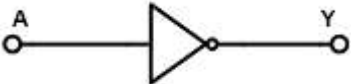
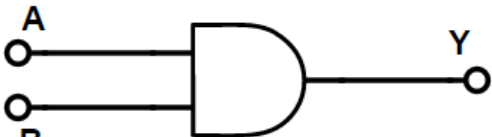
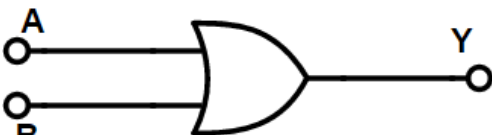
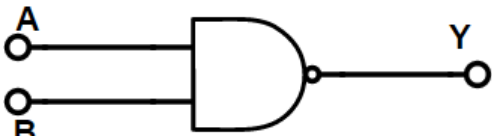
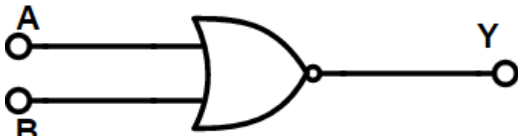
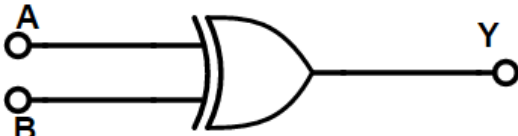
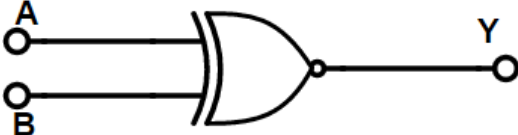




Porti Logice cu diode si tranzistori bipolari

Scopul acestei lucrari este invatarea principiilor de baza care stau la construirea portilor logice folosind diode si tranzistori bipolari.

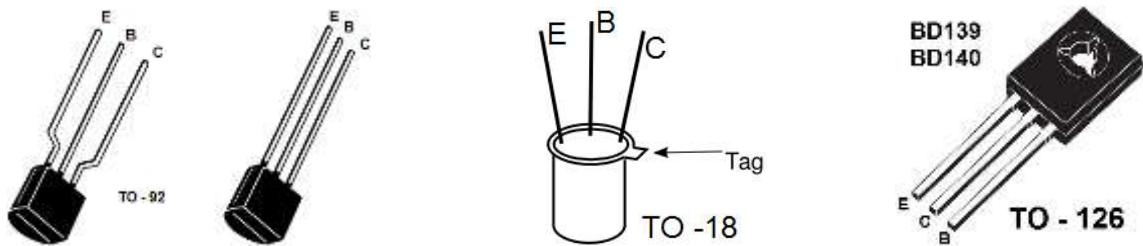
Breviar porți logice

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 <p>Poarta SAU NU (NOR). Functia NICI</p>	<table border="1" data-bbox="1059 1276 1243 1462"> <thead> <tr> <th>A</th> <th>B</th> <th>Y</th> </tr> </thead> <tbody> <tr> <td>L</td> <td>L</td> <td>H</td> </tr> <tr> <td>L</td> <td>H</td> <td>L</td> </tr> <tr> <td>H</td> <td>L</td> <td>L</td> </tr> <tr> <td>H</td> <td>H</td> <td>L</td> </tr> </tbody> </table>	A	B	Y	L	L	H	L	H	L	H	L	L	H	H	L
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

Breviar tranzistoare bipolare

- Tranzistoarele bipolare sunt de doua tipuri in ceea ce priveste structura:
NPN () si PNP ().
- Terminalul inclinat la 45° ce contine sageata este Emitorul, celalalt este Conectorul.
Terminalul ramas este Baza.
- Transistorul bipolar este polarizat corect (functioneaza in regiunea activa normala - RAN) daca: jonctiunea BE este polarizata direct si BC este polarizata invers.
- In RAN curentul fizic de emitor are sensul sagetii de pe simbol si este cel mai mare curent (in valoare absoluta) al tranzistorului. In acest sens putem aproxima $|I_E| \gg |I_C| \gg |I_B|$
- Relatia de curenti pentru un tranzistor bipolar este in RAN $I_E = I_B + I_C$, unde totii curentii au acelasi semn.
- In RAN sensul curentilor se determina gandind tranzistorul ca un nod. Daca curentul de emitor intra in tranzistor, ceilalti doi curenti trebuie sa iasa (cazul PNP), si reciproc, daca curentul de emitor iese din tranzistor, atunci ceilalti trebuie sa intre (cazul NPN).
- Dintre cei 3 curenti curentul de baza este cel mai mic. Intre el si curentul de colector exista o relatie aproximativa $I_C = \beta I_B$, unde β este un factor adimensional de ordinul sutelor ($\cong 100$)
- In timpul functionarii in RAN tensiunea dintre Baza si Emitor, U_{BE} , este cuasi-constanta (de 0.2-0.3V la tranzistorii din Ge, si respectiv, de 0.6-0.7V la transistorii din Si).

Pinout-ul tranzistoarelor folosite in laborator



Modul de lucru

Aveti la dispozitie 3 diode redresoare, 2 LED-uri, tranzistori bipolari 3 NPN si 3 PNP, si rezistente. Construiti pe placa de prototipuri cele 7 circuitele date in continuare. Testati din punct de vedere logic functionarea acestor circuite. Completati tabelele asociate lor. Coloanele cu numele intrarilor si iesirii trebuie completate cu L/H (in loc de 0/1), iar coloanele cu numele dispozitivelor cu starea lor ON/OFF. Construiti intr-o margine a breadbordului circuitul de test din figura 1. Acesta functioneaza astfel: atunci cand tensiunea de intrare aplicată între portul X si masa () este apropiata de 0V (potentialul referintei) se va aprinde bine LED-ul L1, detectand astfel starea Low, notata prescurtat cu L. Atunci când potentialul intrarii X este apropiat de potentialul de alimentare () se va aprinde LED-ul L2, semnalizand astfel o stare H (High). Retineti ca tensiunea pe un LED, atunci cand este polarizat direct, este aproximativ 2V. Calculati valorile rezistentelor R1 si R2 considerand ca LED-ul se aprinde bine la un curent I_{ON} de 10mA, 5mA sau 2mA.

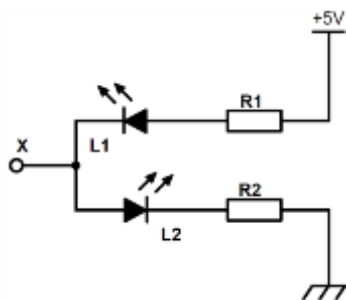


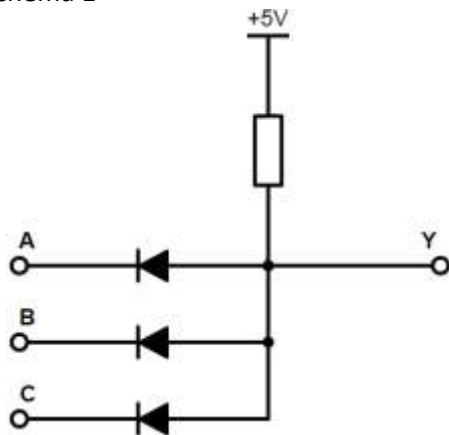
Fig.1. Testerul logic

- Stabiliti formula de calcul pentru R1 in functie de $V_{cc}(=5V)$, $V_x(=0.8$ si $1.6V)$ si $U_{ON}(=1.8$ si $2V)$.
- Stabiliti formula de calcul pentru R2 in functie de $V_x(=3.4$ si $4V)$ si $U_{ON}(=1.8$ si $2V)$.
- Completati tabelul de mai jos, unde prin U_{ON} am notat tensiunea la bornele LED-ului atunci prin LED circula curentul I_{ON} .

$V_x(V)$	$U_{ON}(V)$	$I_{ON}(mA)$	R1(Ω)	$V_x(V)$	$U_{ON}(V)$	$I_{ON}(mA)$	R2(Ω)
1.6	1.8	2		3.4	2.0	2	
1.6	1.8	5		3.4	2.0	5	
1.6	1.8	10		3.4	2.0	10	

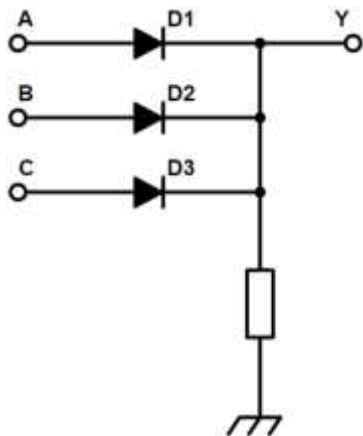
In schemele ce urmeaza rezistentele legata la +5V si la masa se iau de aproximativ 300Ω. Rezistentele serie pe intrari se iau de aproximativ 1kΩ.

Schema 1



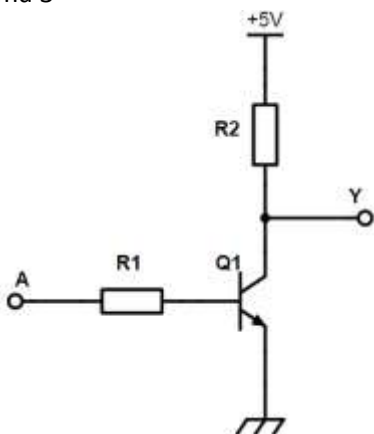
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L	L	L				
L	L	H				
L	H	L				
L	H	H				
H	L	L				
H	L	H				
H	H	L				
H	H	H				
Stare virtuala cu intrarile in aer						

Schema 2



A	B	C	D1	D2	D3	Y
L	L	L				
L	L	H				
L	H	L				
L	H	H				
H	L	L				
H	L	H				
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H	H	H				
Stare virtuala cu intrarile in aer						

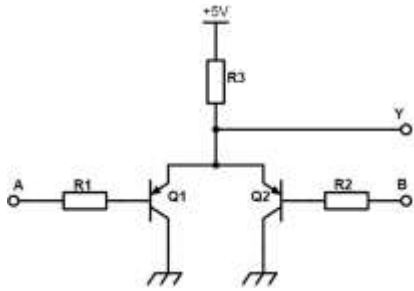
Schema 3



A	Q1	Y
L		
H		

Stare virtuala cu intrarile in aer

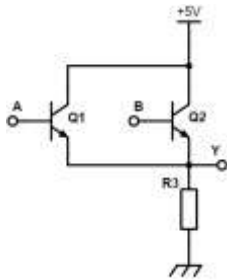
Schema 4



Stare virtuala cu intrarile in aer

A	B	Q1	Q2	Y
L	L			
L	H			
H	L			
H	H			

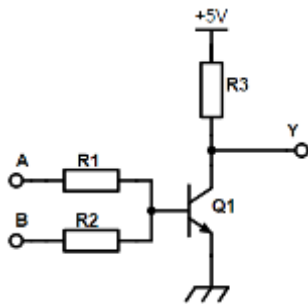
Schema 5



Stare virtuala cu intrarile in aer

A	B	Q1	Q2	Y
L	L			
L	H			
H	L			
H	H			

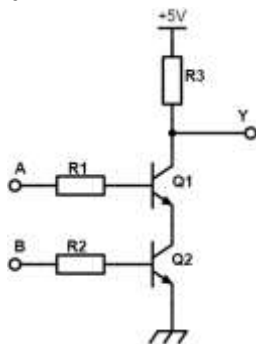
Schema 6



Stare virtuala cu intrarile in aer

A	B	Q1	Q2	Y
L	L			
L	H			
H	L			
H	H			

Schema 7



Stare virtuala cu intrarile in aer

A	B	Q1	Q2	Y
L	L			
L	H			
H	L			
H	H			