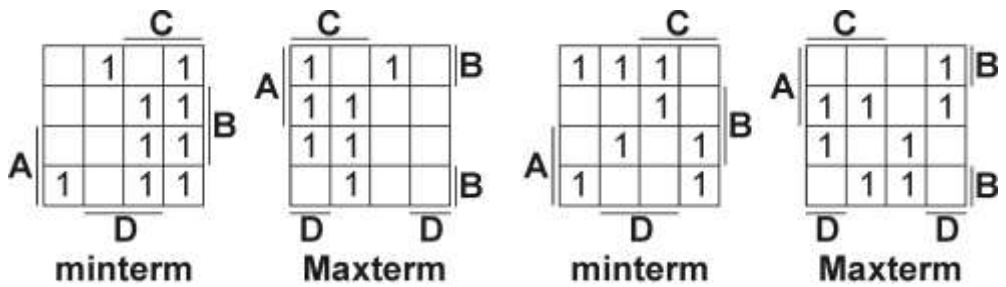
	C			
	1	1		
A	1	1		
		1	1	
			1	1
	D			D

Maxterm

g.) $F^4 = \sum^4(0,1,2,8,9,10,12,13,14)$ h.) $F^4 = \sum^4(1,4,8,9,10,12,14,15)$

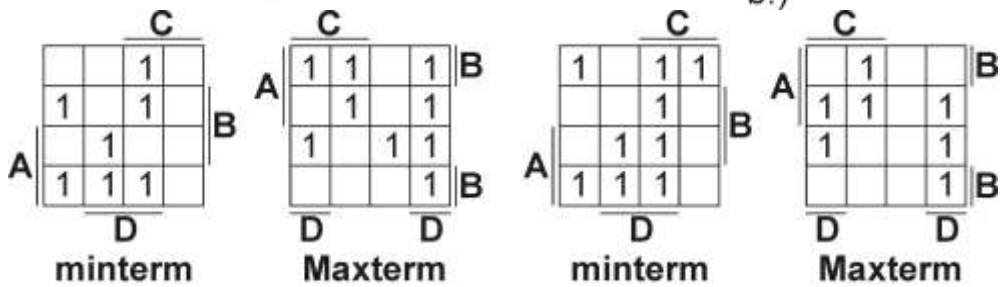


6.2.3.



a.)

b.)

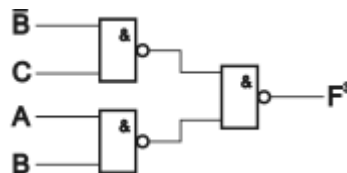
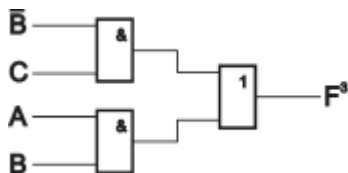


c.)

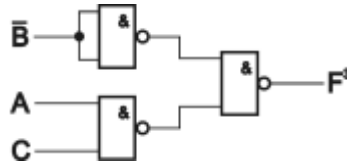
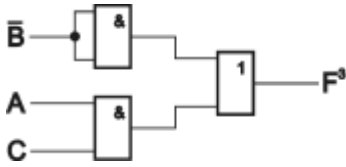
d.)

6.2.4.

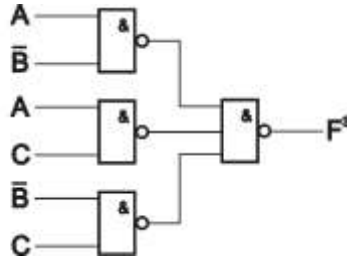
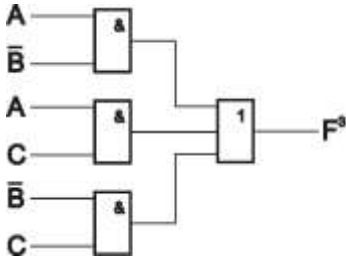
a.) $F^3 = \bar{B} \cdot C + A \cdot B$



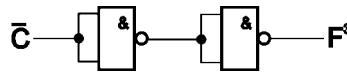
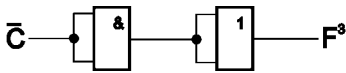
b.) $F^3 = \bar{B} + A \cdot C$



c.) $F^3 = A \cdot \bar{B} + A \cdot C + \bar{B} \cdot C$

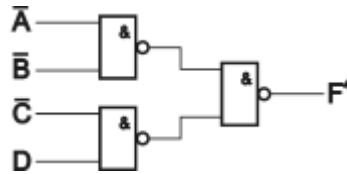
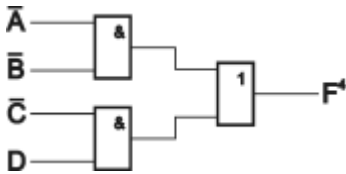


d.) $F^3 = \bar{C}$

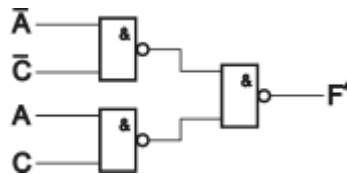
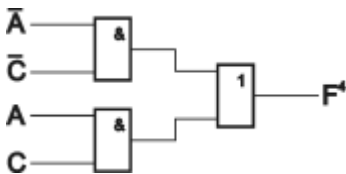


6.2.5.

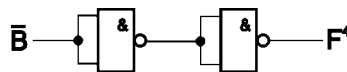
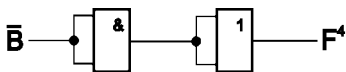
a.) $F^4 = \bar{A} \cdot \bar{B} + \bar{C} \cdot D$



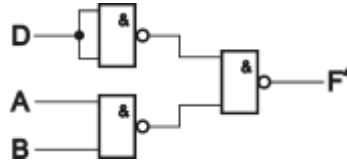
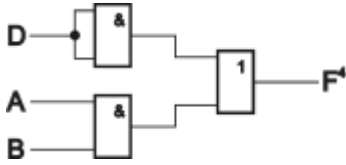
b.) $F^4 = \bar{A} \cdot \bar{C} + A \cdot C$



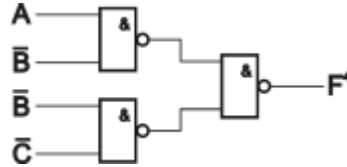
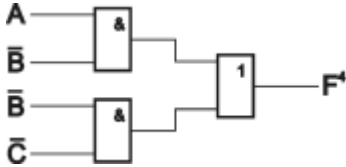
c.) $F^4 = \bar{B}$



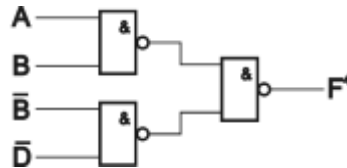
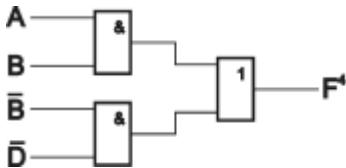
d,) $F^4 = D + A \cdot B$



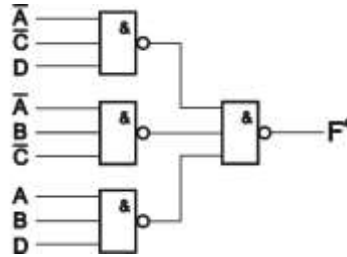
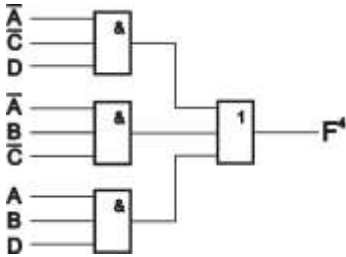
e,) $F^4 = A \cdot \bar{B} + \bar{B} \cdot \bar{C}$



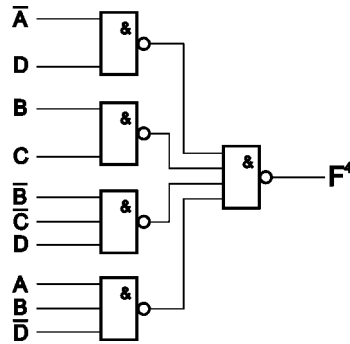
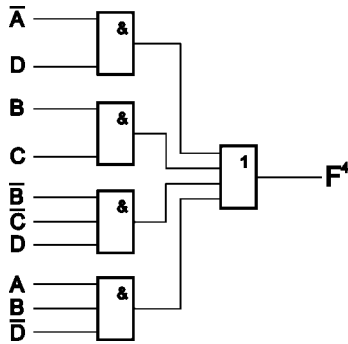
f,) $F^4 = A \cdot B + \bar{B} \cdot \bar{D}$



g,) $F^4 = \bar{A} \cdot \bar{C} \cdot D + \bar{A} \cdot B \cdot \bar{C} + A \cdot B \cdot D$

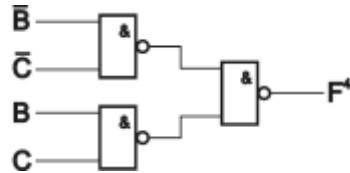
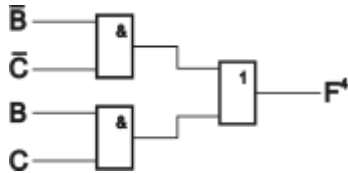


$$h.) F^4 = \bar{A} \cdot D + B \cdot C + \bar{B} \cdot \bar{C} \cdot D + A \cdot B \cdot \bar{D}$$

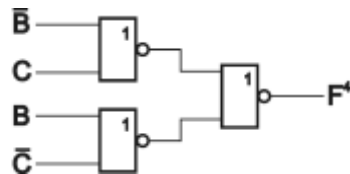
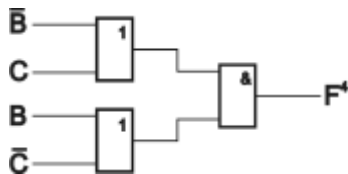


6.2.6.

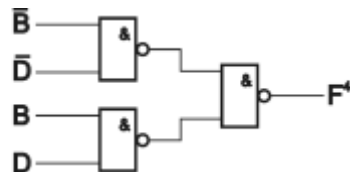
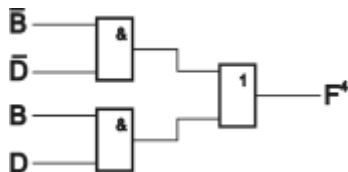
$$a.) F^4 = \bar{B} \cdot \bar{C} + B \cdot C$$



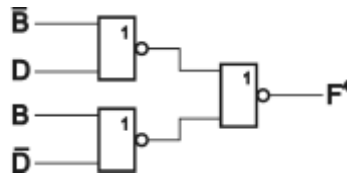
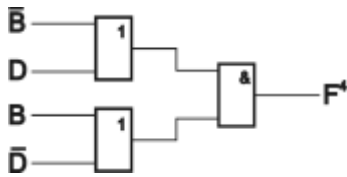
$$F^4 = (\bar{B} + C) \cdot (B + \bar{C})$$



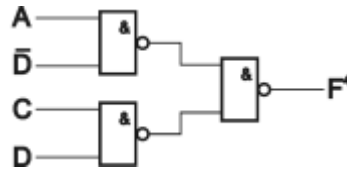
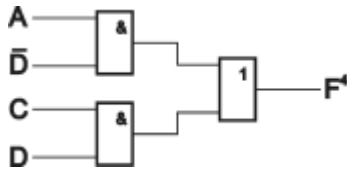
$$b.) F^4 = \bar{B} \cdot \bar{D} + B \cdot D$$



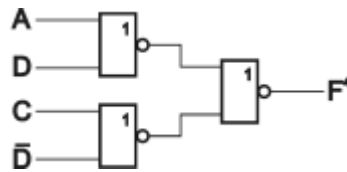
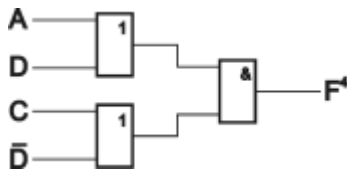
$$F^4 = (\bar{B} + D) \cdot (B + \bar{D})$$



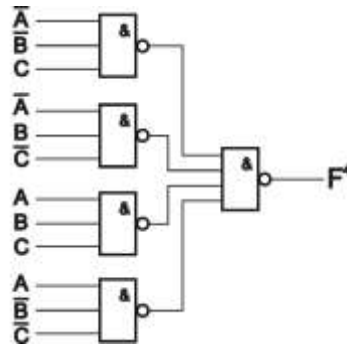
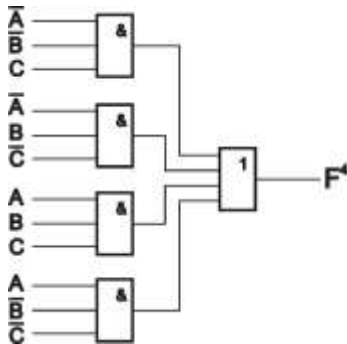
c.) $F^4 = C \cdot D + A \cdot \bar{D}$



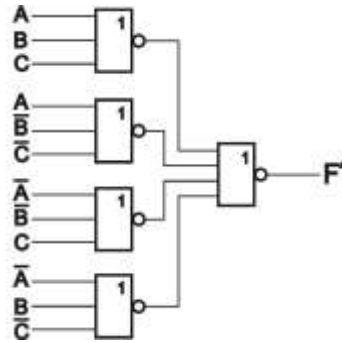
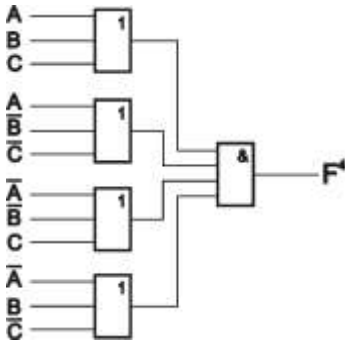
$$F^4 = (C + \bar{D}) \cdot (A + D)$$



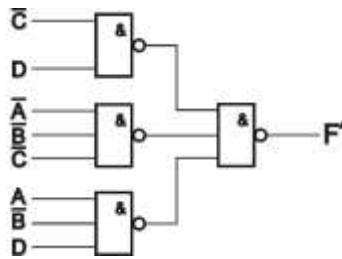
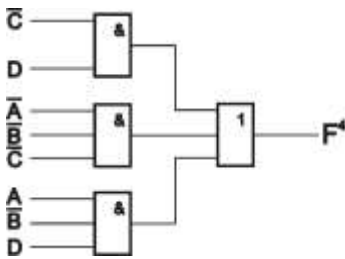
d.) $F^4 = \bar{A} \cdot \bar{B} \cdot C + \bar{A} \cdot B \cdot \bar{C} + A \cdot B \cdot C + A \cdot \bar{B} \cdot \bar{C}$



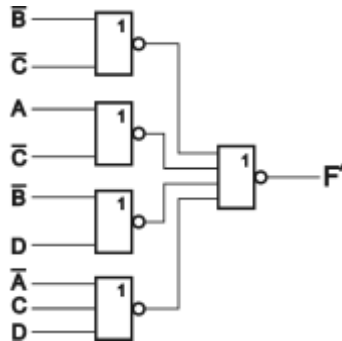
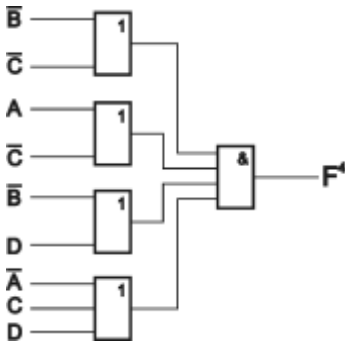
$$F^4 = (A+B+C) \cdot (A+\bar{B}+\bar{C}) \cdot (\bar{A}+\bar{B}+C) \cdot (\bar{A}+B+\bar{C})$$



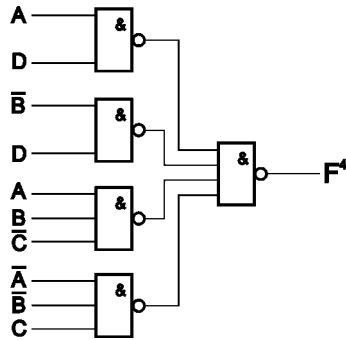
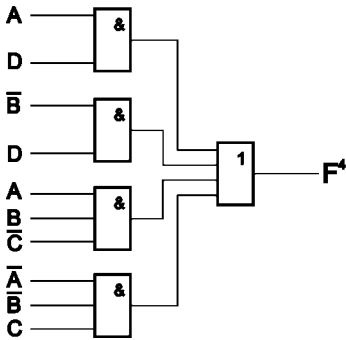
e.) $F^4 = \bar{C} \cdot D + \bar{A} \cdot \bar{B} \cdot \bar{C} + A \cdot \bar{B} \cdot D$



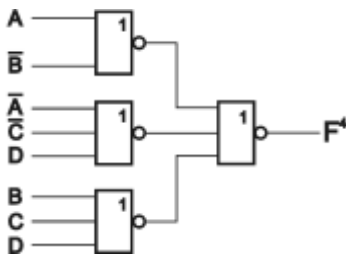
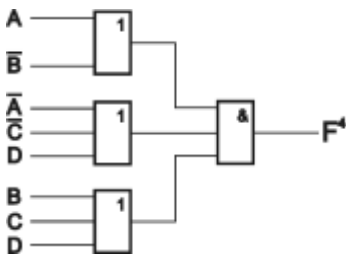
$$F^4 = (\bar{B} + \bar{C}) \cdot (A + \bar{C}) \cdot (\bar{B} + D) \cdot (\bar{A} + C + D)$$



f.) $F^4 = A \cdot D + \bar{B} \cdot D + A \cdot B \cdot \bar{C} + \bar{A} \cdot \bar{B} \cdot C$

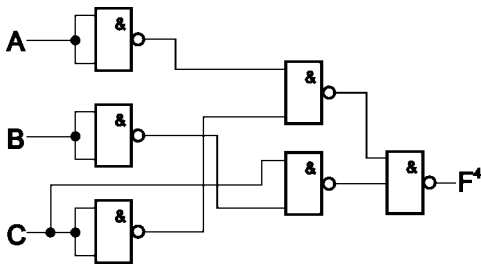


$F^4 = (A + \bar{B}) \cdot (\bar{A} + \bar{C} + D) \cdot (B + C + D)$

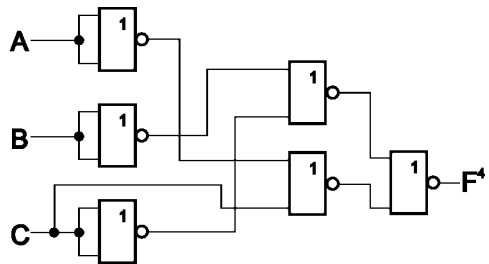


6.2.7.

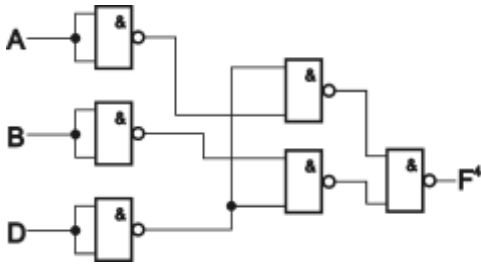
a.) $F^4 = \bar{A} \cdot \bar{C} + \bar{B} \cdot C$



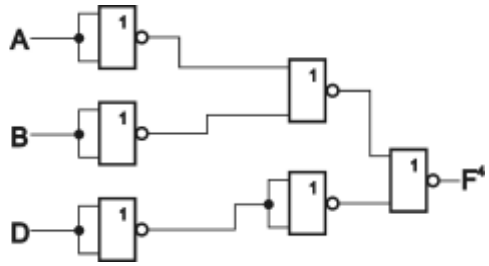
$F^4 = (\bar{B} + \bar{C}) \cdot (\bar{A} + C)$



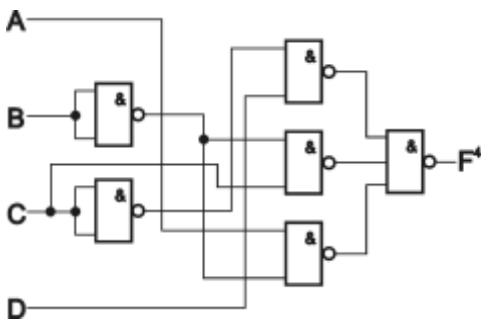
$$b.) F^4 = \bar{A} \cdot \bar{D} + \bar{B} \cdot \bar{D}$$



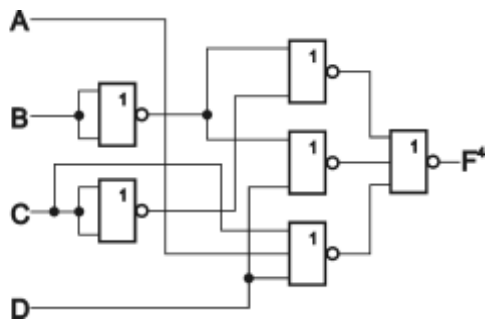
$$F^4 = \bar{D} \cdot (\bar{A} + \bar{B})$$



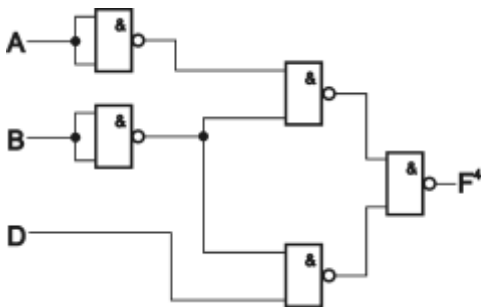
$$c.) F^4 = \bar{C} \cdot D + \bar{B} \cdot C + A \cdot \bar{B}$$



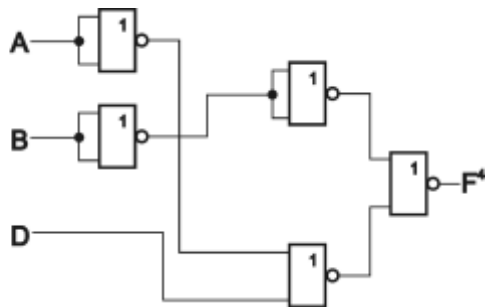
$$F^4 = (\bar{B} + \bar{C}) \cdot (\bar{B} + D) \cdot (A + C + D)$$



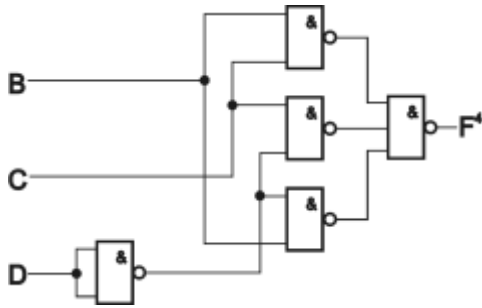
$$d.) F^4 = \bar{A} \cdot \bar{B} + \bar{B} \cdot D$$



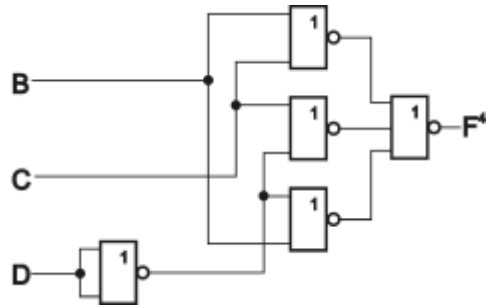
$$F^4 = \bar{B} \cdot (\bar{A} + D)$$



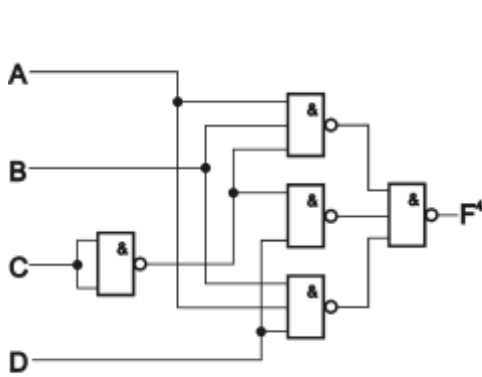
e.) $F^4 = C \cdot \bar{D} + B \cdot C + B \cdot \bar{D}$



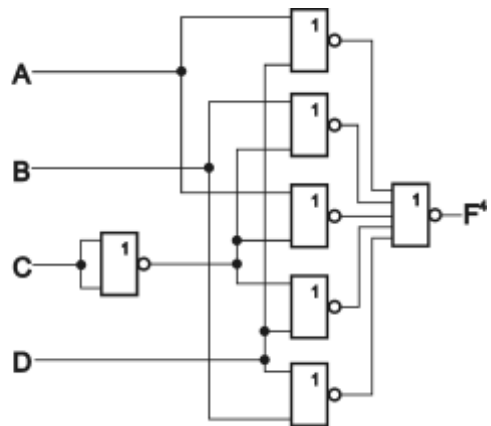
$F^4 = (C + \bar{D}) \cdot (B + C) \cdot (B + \bar{D})$



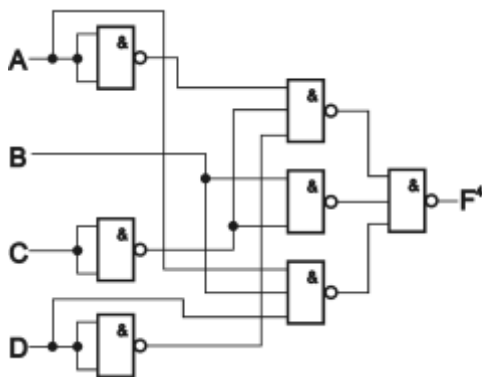
f.) $F^4 = \bar{C} \cdot D + A \cdot B \cdot \bar{C} + A \cdot B \cdot D$



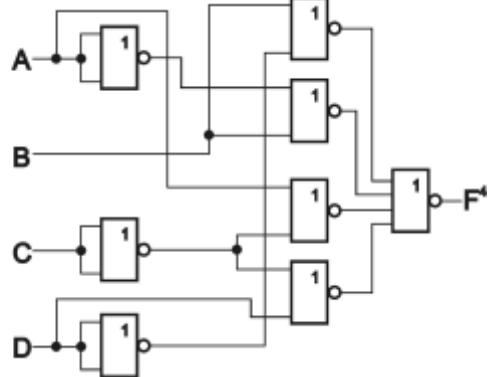
$F^4 = (\bar{C} + D) \cdot (A + \bar{C}) \cdot (B + C) \cdot (A + D) \cdot (B + D)$



g.) $F^4 = B \cdot \bar{C} + \bar{A} \cdot \bar{C} \cdot \bar{D} + A \cdot B \cdot D$



$F^4 = (\bar{C} + D) \cdot (\bar{A} + B) \cdot (B + \bar{D}) \cdot (A + \bar{C})$



h,) $F^4 = C \cdot \bar{D} + B \cdot C + A \cdot \bar{B} + A \cdot D$ $F^4 = (A + C) \cdot (A + B + \bar{D}) \cdot (\bar{B} + C + D)$

