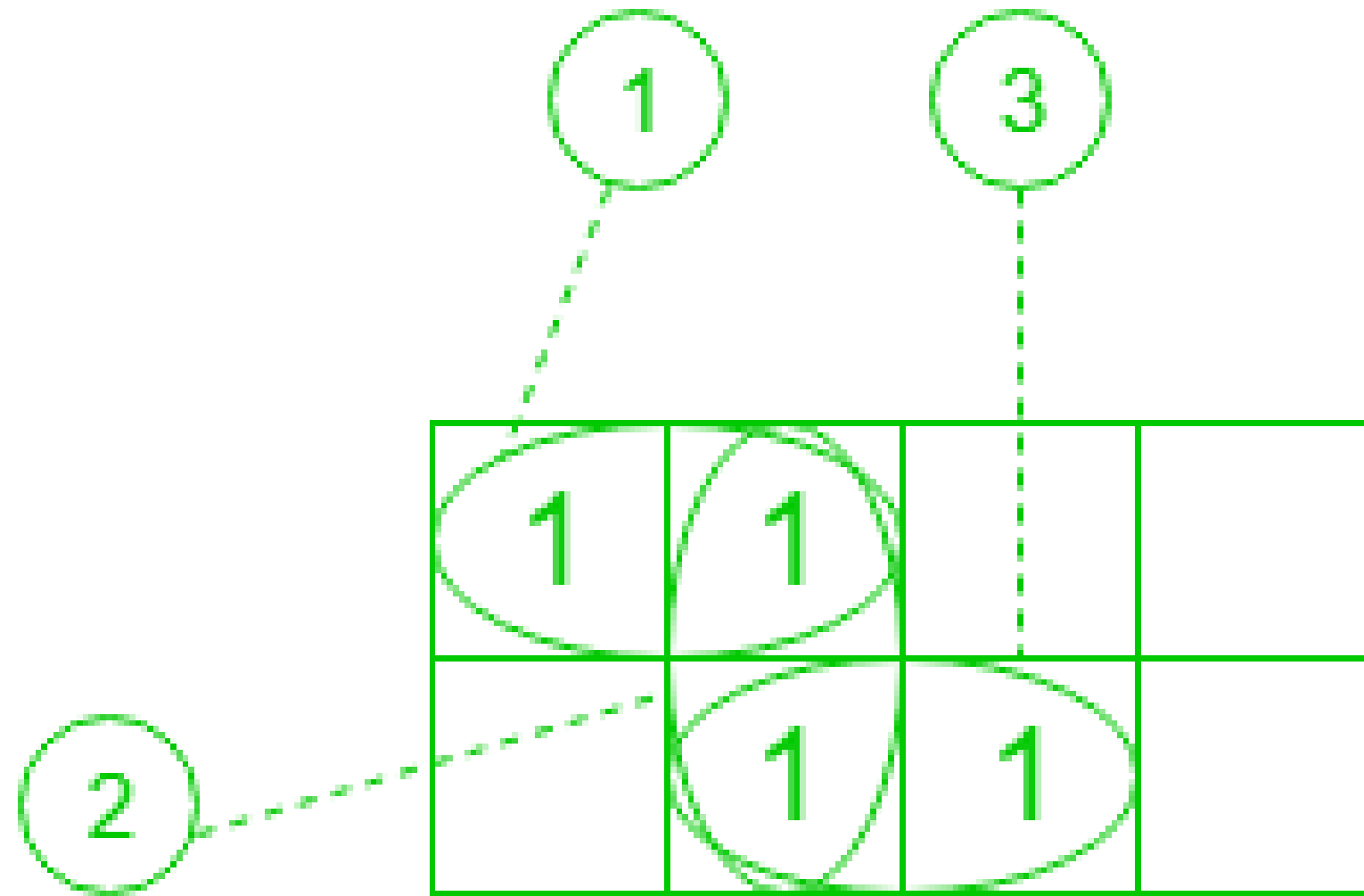


# Implicants in K-Map

- Implicant is a product/minterm term in Sum of Products (SOP) or sum/maxterm term in Product of Sums (POS) of a Boolean function. E.g., consider a boolean function,  $F = AB + ABC + BC$ . Implicants are AB, ABC, and BC.
- **Prime Implicants:** A group of squares or rectangles made up of a bunch of adjacent minterms which is allowed by the definition of K-Map are called prime implicants(PI) i.e. all possible groups formed in K-Map.

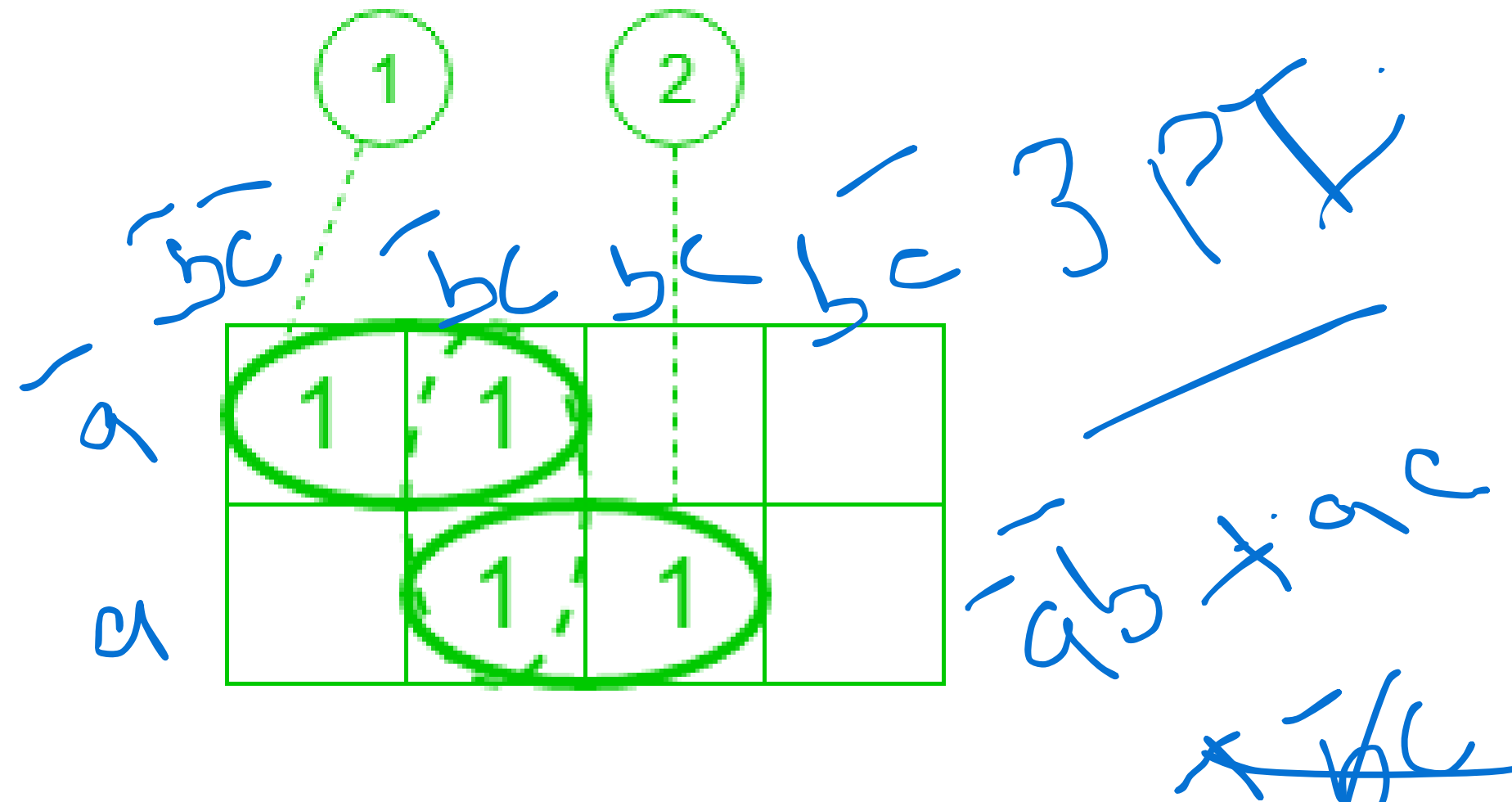


**Prime Implicants:**

No. of Prime Implicants = 3

## 2. Essential Prime Implicants:

- These are those subcubes(groups) that cover at least one minterm that can't be covered by any other prime implicant.
- Essential prime implicants(EPI) are those prime implicants that always appear in the final solution.



No. of Essential Prime Implicants = 2

Handwritten blue notes showing the simplification process:

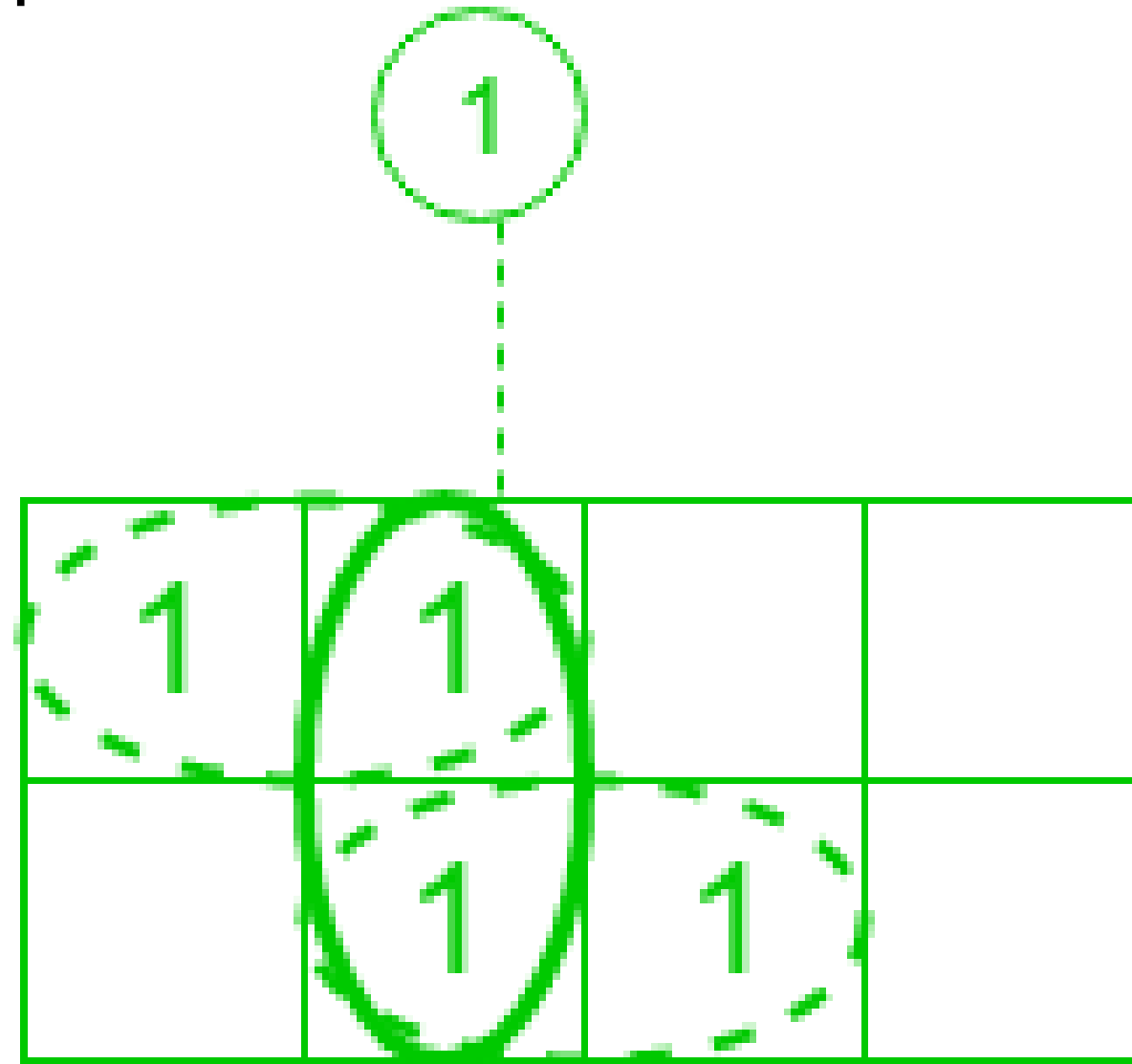
$$\bar{a}\bar{b}\bar{c} + \bar{a}b\bar{c} + a\bar{b}\bar{c} + abc$$

The expression is crossed out with a large blue diagonal line. Below it, the simplified expression is written:

$$\bar{a}\bar{b}\bar{c} + \bar{a}b\bar{c} + a\bar{b}\bar{c} + abc$$

### 3. Redundant Prime Implicants:

The prime implicants for which each of its minterm is covered by some essential prime implicant are redundant prime implicants(RPI). This prime implicant never appears in the final solution.

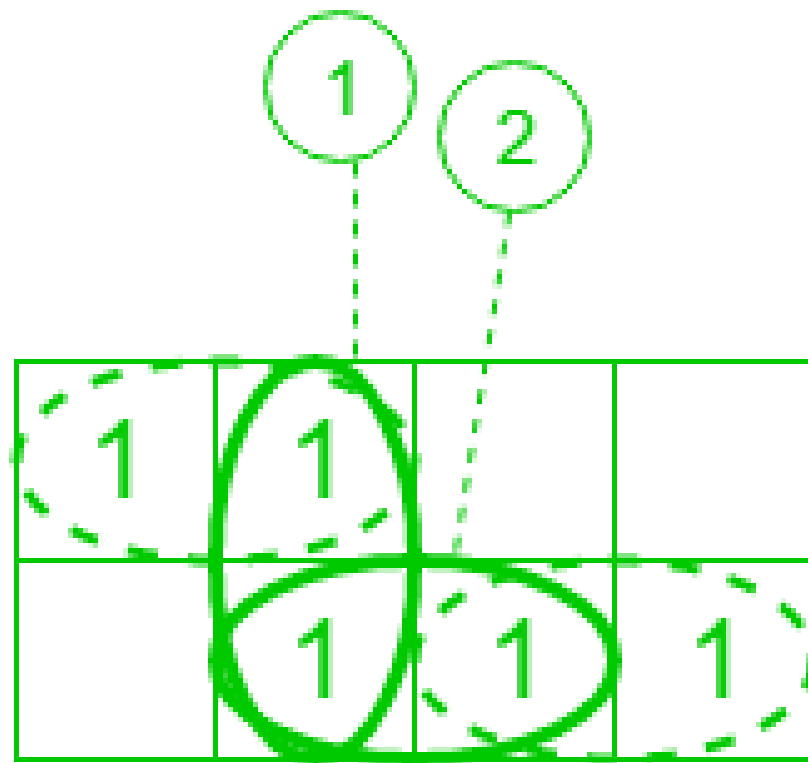


No. of Redundant Prime Implicants = 1

#### 4. Selective Prime Implicants / non-essential prime implicants:

The prime implicants for which are neither essential nor redundant prime implicants are called selective prime implicants(SPI).

**They may appear in some solution or may not appear in some solution.**



$$SPI = PI - (\sum PI + RPI)$$

No. of Selective Prime Implicants = 2

AB \ CD		00	01	11	10
CD	00				
	01		1*	1	
	11			1	1*
	10			1*	

RPI  $\rightarrow$  1.  
prime implicants ;

~~3~~ 4.

$\Sigma PI \rightarrow \bar{c}db$ .  
'acd (3)

'abc

AB \ CD		00	01	11	10
CD	00				
	01		1	1	
	11		X	1	1
	10			1	

**EPI / Essential prime  
implicants ;**

**3**

**Redundant Prime  
Implicants ;**



		AB			
		00	01	11	10
C	0	1	1		
	1		1	1	1

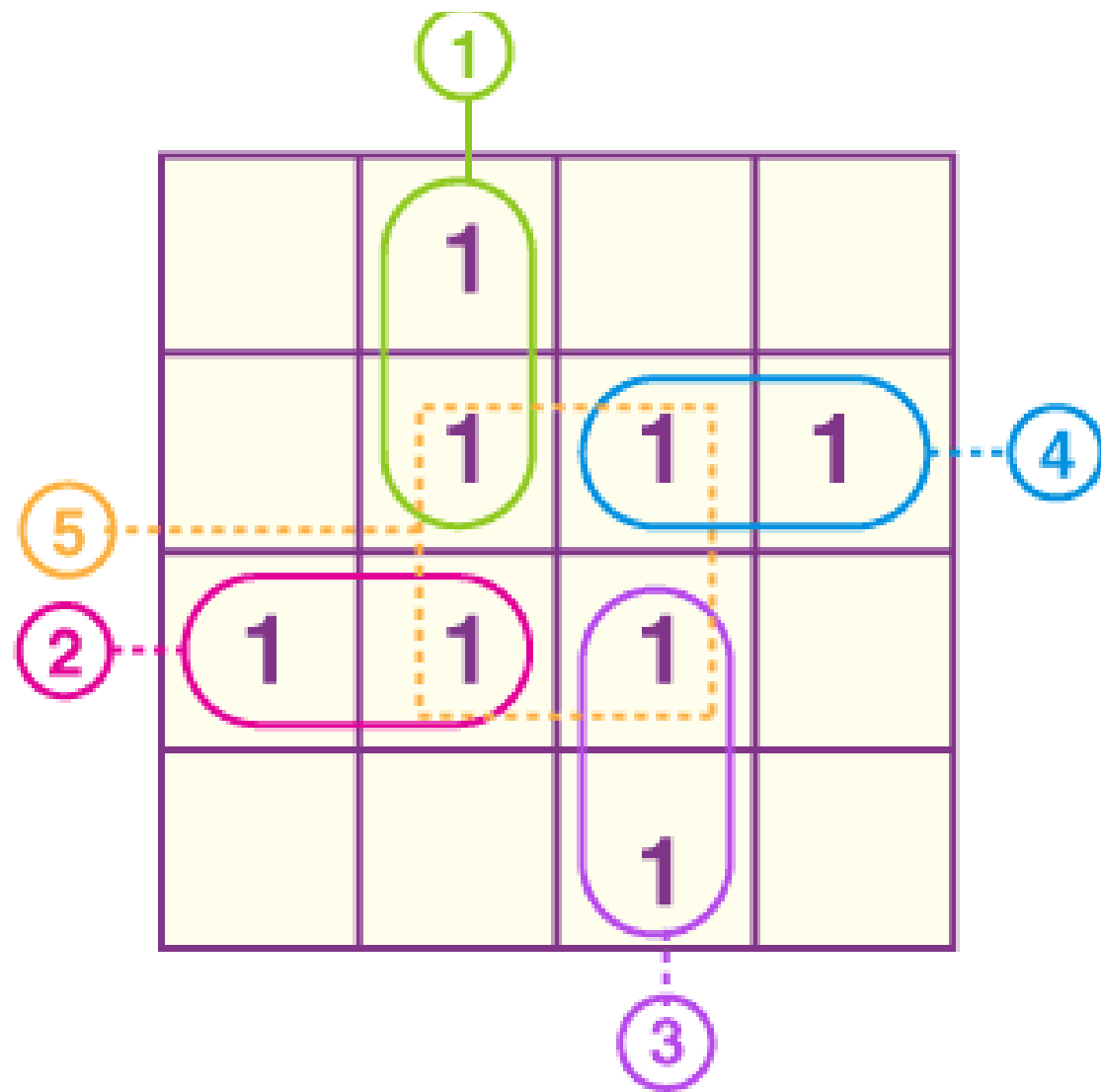
Se I  $\rightarrow$  2

- Prime implicants : 4
- Essential prime implicants : 2  $\rightarrow \bar{c}\bar{a} + ca$
- Redundant prime implicants  $\rightarrow 0$



## Example-1

Find the number of implicants, EPI, PI, RPI and SPI if  $F = \Sigma(1, 5, 6, 7, 11, 12, 13, 15)$



$$F = \textcircled{1} + \textcircled{2} + \textcircled{3} + \textcircled{4}$$

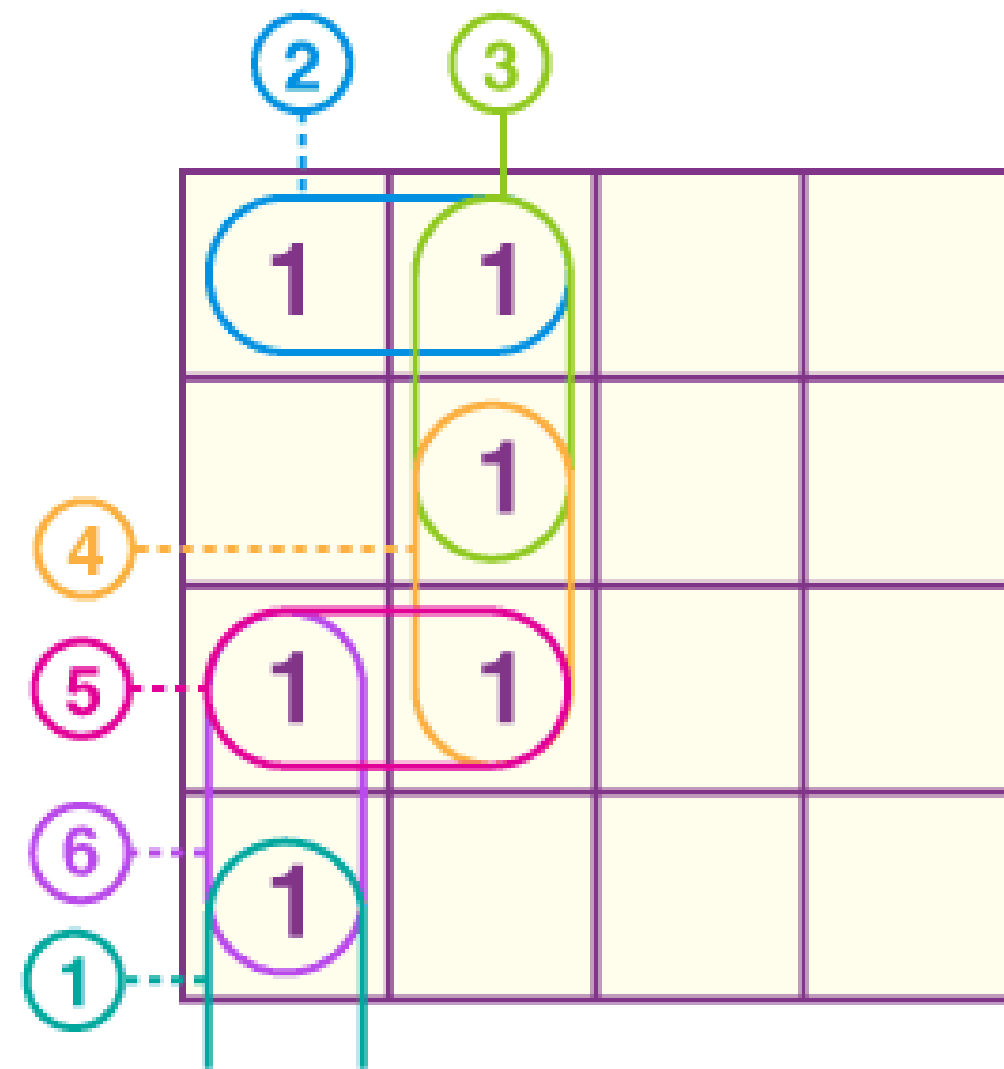
No. of Implicants = 8 ✓

PI = (1,2,3,4,5)

EPI = (1,2,3,4)

RPI = (5)

Find the number of implicants, EPI, PI, RPI and SPI if  $F = \Sigma(0, 1, 5, 8, 12, 13)$



$$F = \textcircled{1} + \textcircled{3} + \textcircled{5}$$

OR

$$F = \textcircled{2} + \textcircled{4} + \textcircled{6}$$

No. of Implicants = 6

PI = (1,2,3,4,5,6)

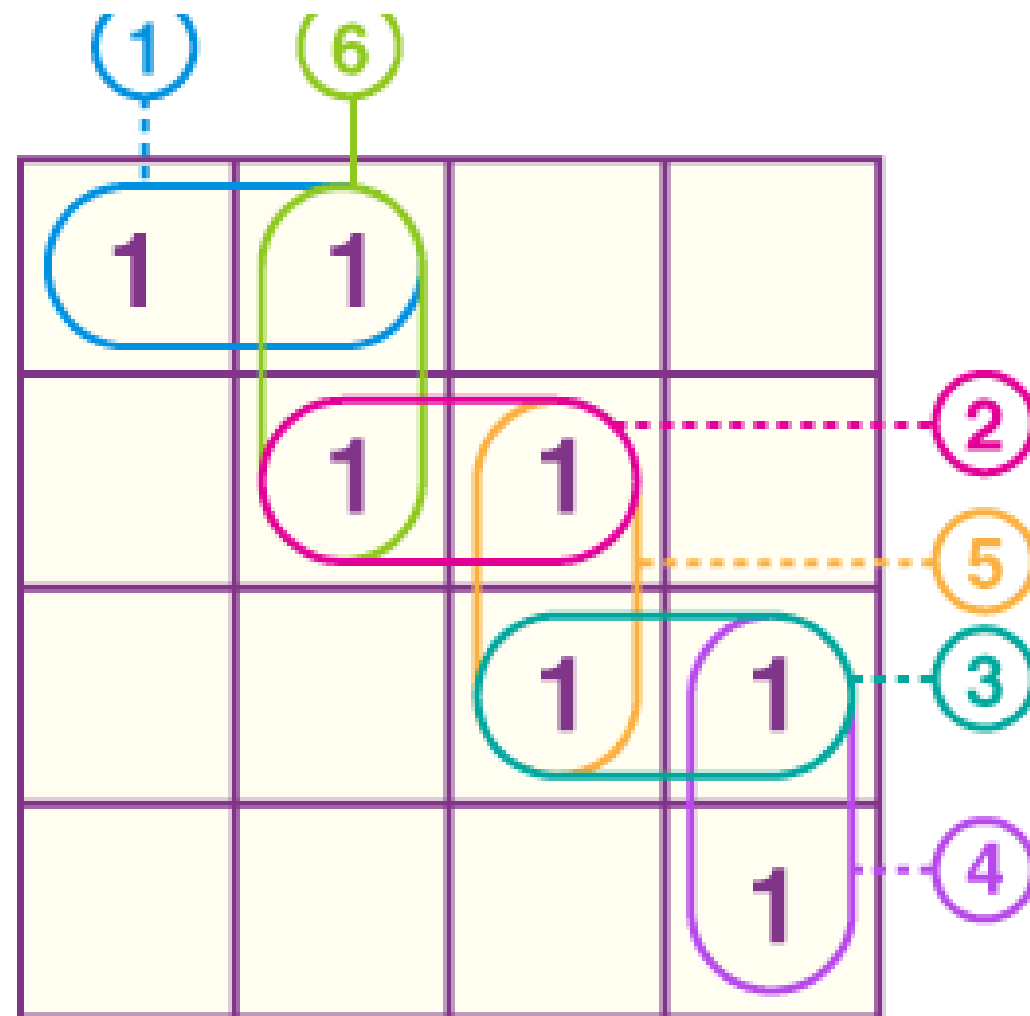
SPI = (1,2,3,4,5,6)

$$\text{EPI} = 0$$

$$\text{RPI} = 0$$

### Example-3

Find the number of implicants, EPI, PI, RPI and SPI if  $F = \Sigma(0, 1, 5, 7, 15, 14, 10)$



No. of Implicants = 7

PI = (1,2,3,4,5,6)

EPI = (1,4)

SPI = (2,3,5,6)

$RPI = 0$

$$F = \textcircled{1} + \textcircled{2} + \textcircled{3} + \textcircled{4}$$

OR

$$F = \textcircled{1} + \textcircled{5} + \textcircled{6} + \textcircled{4}$$