

6.6 DESIGN OF LOGIC NETWORKS

6.6.1 Define the Problem in Words

We want the alarm system to create a high signal sounding the alarm for certain combinations of the house sensors. Also, we want the user to be able to select one of three operating states:

1. An active state where the alarm will sound only if the windows or doors are disturbed. This state is useful when the occupants are sleeping.
2. An active state where the alarm will sound if the windows or doors are disturbed or if there is motion in the house. This state is useful when the occupants are away.
3. A disabled state where the alarm will not sound. This state is useful during normal household activity.

Boolean variables:

- n A : state of the door and window sensors
- n B : state of the motion detector
- n Y : output used to sound the alarm
- n CD : 2-bit code set by the user to select the operating state defined by

$$D = \begin{cases} 0\ 1 & \text{operating state} \\ 1\ 0 & \text{operating state} \\ 0\ 0 & \text{operating state} \end{cases}$$

6.6.2 Write Quasi-Logic Statements

Activate the alarm ($Y = 1$) if A is high *and* the code CD is 0 1 *or* activate the alarm if A *or* B is high *and* the code is 1 0.

6.6.3 Write the Boolean Expression

$$Y = A \cdot (\bar{C} \cdot D) + (A + B) \cdot (C \cdot \bar{D}). \quad (6.29)$$

C	D	$(\bar{C} \cdot D)$	$(C \cdot \bar{D})$
0	0	0	0
1	0	0	1
0	1	1	0

$$Y = (A \cdot D) + (A + B) \cdot C \quad (6.30)$$

6.6.4 AND Realization

$$Y = (A \cdot D) + (A + B) \cdot C \quad (6.31)$$

$$Y = (A \cdot D) + (\overline{\bar{A} \cdot \bar{B}}) \cdot C \quad (6.32)$$

$$Y = \overline{\overline{A \cdot D} \cdot \overline{\bar{A} \cdot \bar{B}}} \cdot C \quad (6.33)$$

6.6.5 Draw the Circuit Diagram

