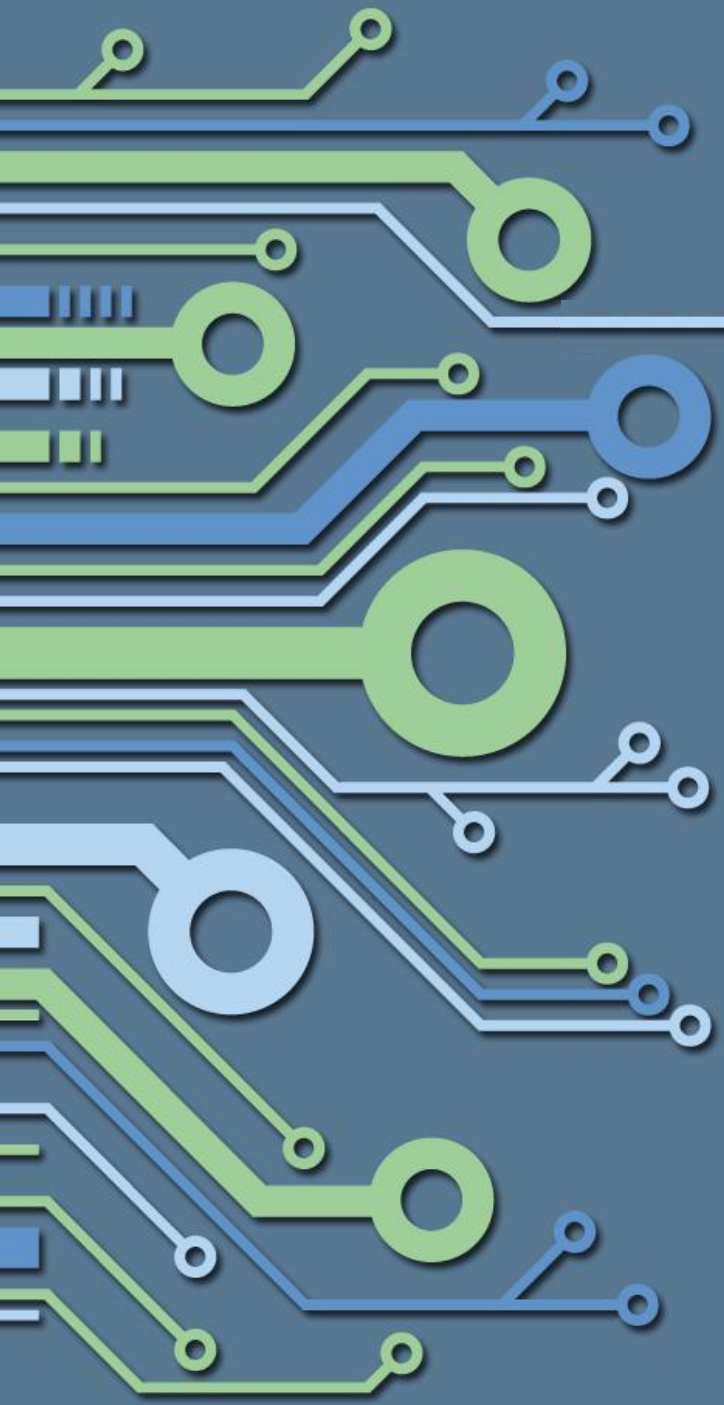


Chapter 6

ANALYSIS of COMBINATIONAL CIRCUITS

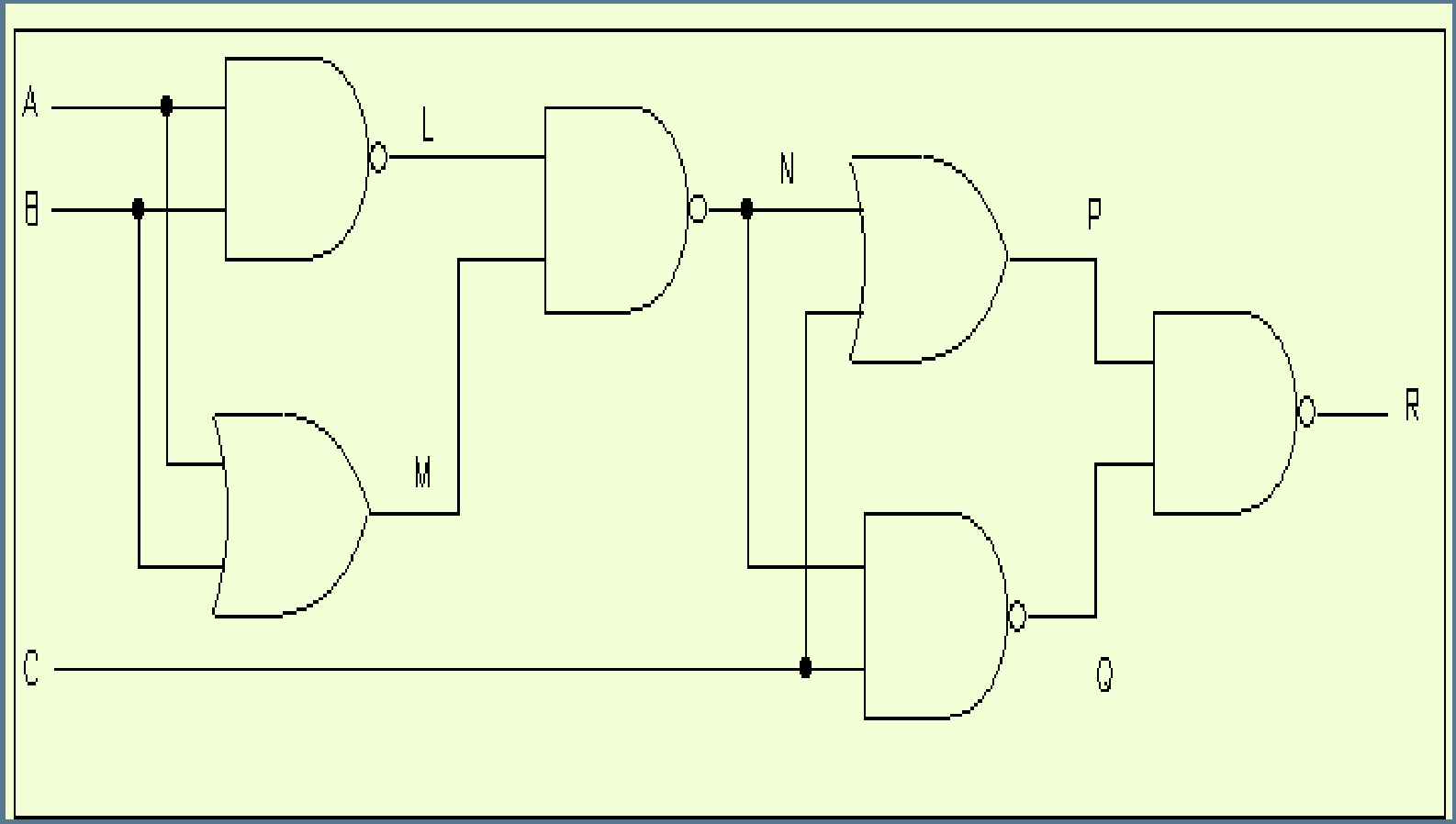
Analysis of Combinational Circuits

- Two methods:
  - Boolean algebra analysis
  - Truth table analysis

Boolean Algebra Analysis

1. Label each gate in the given circuit.
2. Obtain the Boolean function for the inputs and previously labeled gates.
3. Repeat the process until the outputs of the circuit are obtained.

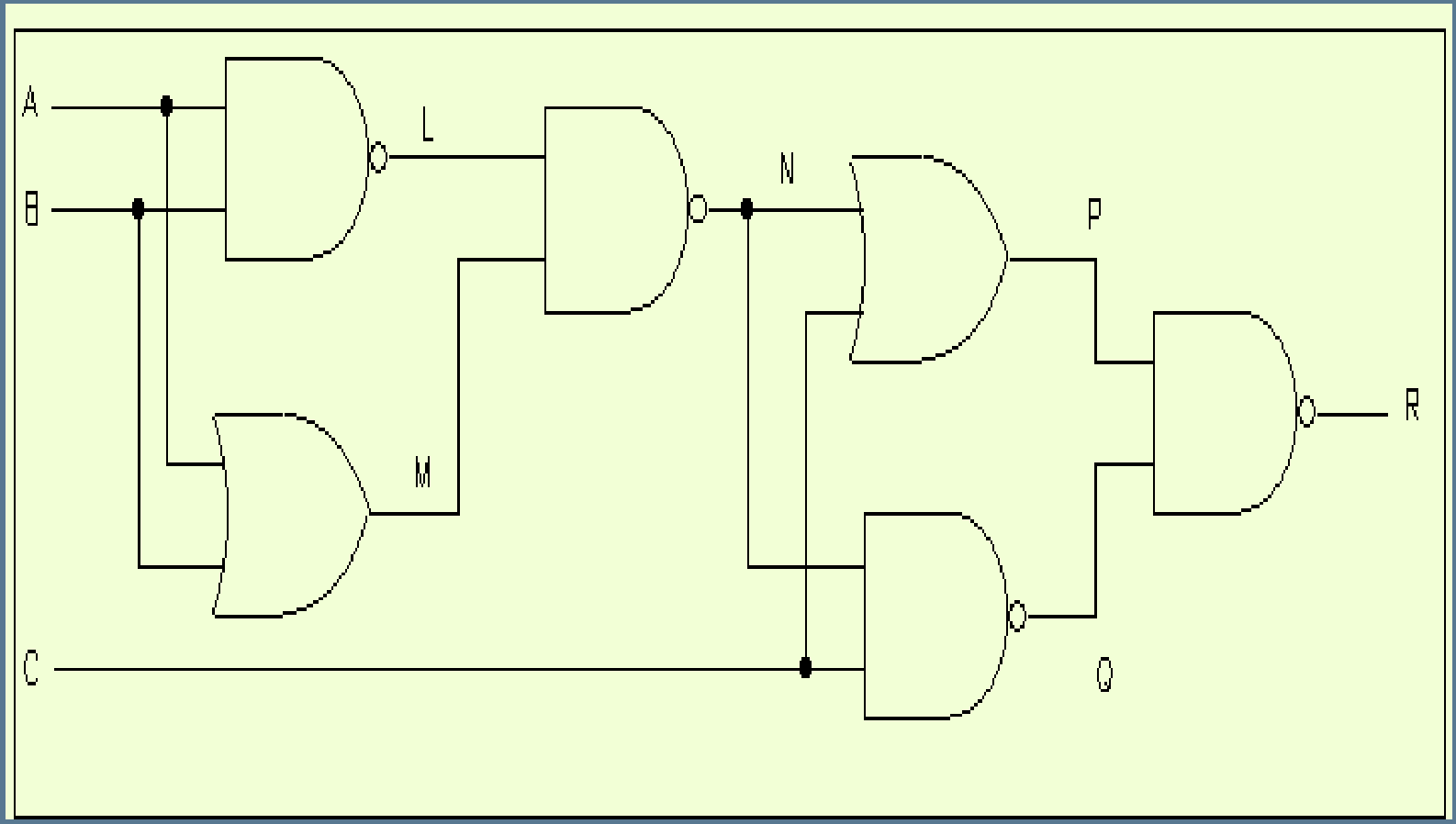
Example



Example

L = (AB)'

Example

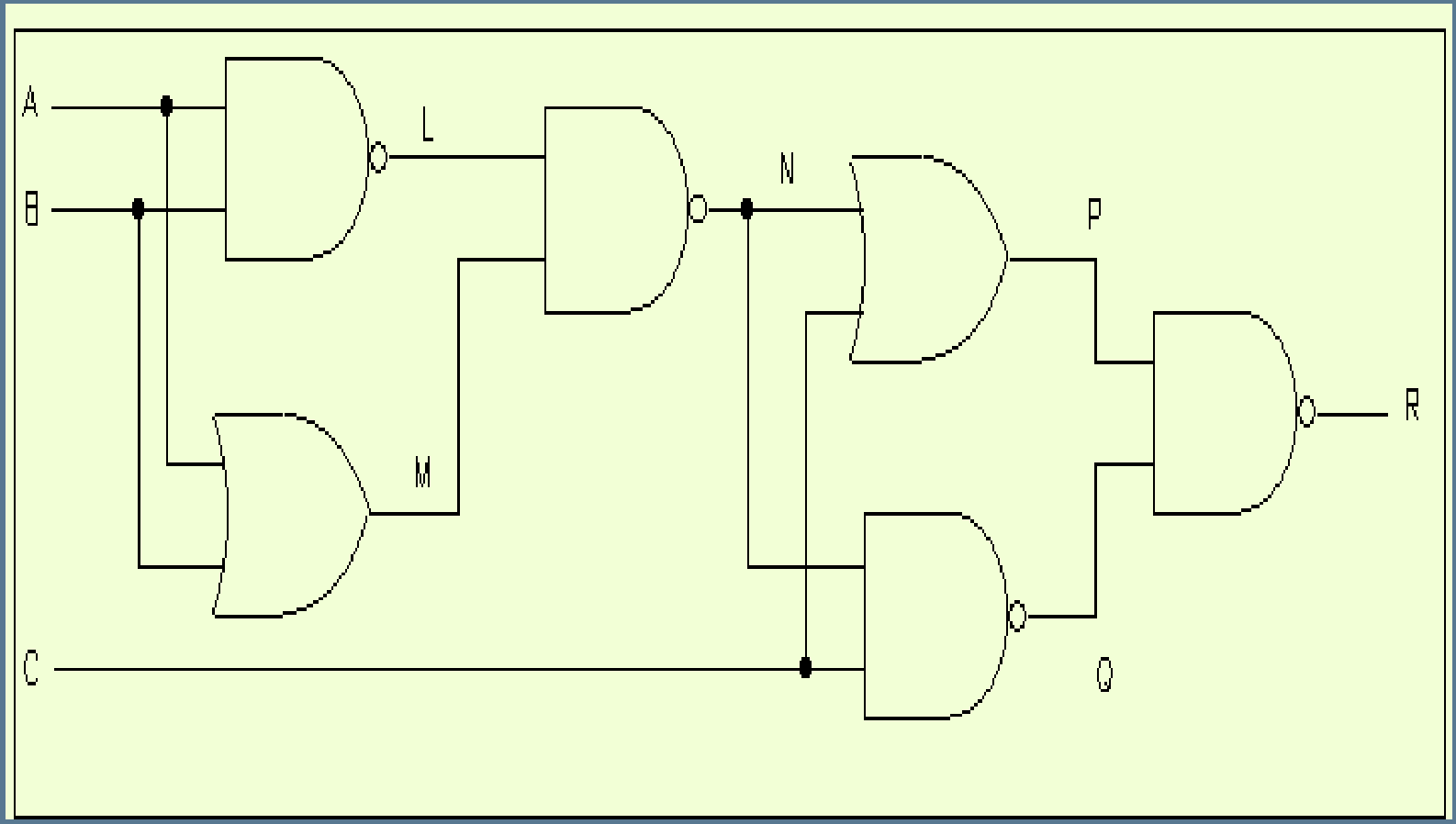


Example

L = (AB)'

M = (A+B)

Example



Example

L = (AB)'

M = (A+B)

N = (LM)'

Example

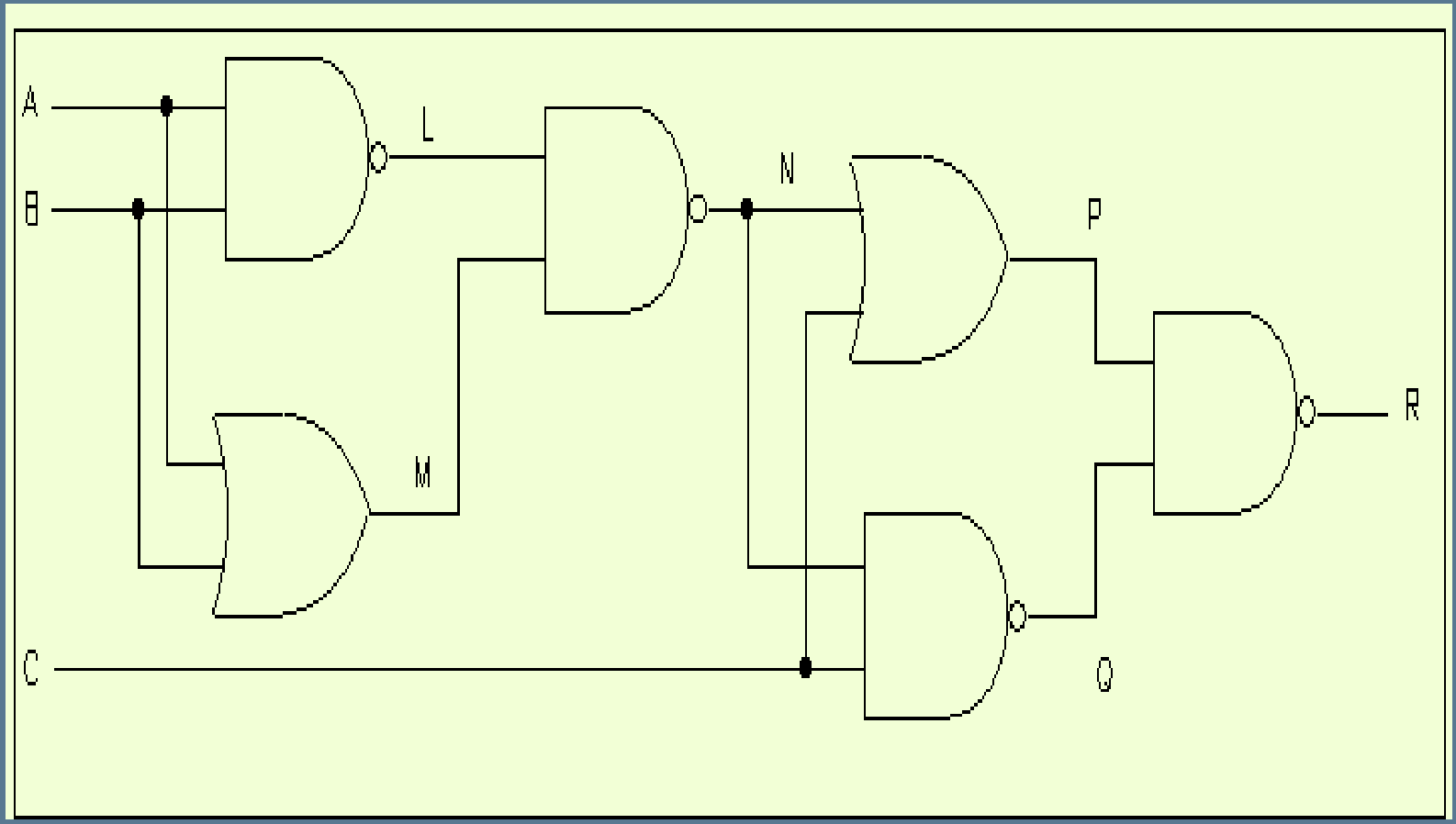
L = (AB)'

M = (A+B)

N = (LM)'

= ((AB)'(A+B))'

Example



Example

L = (AB)'

M = (A+B)

N = (LM)'

= ((AB)'(A+B))'

P = N + C

Example

L = (AB)'

M = (A+B)

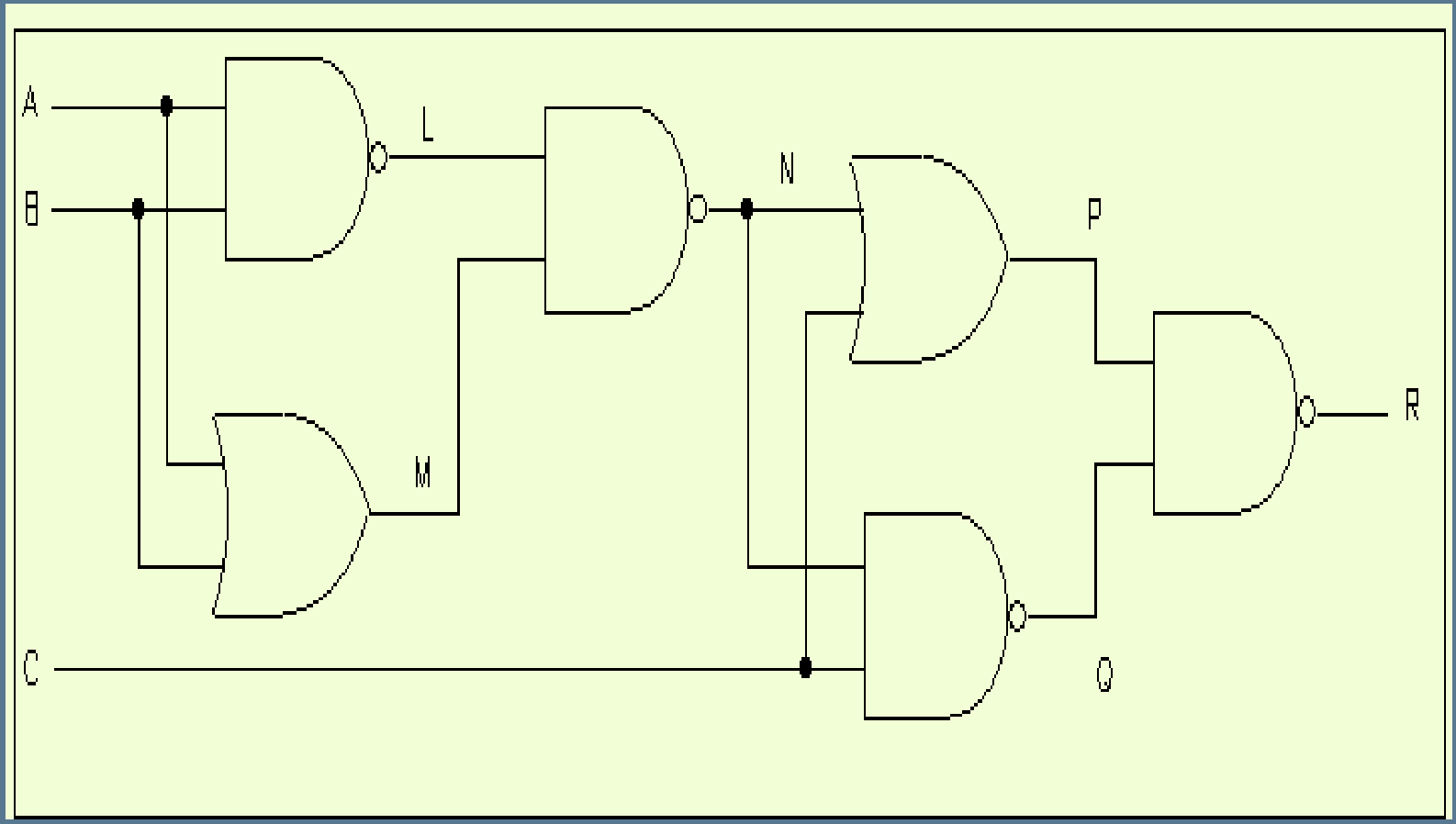
N = (LM)'

= ((AB)'(A+B))'

P = N + C

= ((AB)'(A+B))' + C

Example



Example

L = (AB)'

M = (A+B)

N = (LM)'

= ((AB)'(A+B))'

P = N + C

= ((AB)'(A+B))' + C

Q = (NC)'

Example

L = (AB)'

M = (A+B)

N = (LM)'

= ((AB)'(A+B))'

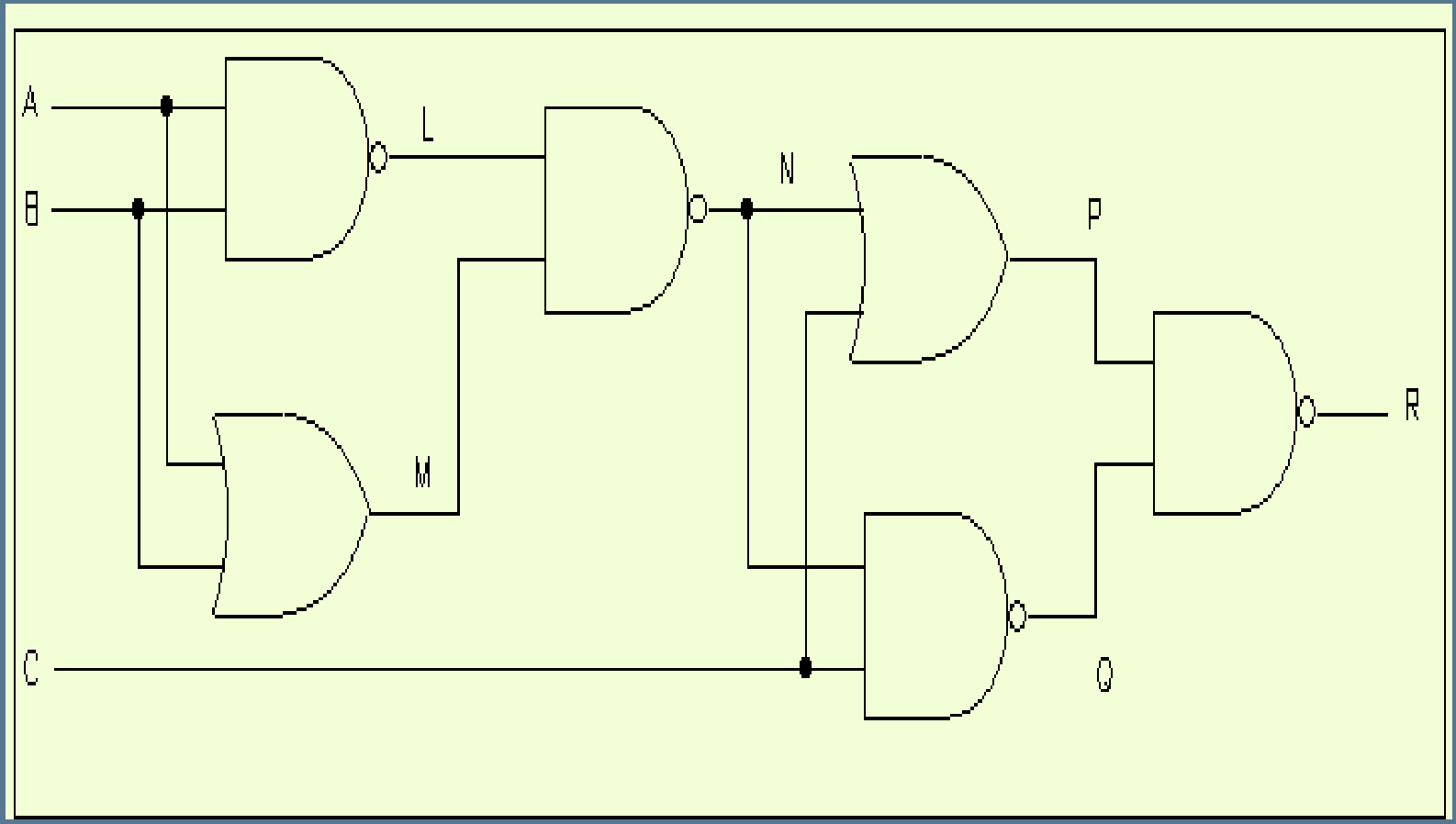
P = N + C

= ((AB)'(A+B))' + C

Q = (NC)'

= (((AB)'(A+B))'C)'

Example



Example

L = (AB)'

M = (A+B)

N = (LM)'

= ((AB)'(A+B))'

P = N + C

= ((AB)'(A+B))' + C

Q = (NC)'

= (((AB)'(A+B))'C)'

R = (PQ)'

Example

L = (AB)'

M = (A+B)

N = (LM)'

= ((AB)'(A+B))'

P = N + C

= ((AB)'(A+B))' + C

Q = (NC)'

= (((AB)'(A+B))'C)'

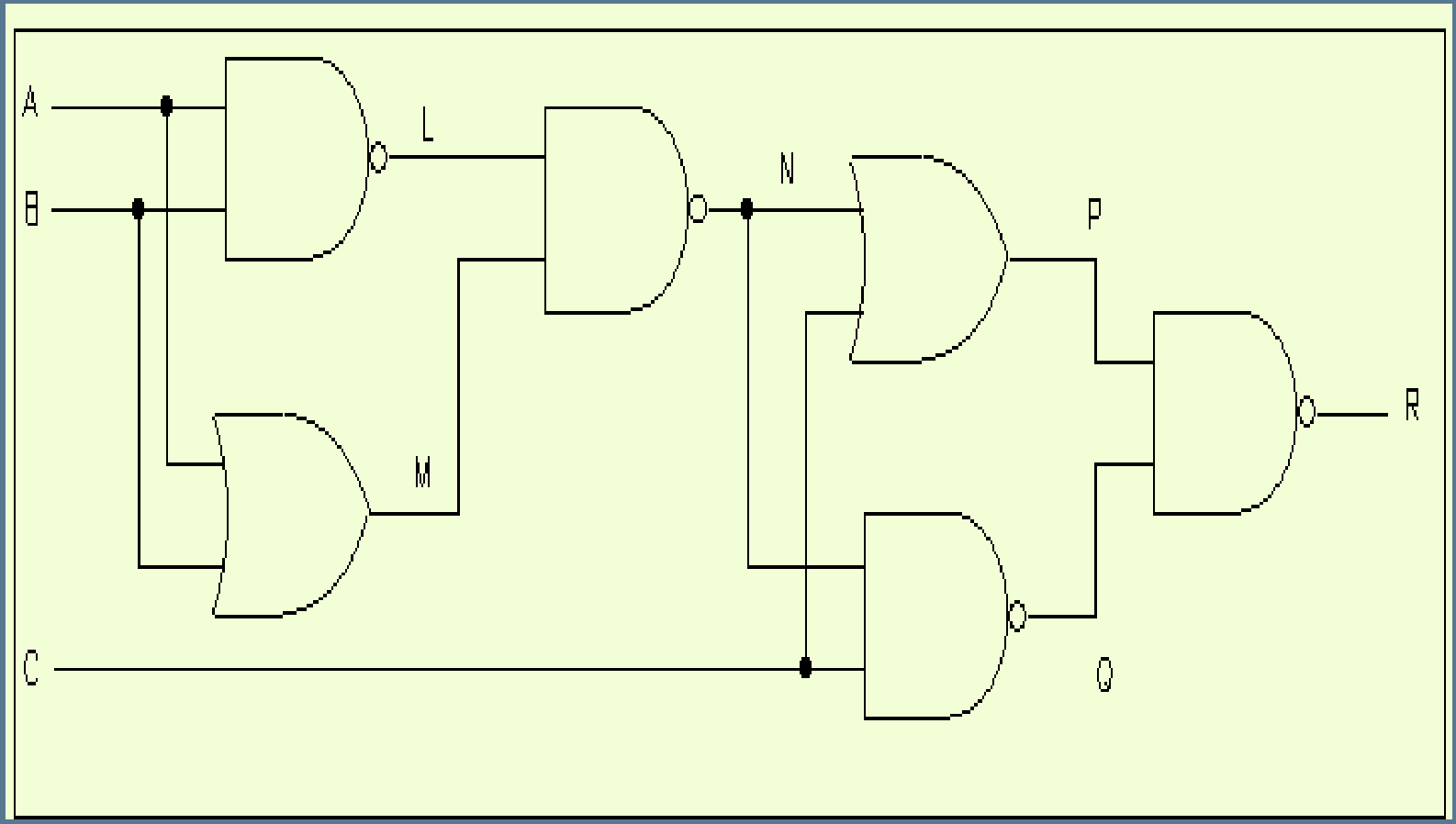
R = (PQ)'

= ((((AB)'(A+B))' + C)((((AB)'(A+B))'C)'))'

Truth table Analysis

1. Determine the # of inputs. For *n* inputs, construct the 2^n input combinations.
2. Label the outputs of selected gates.
3. Derive the truth table of gates that are functions of input variables only.
4. Obtain the truth table for gates that are functions of previously defined values.

Example



Example

a b c	a, b nand L	a,b or M	L,M nand N	N,C or P	N,C nand Q	P,Q nand R
0 0 0						
0 0 1						
0 1 0						
0 1 1						
1 0 0						
1 0 1						
1 1 0						
1 1 1						

Example

a b c	a, b nand L	a,b or M	L,M nand N	N,C or P	N,C nand Q	P,Q nand R
0 0 0	1					
0 0 1	1					
0 1 0	1					
0 1 1	1					
1 0 0	1					
1 0 1	1					
1 1 0	0					
1 1 1	0					

Example

a b c	a, b nand L	a,b or M	L,M nand N	N,C or P	N,C nand Q	P,Q nand R
0 0 0	1	0				
0 0 1	1	0				
0 1 0	1	1				
0 1 1	1	1				
1 0 0	1	1				
1 0 1	1	1				
1 1 0	0	1				
1 1 1	0	1				

Example

	a, b nand	a,b or	L,M nand	N,C or	N,C nand	P,Q nand
a b c	L	M	N	P	Q	R
0 0 0	1	0	1			
0 0 1	1	0	1			
0 1 0	1	1	0			
0 1 1	1	1	0			
1 0 0	1	1	0			
1 0 1	1	1	0			
1 1 0	0	1	1			
1 1 1	0	1	1			

Example

a b c	a, b nand L	a,b or M	L,M nand N	N,C or P	N,C nand Q	P,Q nand R
0 0 0	1	0	1	1		
0 0 1	1	0	1	1		
0 1 0	1	1	0	0		
0 1 1	1	1	0	1		
1 0 0	1	1	0	0		
1 0 1	1	1	0	1		
1 1 0	0	1	1	1		
1 1 1	0	1	1	1		

Example

	a, b nand	a,b or	L,M nand	N,C or	N,C nand	P,Q nand
a b c	L	M	N	P	Q	R
0 0 0	1	0	1	1	1	
0 0 1	1	0	1	1	0	
0 1 0	1	1	0	0	1	
0 1 1	1	1	0	1	1	
1 0 0	1	1	0	0	1	
1 0 1	1	1	0	1	1	
1 1 0	0	1	1	1	1	
1 1 1	0	1	1	1	0	

Example

a b c	a, b nand L	a,b or M	L,M nand N	N,C or P	N,C nand Q	P,Q nand R
0 0 0	1	0	1	1	1	0
0 0 1	1	0	1	1	0	1
0 1 0	1	1	0	0	1	1
0 1 1	1	1	0	1	1	0
1 0 0	1	1	0	0	1	1
1 0 1	1	1	0	1	1	0
1 1 0	0	1	1	1	1	0
1 1 1	0	1	1	1	0	1