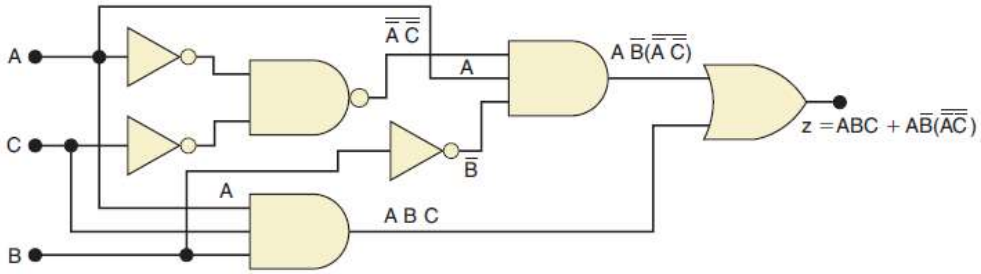
Module : Combinational & Sequential Logic L1 IE : S1 Duration: 1h30 20/01/2025

Solution 1:



The result is $Z = ABC + A\bar{B}(\overline{\bar{A}\bar{C}})$

Once the expression is determined, it is usually a good idea to break down all large inverter signs using DeMorgan's theorems and then multiply out all terms.

$$\begin{aligned} z &= ABC + A\overline{B}(\overline{\overline{A}} + \overline{\overline{C}}) \\ &= ABC + A\overline{B}(A + C) \\ &= ABC + A\overline{B}A + A\overline{B}C \\ &= ABC + A\overline{B} + A\overline{B}C \end{aligned}$$

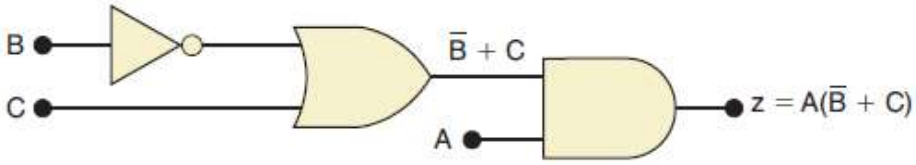
With the expression now in SOP form, we should look for common variables among the various terms with the intention of factoring. The first and third terms above have AC in common, which can be factored out:

$$z = AC(B + \overline{B}) + A\overline{B}$$

Since $B + \bar{B} = 1$, then

$$\begin{aligned} z &= AC(1) + A\overline{B} \\ &= AC + A\overline{B} \end{aligned}$$

We can now factor out A, which results in $Z = A(\bar{B} + C)$



Solution 2:

Analyzing the truth table shown in Table 2, we can deduce that the function F can take the following form:

$$F(A,B,C) = \begin{cases} \bar{B} & if\ A = 0 \\ B + C & if\ A = 1 \end{cases}$$

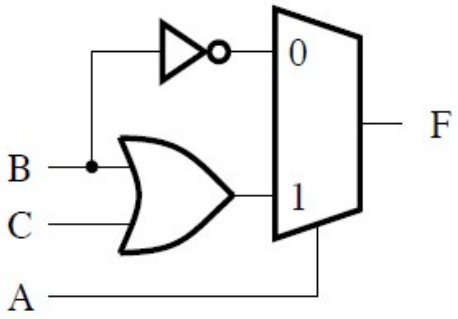
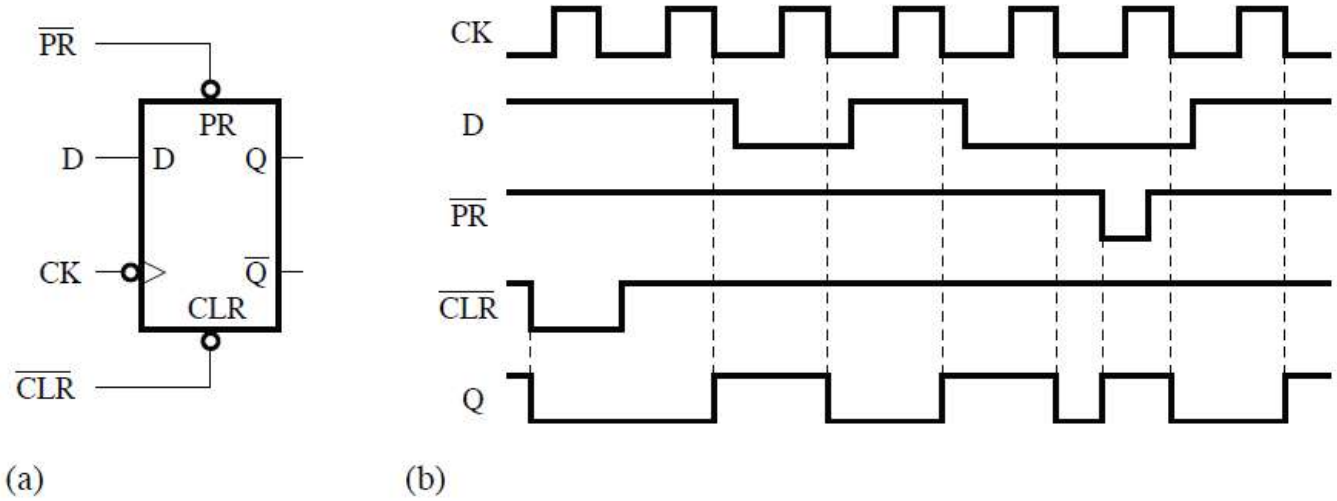


Table 2

A	B	C	F	
0	0	0	1	
0	0	1	1	
0	1	0	0	$\overline{B}$
0	1	1	0	
1	0	0	0	
1	0	1	1	
1	1	0	1	$B + C$
1	1	1	1	

Solution3:



Solution 4:

Present State	Inputs		Next State	Output
Q	x	y	Q	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1