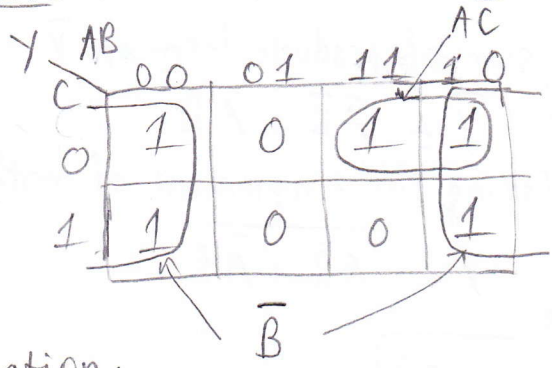
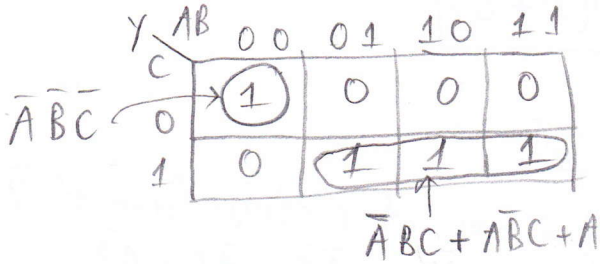
EXAMPLE PROBLEMS

Example 2.9 : Minimization of a three-variable function using a K-map



Thus, $\boxed{Y = A\bar{C} + \bar{B}}$

Variation:



Thus, $Y = \bar{A}\bar{B}\bar{C} + \bar{A}BC + A\bar{B}C + ABC$

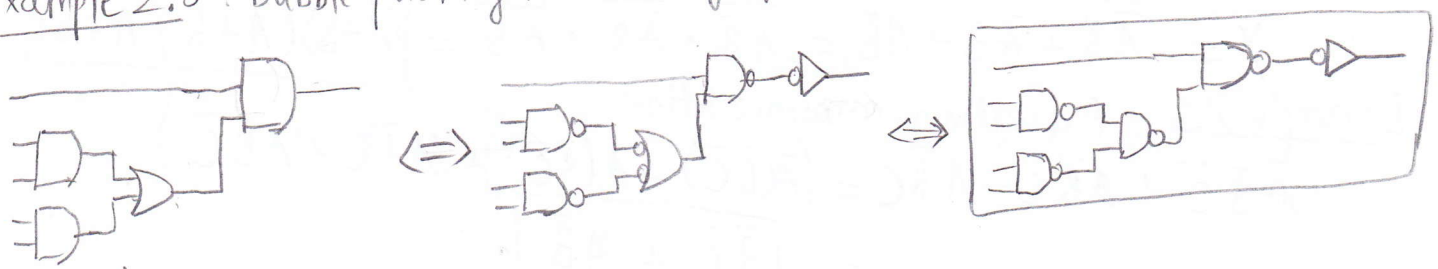
$= \bar{A}\bar{B}\bar{C} + (\bar{A}B + A\bar{B} + AB)C$

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

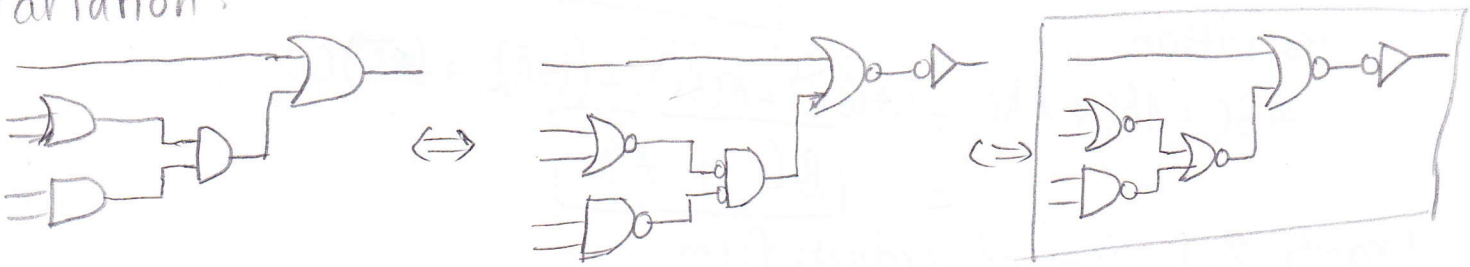
$= \bar{A}\bar{B}\bar{C} + (A + B)C$

$\boxed{Y = \bar{A}\bar{B}\bar{C} + AC + BC}$

Example 2.8 : Bubble pushing for CMOS logic



Variation:



Example 2.4: Derive the product-of-sums form

A	B	Y	$\bar{Y}$	minterm
0	0	0	1	$\bar{A}\bar{B}$
0	1	0	1	$\bar{A}B$
1	0	1	0	$A\bar{B}$
1	1	1	0	AB

$\Rightarrow$ sum-of-products form of $\bar{Y}$:

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

Taking the complement of both sides:

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

Using De Morgan's theorem twice:

$Y = \overline{\bar{A}\bar{B}} \cdot \overline{\bar{A}B} = \boxed{(A+B)(A+\bar{B})}$

Variation:

A	B	Y	$\bar{Y}$	minterm
0	0	0	1	$\bar{A}\bar{B}$
0	1	0	1	$\bar{A}B$
1	0	0	1	$A\bar{B}$
1	1	1	0	AB

$\Rightarrow$ sum-of-products form of $\bar{Y}$

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

Taking the complement of both side and applying DeMorgan's theorem:

$Y = \bar{A}\bar{B} + \bar{A}B + A\bar{B} = \overline{\bar{A}\bar{B}} \cdot \overline{\bar{A}B} \cdot \overline{A\bar{B}} = \boxed{(A+B)(A+\bar{B})(\bar{A}+B)}$

Example 2.6: Equation minimization

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

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

Variation:

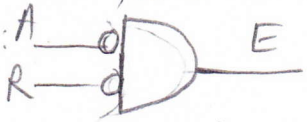
$\bar{A}BC + ABC + A\bar{B}C = (\bar{A}(BC) + A(BC)) + ((A\bar{B})C + (A\bar{B})C)$

$= \boxed{BC + A\bar{B}}$

Example 2.1: Sum-of-products form

A = there are ants, R = It rains, E = Ben enjoys the picnic

$\Rightarrow E = \bar{A}\bar{R} = \Sigma(0)$ $\Rightarrow$ circuit:



Variation:

L = Ben feels lazy, R = It rains, S = Ben skips class

$\Rightarrow S = LR = \Sigma(3)$ $\Rightarrow$ circuit: