

**Course:** Digital Engineering**Semester:** 1st term 2025/2026.**Lecturers:** Dr. Osama Elnahas, Dr. Dina Abdelhafiz, Dr. Bassant Tolba, Dr. Radwa Rady**Assistants:**

Tutorial 5: K-maps

Q1: Simplify the following 3-variable Boolean function in SOP form using K-Map.

$$F(P,Q,R)=\sum m(0,1,3,5,7)$$

Solution

The K-Map representation of the given Boolean function is shown in Figure:

P \ QR	QR			
	00	01	11	10
0	1	1	1	
1		1	1	

Decimal	P	Q	R	F
0	0	0	0	1
1	0	0	1	1
2	0	1	0	0
3	0	1	1	1
4	1	0	0	0
5	1	0	1	1
6	1	1	0	0
7	1	1	1	1

the simplified SOP expression is $F=R+\overline{P}\overline{Q}$ **Q2: Simplify the following 3-variable Boolean function in POS form using K-Map.**

$$F(A,B,C)=\prod M(1,2,4,6)$$

Solution

The POS K-map representation of the given Boolean function is shown in Figure.

A/BC	BC			
	00	01	11	10
0	1		1	
1		1	1	

Decimal	A	B	C	F
0	0	0	0	1
1	0	0	1	0
2	0	1	0	0
3	0	1	1	1
4	1	0	0	0
5	1	0	1	1
6	1	1	0	0
7	1	1	1	1

the simplified SOP expression is, $F=(\overline{A}\overline{B}\overline{C})+(AC)+(BC)$

or

A \ BC	BC			
	00	01	11	10
0		0		0
1	0			0

the simplified POS expression is, $F=(A+B+\overline{C})(\overline{B}+C)(\overline{A}+C)$



Q3: Simplify the following Boolean functions, using three-variable K-maps:

$$F(x,y,z) = \Sigma(0,2,4,5,6)$$

Decimal	X	y	z	F
0	0	0	0	1
1	0	0	1	0
2	0	1	0	1
3	0	1	1	0
4	1	0	0	1
5	1	0	1	1
6	1	1	0	1
7	1	1	1	0

x/yz	00	01	11	10
0	1			1
1	1	1		1

the simplified SOP expression is, $F = \bar{z} + x\bar{y}$

Q4: Simplify the following Boolean functions, using three-variable K-maps:

$$F(x,y,z) = \Sigma(0,1,2,3,5)$$

x/yz	00	01	11	10
0	1	1	1	1
1	0	1	0	0

Decimal	x	y	z	F
0	0	0	0	1
1	0	0	1	1
2	0	1	0	1
3	0	1	1	1
4	1	0	0	0
5	1	0	1	1
6	1	1	0	0
7	1	1	1	0

the simplified SOP expression is, $F = \bar{x} + \bar{y}z$



Q5: Simplify the following Boolean functions, using three-variable K-maps:

$$F(x,y,z) = \Sigma(1,2,3,7)$$

Decimal	x	y	z	F
0	0	0	0	0
1	0	0	1	1
2	0	1	0	1
3	0	1	1	1
4	1	0	0	0
5	1	0	1	0
6	1	1	0	0
7	1	1	1	1

x/yz	00	01	11	10
0		1	1	1
1			1	

the simplified SOP expression is, $F = yz + \bar{x}z + \bar{x}y$

Q6: Simplify the following Boolean functions, using three-variable K-maps: $F(x,y,z) = \Sigma(0,2,4,6)$

Decimal	x	y	z	F
0	0	0	0	1
1	0	0	1	0
2	0	1	0	1
3	0	1	1	0
4	1	0	0	1
5	1	0	1	0
6	1	1	0	1
7	1	1	1	0

x/yz	00	01	11	10
0	1			1
1	1			1

the simplified SOP expression is, $F = \bar{z}$



كلية تكنولوجيا الصناعة والطاقة

Information Technology Department
2nd Year



جامعة برج العرب التكنولوجية
BORG AL ARAB TECHNOLOGICAL UNIVERSITY

جامعة برج العرب التكنولوجية

Q7: Simplify the following Boolean functions, using three-variable K-maps:
 $F(x,y,z) = \Pi(3, 5, 7)$

Decimal	x	y	z	F
0	0	0	0	1
1	0	0	1	1
2	0	1	0	1
3	0	1	1	0
4	1	0	0	1
5	1	0	1	0
6	1	1	0	1
7	1	1	1	0

x/yz	00	01	11	10
0	1	1		1
1	1			1

the simplified SOP expression is, $F = \bar{x}\bar{y} + \bar{z}$