Karnaugh maps

Solutions to Student Exercises

Exercise 1:

1. AND gate:

Inputs		Output
B	**A**	**Q**
0	0	0
0	1	0
1	0	0
1	1	1

B \ A	0	1
0	0	0
1	0	1

2. NOR gate:

Inputs		Output
B	**A**	**Q**
0	0	1
0	1	0
1	0	0
1	1	0

B \ A	0	1
0	1	0
1	0	0

3. ExOR gate

Inputs		Output
B	**A**	**Q**
0	0	0
0	1	1
1	0	1
1	1	0

B \ A	0	1
0	0	1
1	1	0

4. NAND gate

Inputs		Output
B	A	Q
0	0	1
0	1	1
1	0	1
1	1	0

B \ A	0	1
0	1	1
1	1	0

5. ExNOR gate

Inputs		Output
B	A	Q
0	0	1
0	1	0
1	0	0
1	1	1

B \ A	0	1
0	1	0
1	0	1

Exercise 2:

Inputs		Output
B	A	Q
0	0	1
0	1	0
1	0	1
1	1	1

B \ A	0	1
0	1	0
1	1	1

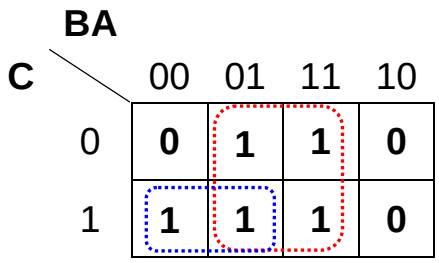
Simplest Boolean expression = $\overline{A}+B$

Check via Boolean gives

$$\overline{A}.\overline{B}+\overline{A}.B+A.B$$
$$\overline{A}.\overline{B}+B.(\overline{A}+A)$$
$$\overline{A}.\overline{B}+B$$
$$\overline{A}+B$$

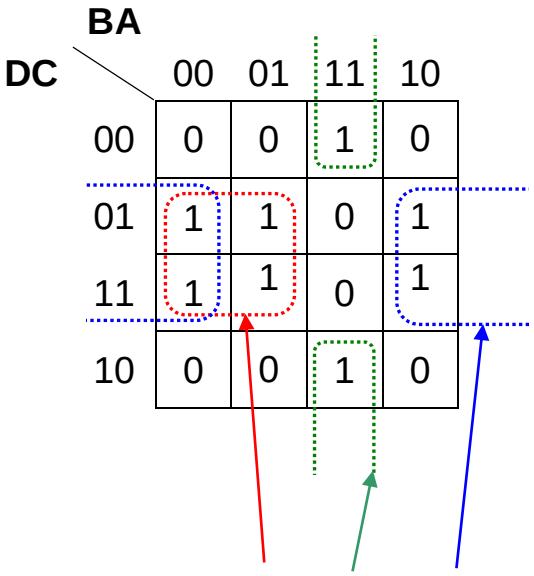
Exercise 3.

Inputs			Output
C	B	A	Q
0	0	0	**0**
0	0	1	**1**
0	1	0	**0**
0	1	1	**1**
1	0	0	**1**
1	0	1	**1**
1	1	0	**0**
1	1	1	**1**



Simplest Boolean expression = $A + \overline{B}.C$

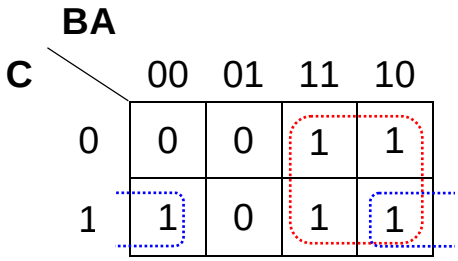
Example 2 :



Boolean expression is : $\overline{B}.C + A.B.\overline{C} + \overline{A}.C$

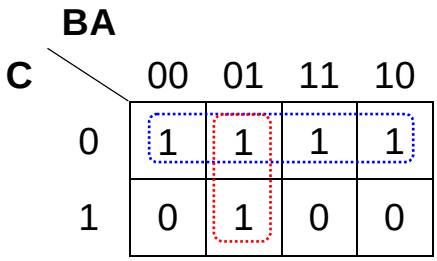
Exercise 4:

1. $\overline{A}.\overline{B}.C + \overline{A}.B.\overline{C} + A.B + B.C$



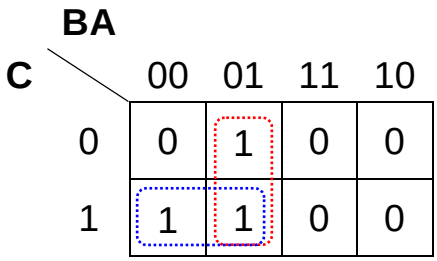
Simplest Boolean expression = $B + \overline{A}.C$

2. $\overline{A}.\overline{B}.\overline{C} + A.B.\overline{C} + A.\overline{B} + \overline{A}.\overline{C}$



Simplest Boolean expression = $\overline{C} + A.\overline{B}$

3. $A.\overline{B}.\overline{C} + \overline{A}.\overline{B}.C + A.\overline{B}.C$



Simplest Boolean expression = $A.\overline{B} + \overline{B}.C$ or $\overline{B}.(A + C)$