

Steps to Solve the Coffee Shop Problem

1. Identify the variables in the domain: A, M, C, K
2. Transpose the requirements into algebraic form:

Amy, Kathy, and Marmaduke vote NO and Cedric votes YES,	$\bar{A}\bar{K}\bar{M}C$
or Amy and Marmaduke vote NO and the rest vote YES,	$\bar{A}K\bar{M}C$
or Cedric and Marmaduke vote YES and the rest vote NO,	$\bar{A}\bar{K}MC$
or Amy votes NO and the others vote YES,	$\bar{A}KMC$
or Cedric votes NO and the others vote YES,	$AKM\bar{C}$
or Cedric and Amy vote YES and the others vote NO,	$A\bar{K}\bar{M}C$
or Kathy votes NO and the others vote YES,	$A\bar{K}MC$
or Marmaduke votes NO and the others vote YES,	$AK\bar{M}C$
or Amy and Kathy vote YES and the others vote NO,	$AKM\bar{C}$
or they all vote YES.	$AKMC$

3. Establish the logic required to achieve the desired output:

		BUY
	$\bar{A}\bar{K}\bar{M}C$	1
OR	$\bar{A}K\bar{M}C$	1
OR	$\bar{A}\bar{K}MC$	1
OR	$\bar{A}KMC$	1
OR	$AKM\bar{C}$	1
OR	$A\bar{K}\bar{M}C$	1
OR	$A\bar{K}MC$	1
OR	$AK\bar{M}C$	1
OR	$AKM\bar{C}$	1
OR	$AKMC$	1

4. Convert into a standard Boolean expression.

$$\bar{A}\bar{K}\bar{M}\bar{C} + \bar{A}\bar{K}\bar{M}C + \bar{A}\bar{K}MC + \bar{A}KMC + AKM\bar{C} + A\bar{K}\bar{M}\bar{C} + A\bar{K}MC + AK\bar{M}\bar{C} + AK\bar{M}C + AKMC$$

5. In order to simplify using a Karnaugh Map, convert the Boolean expression to its binary equivalent:

$\bar{A}\bar{K}\bar{M}\bar{C}$	$\bar{A}\bar{K}\bar{M}C$	$\bar{A}\bar{K}MC$	$\bar{A}KMC$	$AKM\bar{C}$	$A\bar{K}\bar{M}\bar{C}$	$A\bar{K}MC$	$AK\bar{M}\bar{C}$	$AK\bar{M}C$	$AKMC$
0001	0101	0011	0111	1110	1001	1011	1101	1100	1111

6. Draw the Karnaugh Map for the required domain (4 variables in this case):

MC \ AK	00	01	11	10
00				
01				
11				
10				

7. Populate the Map as per the expression:

MC \ AK	00	01	11	10
00		1	1	
01		1	1	
11	1	1	1	1
10		1	1	

8. Group the 1's into the largest groups possible:

MC \ AK	00	01	11	10
00		1	1	
01		1	1	
11	1	1	1	1
10		1	1	

9. Read the map for each group:

Vertical Group = C

Horizontal Group = AK

10. Read the minimised logic:

$$C + AK = \text{BUY}$$

11. Implement the logic:

