Digital Logic

COMP311 Connor McMahon

Announcements

- TA Office Hours are on the Syllabus
- Participation photos
- Lecture Absences

Logic Gates

Inverter/Not Gate

Symbol

Truth Table

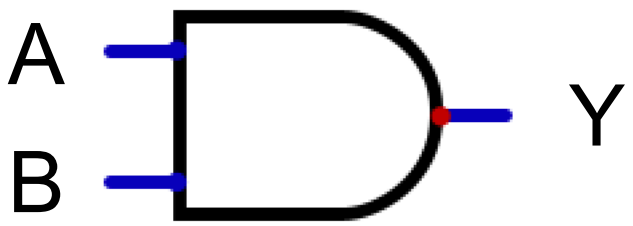
A	Y
0	1
1	0

Equation

$$Y = \overline{A}$$

AND Gate

Symbol



Truth Table

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

Equation

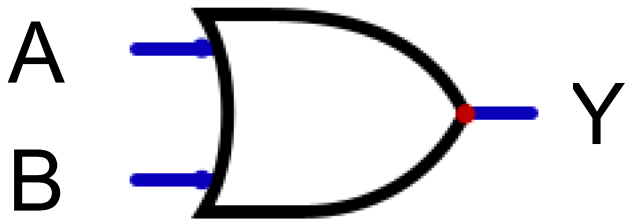
$$Y = A \times B$$

or

$$Y = AB$$

OR Gate

Symbol



Truth Table

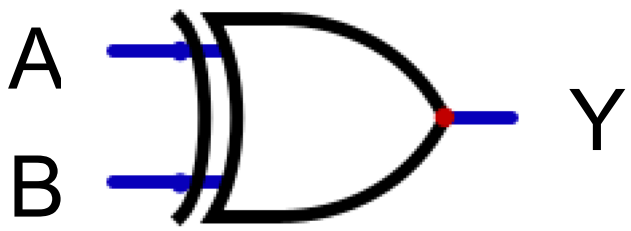
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

Equation

$$Y = A + B$$

XOR Gate

Symbol



Truth Table

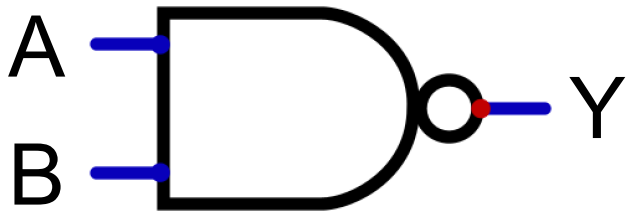
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

Equation

$$Y = A \oplus B$$

NAND

Symbol



Truth Table

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

Equation

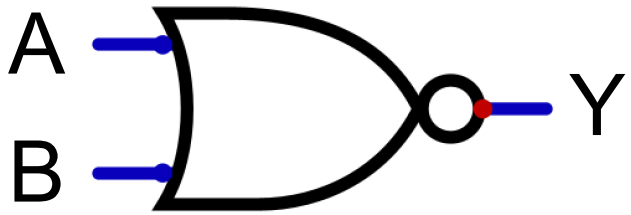
$$Y = \overline{A \; x \; B}$$

or

$$Y = \overline{AB}$$

NOR

Symbol



Truth Table

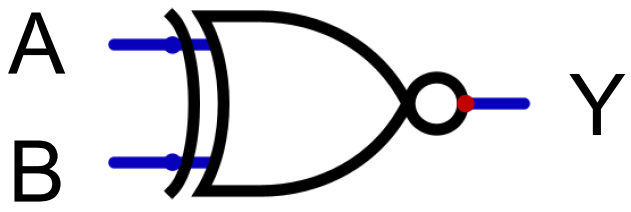
A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

Equation

$$Y = \overline{A + B}$$

XNOR Gate

Symbol



Truth Table

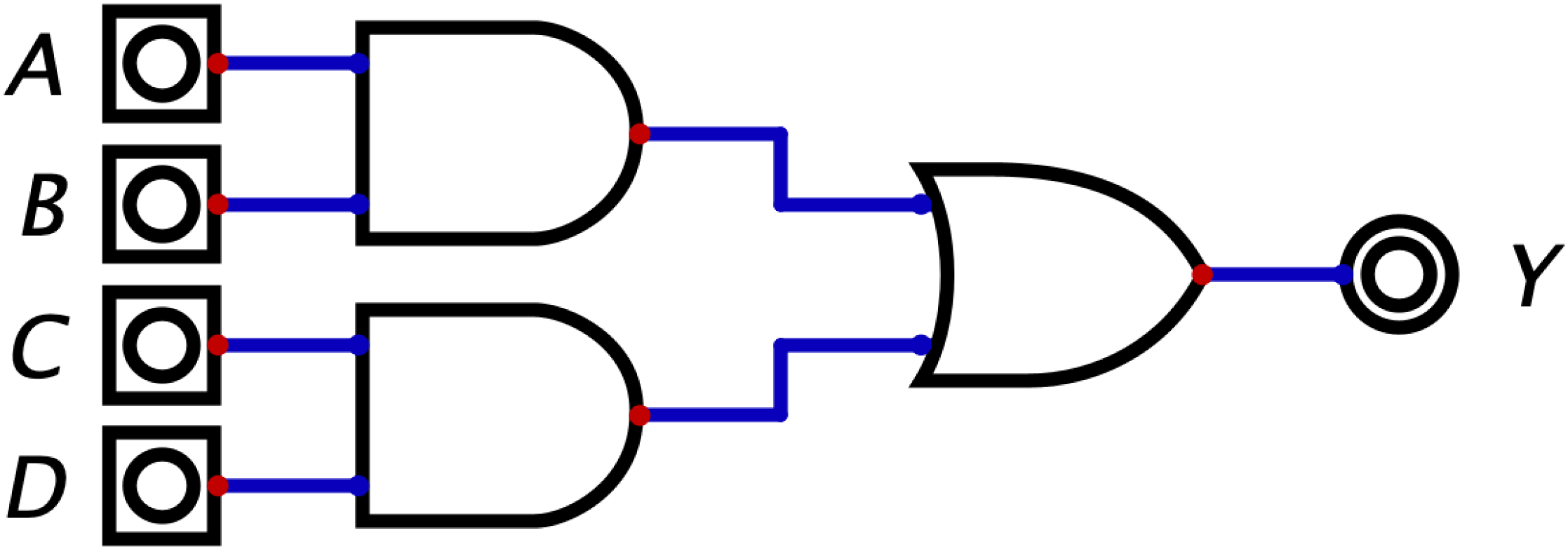
A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

Equation

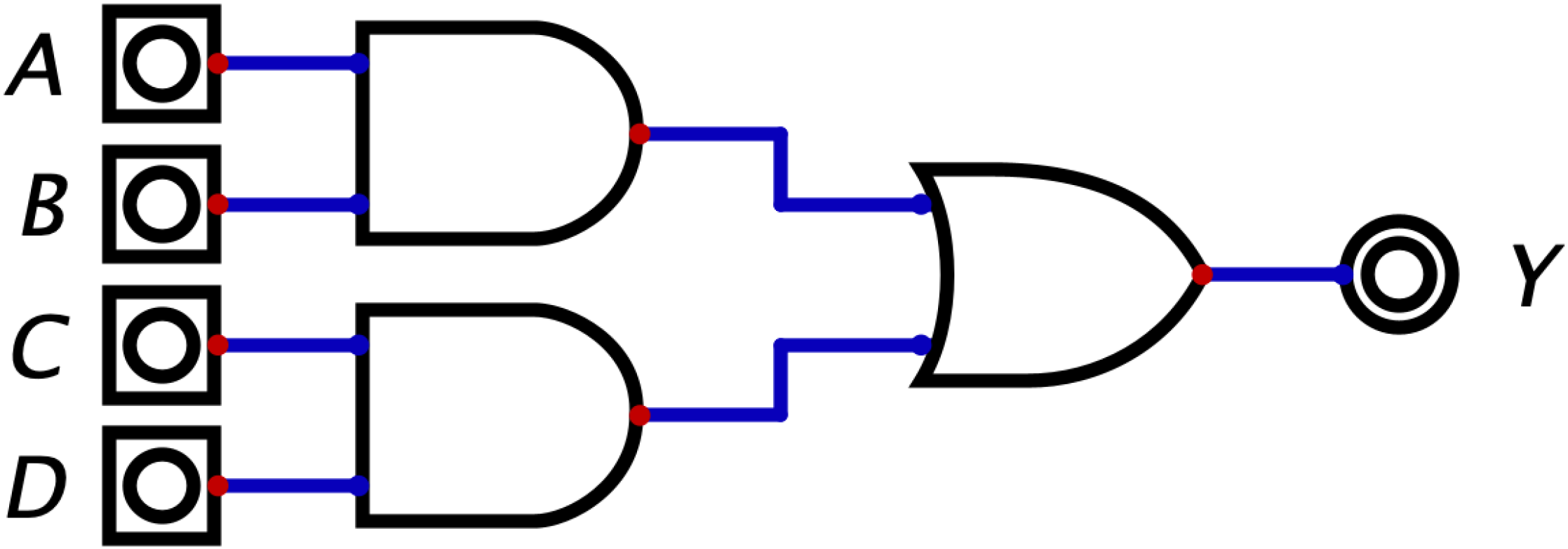
$$Y = \overline{A \oplus B}$$

Forming Equations from Logic Diagrams

Ex1: Forming Equations from Logic Diagrams

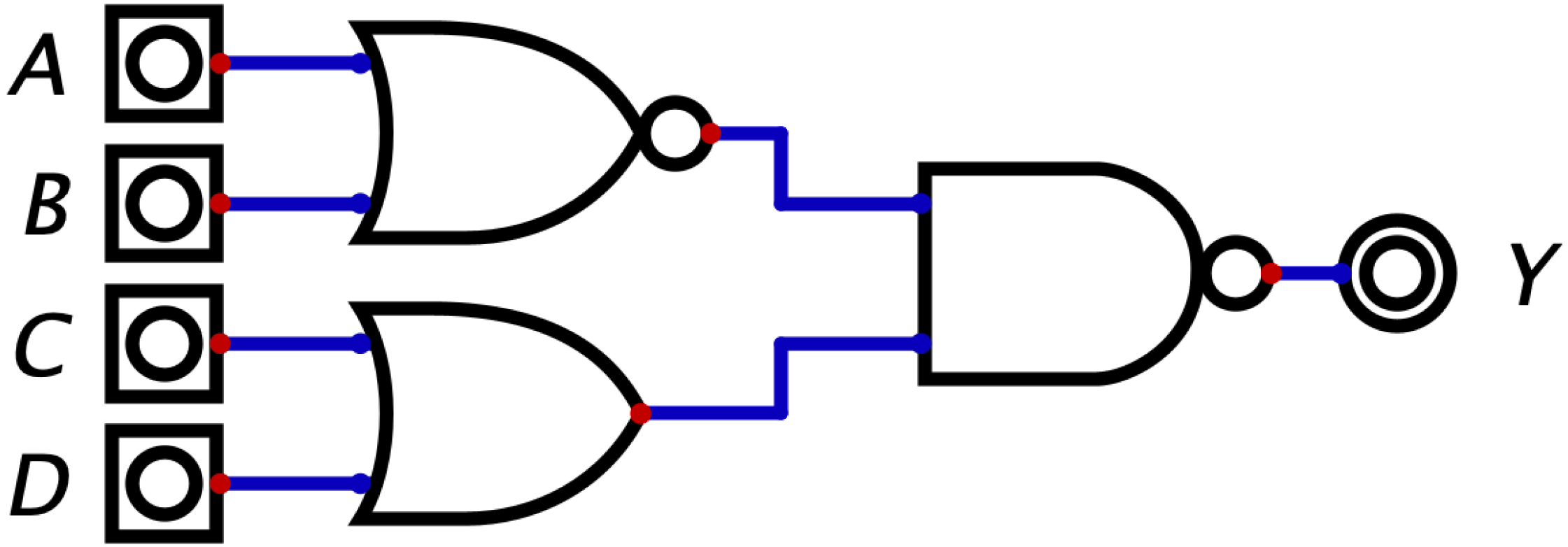


Ex1: Forming Equations from Logic Diagrams

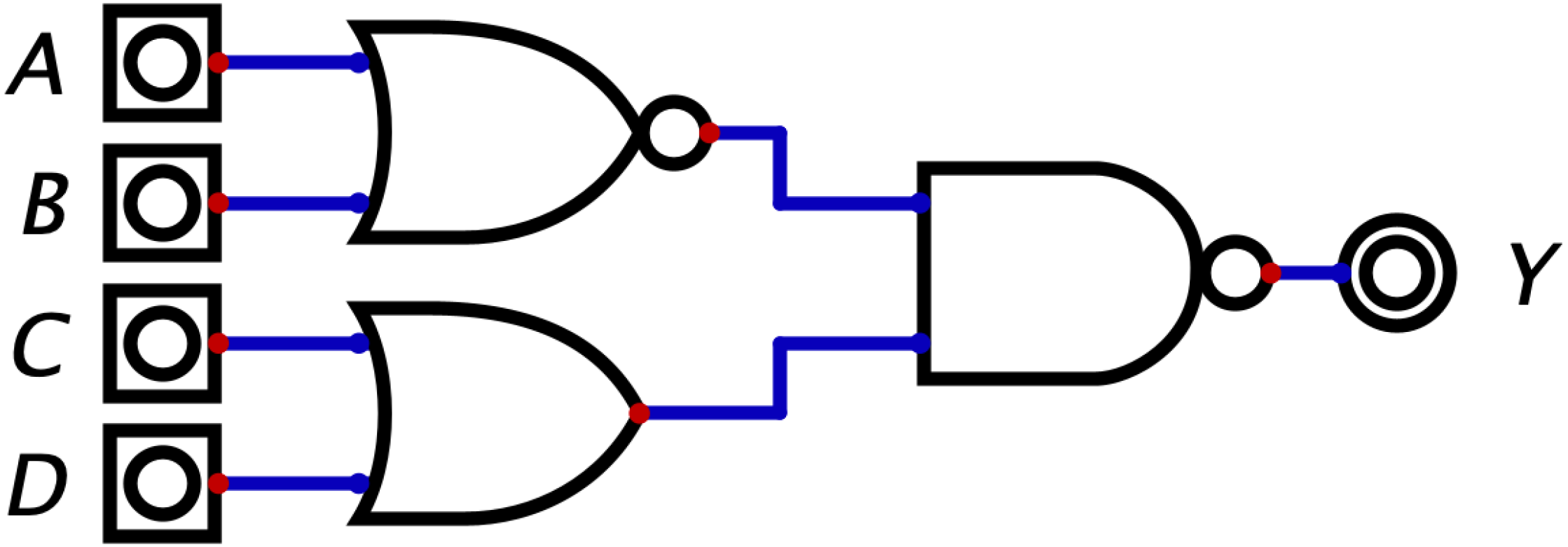


$$Y = AB + CD$$

Ex2: Forming Equations from Logic Diagrams

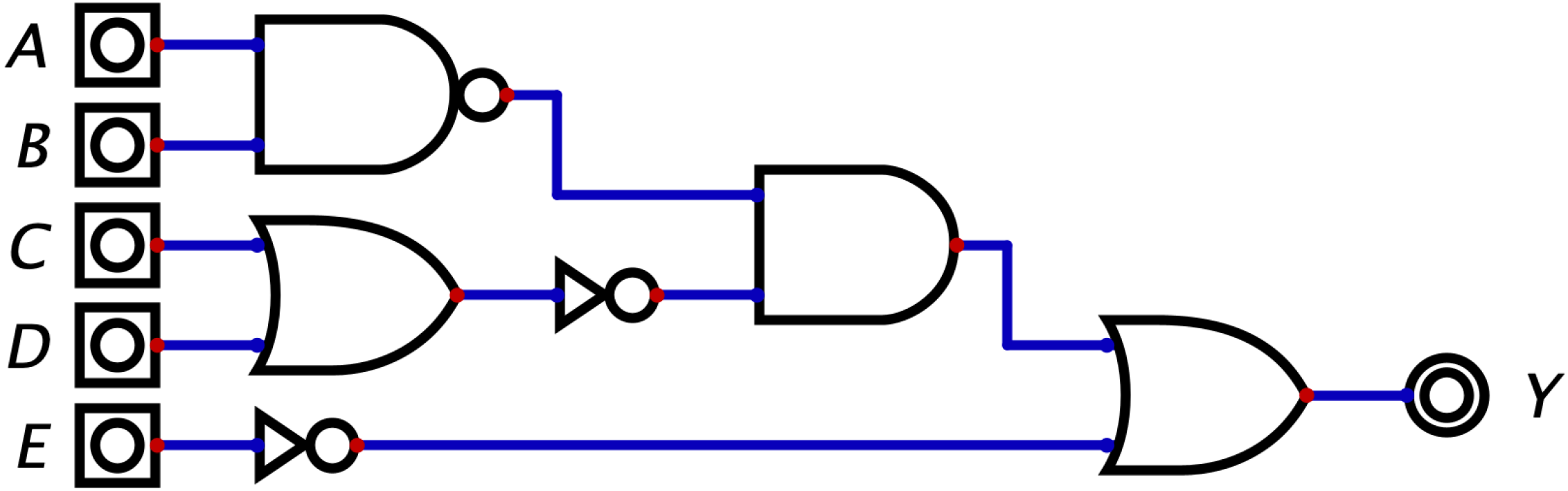


Ex2: Forming Equations from Logic Diagrams

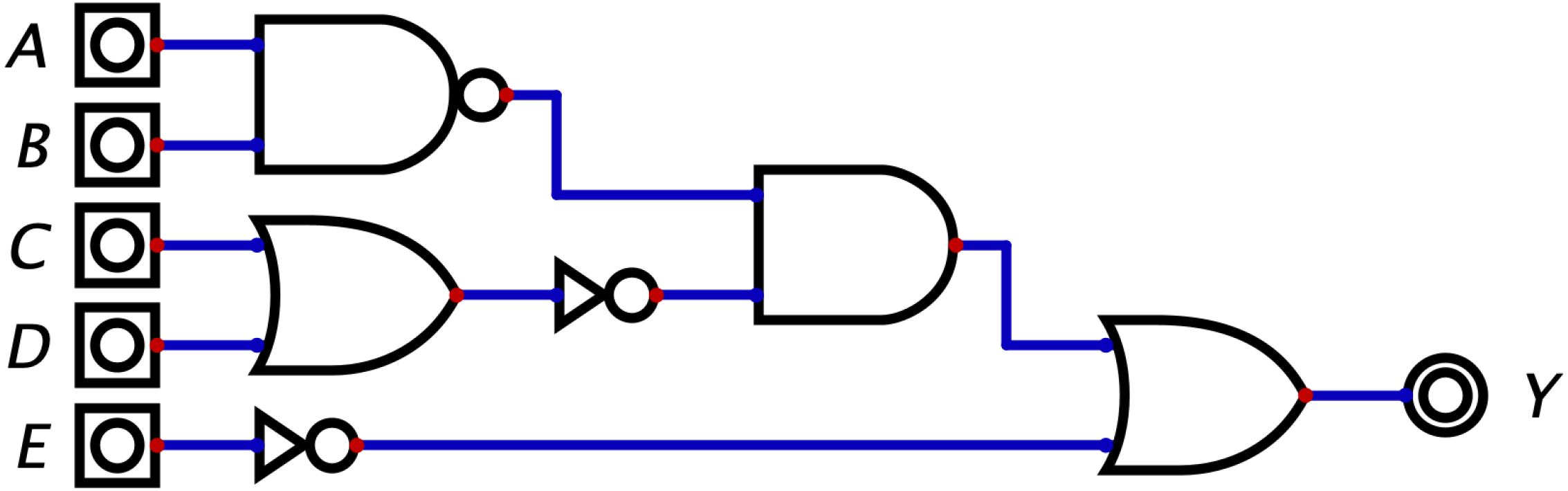


$$Y = \overline{(\overline{A + B})(C + D)}$$

Ex3: Forming Equations from Logic Diagrams

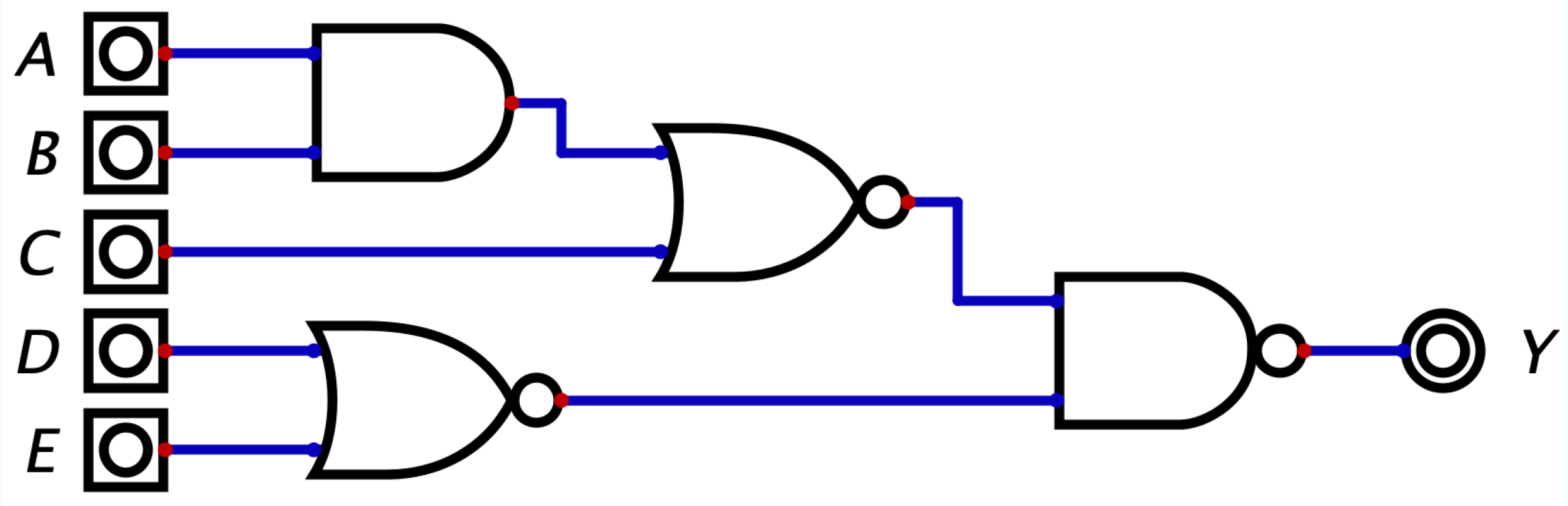


Ex3: Forming Equations from Logic Diagrams

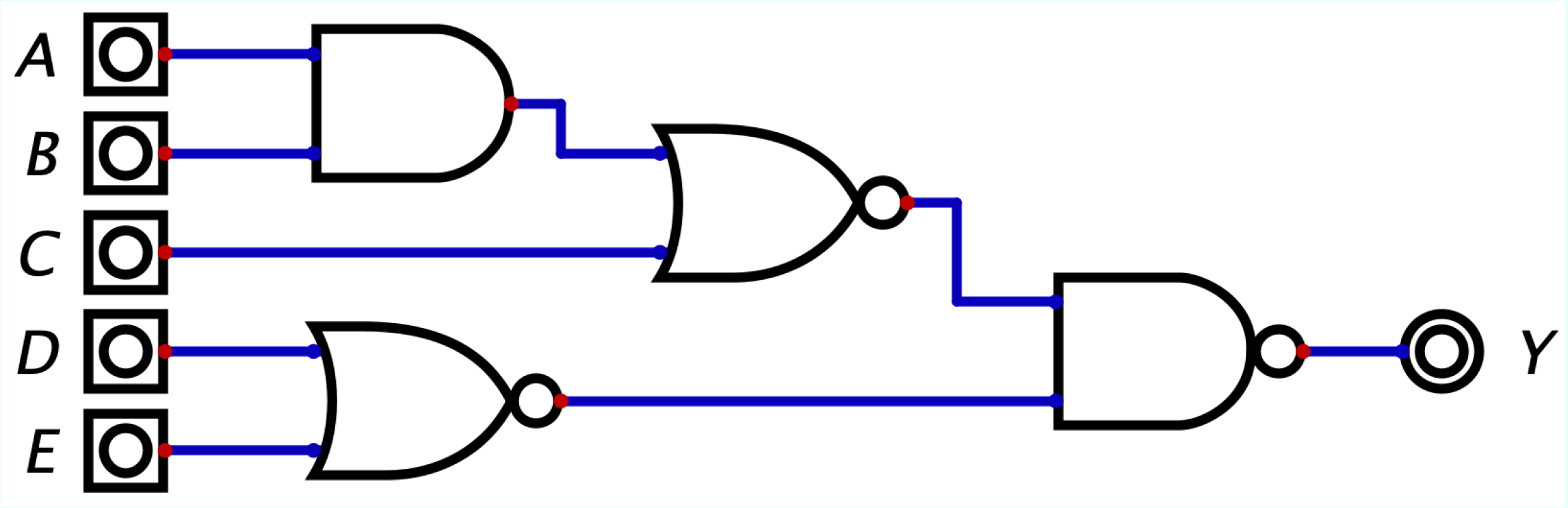


$$Y = (\overline{AB})\overline{(C + D)} + \bar{E}$$

Forming Equations from Logic Diagrams



Forming Equations from Logic Diagrams



$$Y = \overline{\overline{(AB + C)}\ \overline{(D + E)}}$$

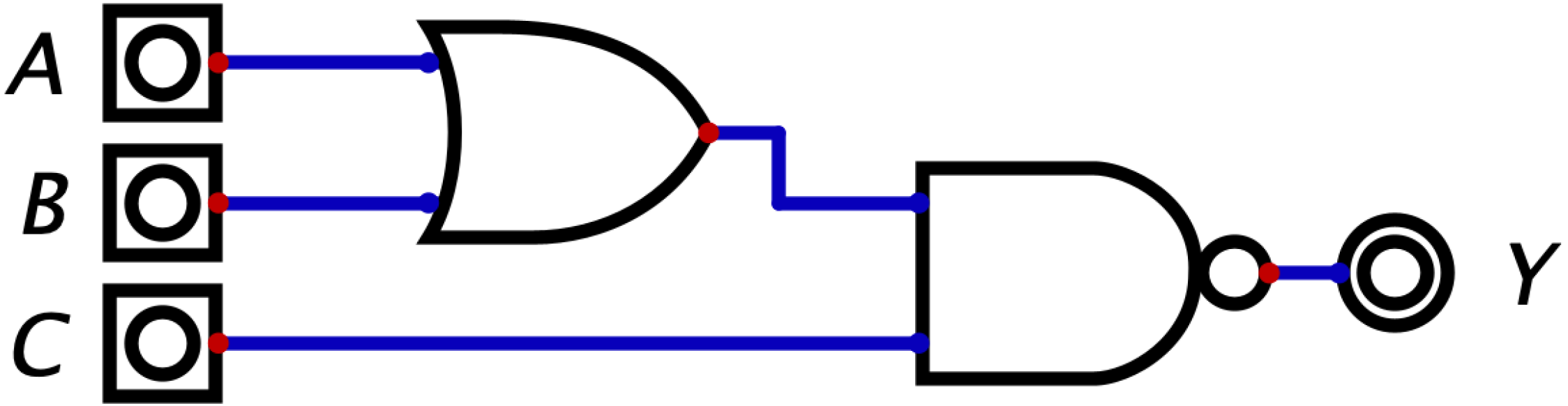
Forming Logic Diagrams from Equations

Ex1: Forming Logic Diagrams from Equations

$$Y = \overline{(A + B)C}$$

Ex1: Forming Logic Diagrams from Equations

$$Y = \overline{(A + B)C}$$

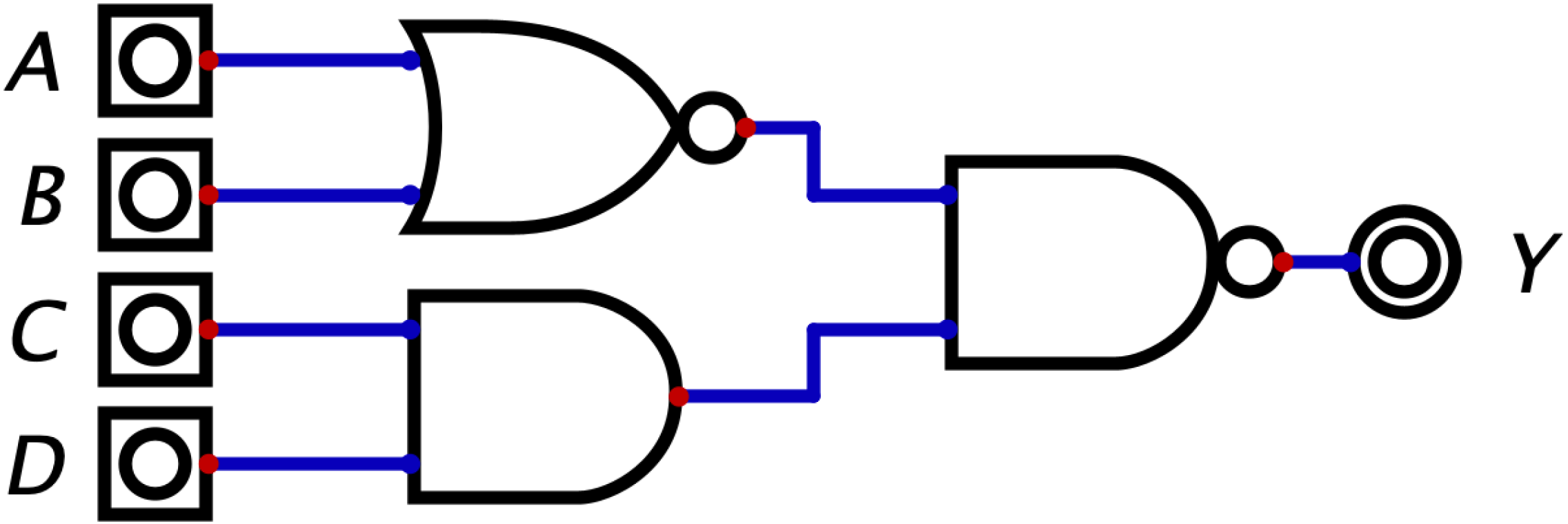


Ex2: Forming Logic Diagrams from Equations

$$Y = \overline{\overline{(A + B)}CD}$$

Ex2: Forming Logic Diagrams from Equations

$$Y = \overline{\overline{(A + B)}CD}$$

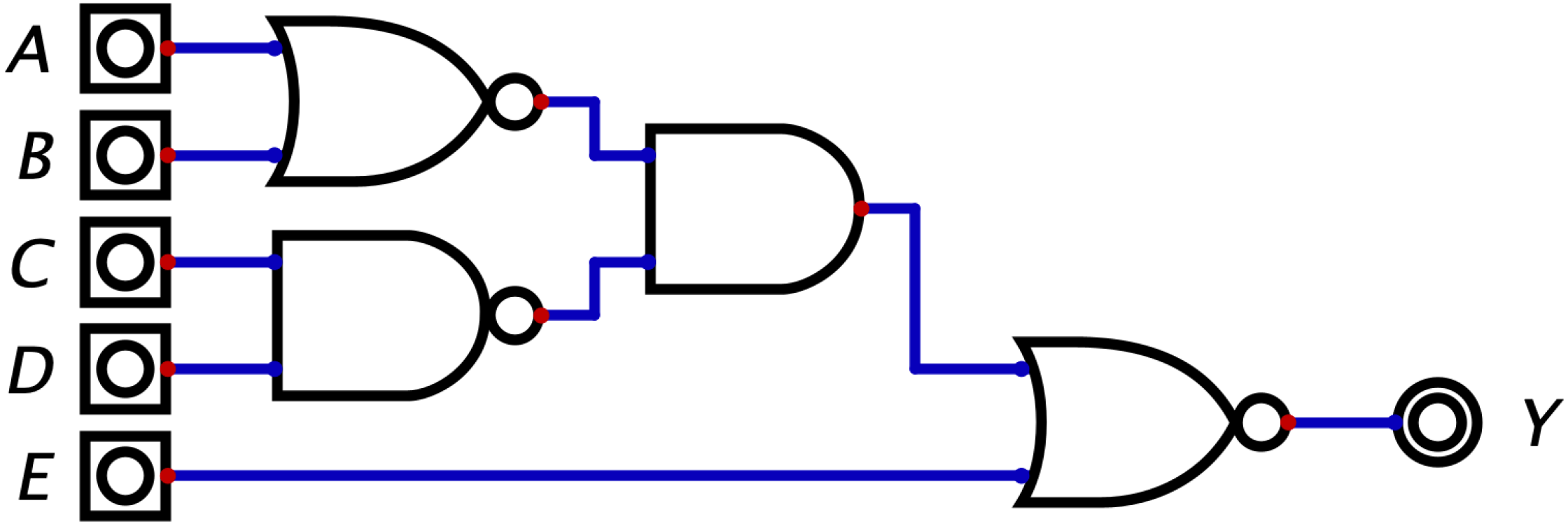


Ex3: Forming Logic Diagrams from Equations

$$Y = \overline{(\overline{A + B})(\overline{CD}) + E}$$

Ex3: Forming Logic Diagrams from Equations

$$Y = \overline{(\overline{A + B})(\overline{CD}) + E}$$

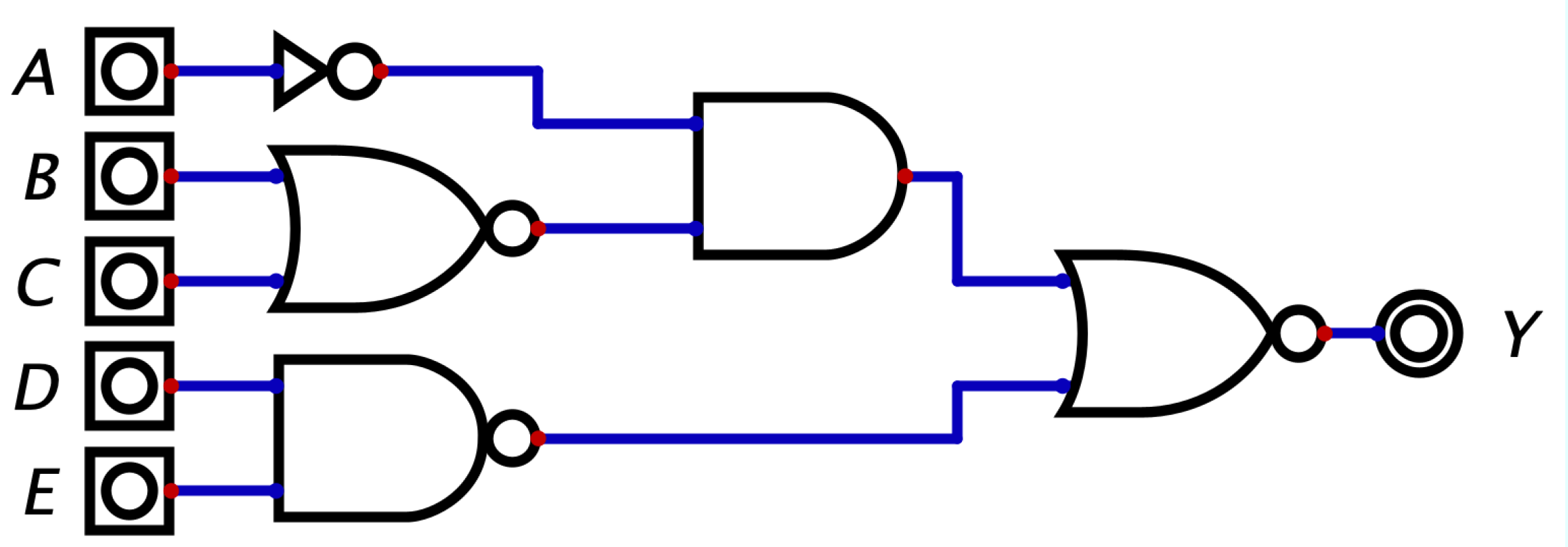


Forming Logic Diagrams from Equations

$$Y = \overline{(\bar{A})(\overline{B + C}) + \overline{DE}}$$

Forming Logic Diagrams from Equations

$$Y = \overline{(\bar{A})(\,\overline{\overline{B + C}}) + \,\overline{\overline{DE}}}$$



Forming Truth Tables from Equations

Ex1: Forming Truth Tables from Equations

$$Y = A + \bar{B}$$

A	B	Y
0	0	
0	1	
1	0	
1	1	

Ex1: Forming Truth Tables from Equations

$$Y = A + \bar{B}$$

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	1

Ex2: Forming Truth Tables from Equations

$$Y = AB + \bar{C}$$

A	B	C	Y
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

Ex2: Forming Truth Tables from Equations

$$Y = AB + \bar{C}$$

A	B	C	Y
0	0	0	1
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

Forming Truth Tables from Equations

$$Y = A + \bar{A}B\bar{C}$$

A	B	C	Y
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

Forming Truth Tables from Equations

$$Y = A + \bar{A}B\bar{C}$$

A	B	C	Y
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Forming Truth Tables from Equations

$$Y = \bar{A}\bar{B} + \overline{AB}$$

A	B	C	Y
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

Forming Truth Tables from Equations

$$Y = \bar{A}\bar{B} + \overline{AB}$$

A	B	C	Y
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

Ex: Forming Equations from Truth Tables

A	B	C	Y
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

Ex: Forming Equations from Truth Tables

A	B	C	Y	
0	0	0	1	$\bar{A}\bar{B}\bar{C}$
0	0	1	0	
0	1	0	1	$\bar{A}B\bar{C}$
0	1	1	0	
1	0	0	0	
1	0	1	1	$A\bar{B}C$
1	1	0	0	
1	1	1	0	

$$Y = \bar{A}\bar{B}\bar{C} + \bar{A}B\bar{C} + A\bar{B}C$$

Forming Equations from Truth Tables

A	B	C	Y
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

Forming Equations from Truth Tables

A	B	C	Y	
0	0	0	0	
0	0	1	1	$\bar{A}\bar{B}C$
0	1	0	0	
0	1	1	0	
1	0	0	1	$A\bar{B}\bar{C}$
1	0	1	0	
1	1	0	1	$AB\bar{C}$
1	1	1	1	ABC

$$Y = \bar{A}\bar{B}C + A\bar{B}\bar{C} + AB\bar{C} + ABC$$