

three sensors are attached to a printing device, with three alarms attached to the sensors. The first sensor 'A' detects if the device needs ink. The second sensor 'B' detects if the device needs repair. The third sensor 'C' detects if the device should jam. An alarm sounds if 2 or more problems occur

when $A=1 \Rightarrow$ the device needs ink, otherwise $A=0$

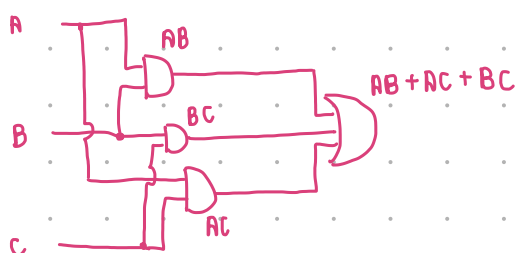
when $B=1 \Rightarrow$ the device needs repair, otherwise $B=0$

when $C=1 \Rightarrow$ the device should jam, otherwise $C=0$

alarm $X = 1$ when two or more problems occur

A	B	C	X
0	0	0	0
1	0	0	0
0	1	0	0
0	0	1	0
1	1	0	1 $\Rightarrow AB\bar{C}$
1	0	1	1 $\Rightarrow A\bar{B}C$
0	1	1	1 $\Rightarrow \bar{A}BC$
1	1	1	1 $\Rightarrow ABC$

$$\begin{aligned}
 \therefore X &= AB\bar{C} + A\bar{B}C + \bar{A}BC + ABC \\
 &= AB(\bar{C} + C) + A\bar{B}C + \bar{A}BC \\
 &= AB + A\bar{B}C + \bar{A}BC \\
 &= A(B + \bar{B}C) + \bar{A}BC \\
 &= A(B + \bar{B})(B + C) + \bar{A}BC \\
 &= AB + AC + \bar{A}BC \\
 &= AB + C(A + \bar{A}B) \\
 &= AB + C(A + \bar{A})(A + B) \\
 &= AB + AC + BC
 \end{aligned}$$



Schools are given snow days given specific circumstances. If there is ice on the roads, but no salt, then a snow day is given. If there is salt however, then a snow day is not given. Regardless of whether or not there is salt, whenever there is >2 inches of snow, then a snow day is given.

$I=1$, when there is ice on the road

$S=1$, when there is no salt on the road

$T=1$, when there is greater than 2 inches of snow

I	S	T	X	
0	0	0	0	
1	0	0	0	
0	0	1	1	$\Rightarrow \bar{I}\bar{S}T$
0	1	0	0	
1	1	0	1	$\Rightarrow IS\bar{T}$
1	0	1	1	$\Rightarrow I\bar{S}T$
0	1	1	1	$\Rightarrow \bar{I}ST$
1	1	1	1	$\Rightarrow IST$

A computer chip controls whether or not children are allowed to watch a specific TV show. If the time is before 5PM, then the TV always works. However, if it's after 5PM, then the shows rating is used. If the rating is for General Audiences, then the TV will work; however, if the rating is for Mature Audiences, then the TV does not turn on

$B=1 \Rightarrow$ before 5PM, else $B=0$

$G=1 \Rightarrow$ rating for general audiences \Rightarrow else $G=0$

$M=1 \Rightarrow$ rating for mature audiences \Rightarrow else $M=0$

B	G	M	X
0	0	0	0
1	0	0	1
0	1	0	1
0	0	1	0
1	1	0	1
1	0	1	1
0	1	1	0
1	1	1	1

$$\Rightarrow B\bar{G}\bar{M}$$

$$\Rightarrow \bar{B}G\bar{M}$$

$$\Rightarrow B\bar{G}\bar{M}$$

$$\Rightarrow B\bar{G}M$$

$$\Rightarrow BGM$$

$$\begin{aligned}
 X &= B\bar{G}\bar{M} + \bar{B}G\bar{M} + B\bar{G}M + B\bar{G}M + BGM \\
 &= B\bar{G}(\bar{M} + M) + B\bar{G}(\bar{M} + M) + \bar{B}G\bar{M} \\
 &= B\bar{G} + B\bar{G} + \bar{B}G\bar{M} \\
 &= B(\bar{G} + G) + \bar{B}G\bar{M} \\
 &= B + \bar{B}G\bar{M} \\
 &= (B + \bar{B})(B + G)(B + \bar{M}) \\
 &= B + B\bar{M} + BG + G\bar{M} \\
 &= B(1 + \bar{M}) + BG + G\bar{M} \\
 &= B(1 + G) + G\bar{M} \\
 &= B + G\bar{M}
 \end{aligned}$$

