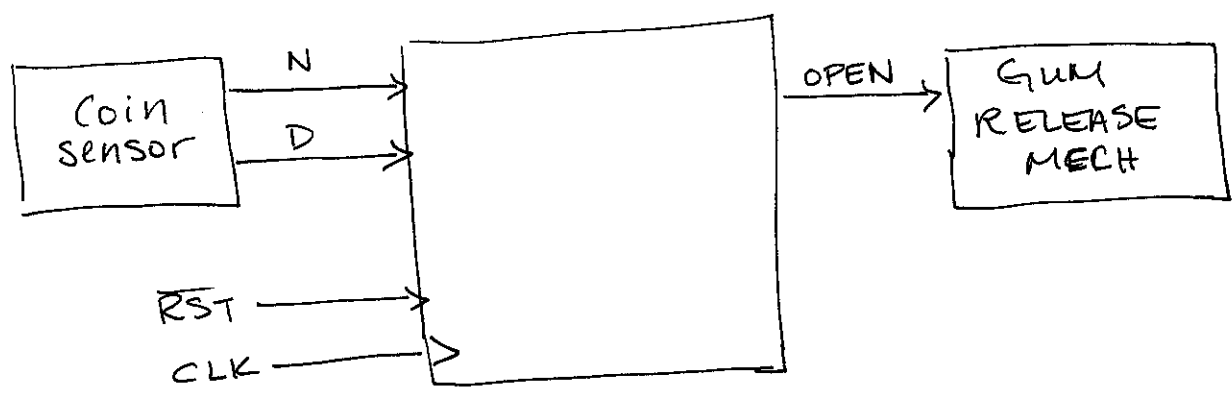
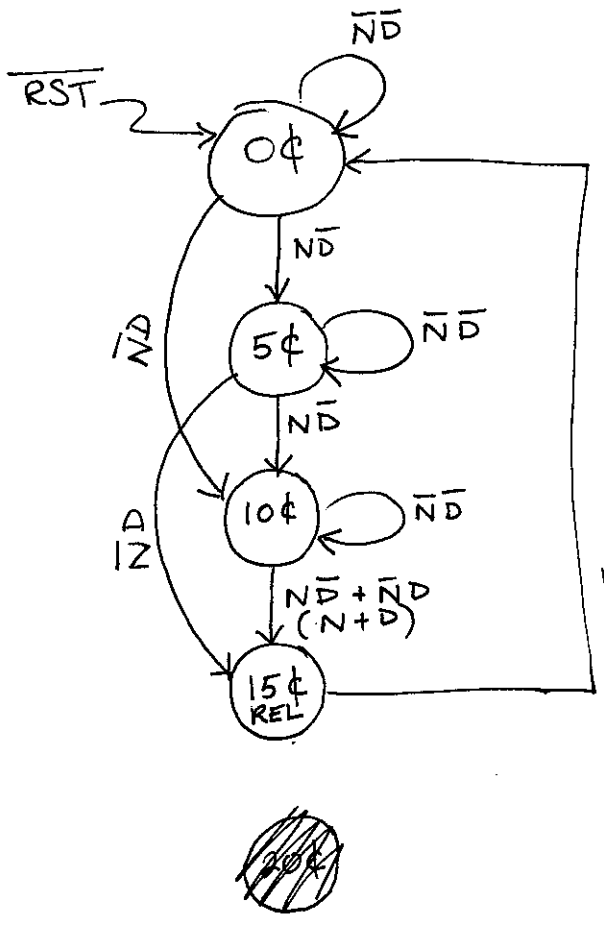


# VENDING MACHINE FSM

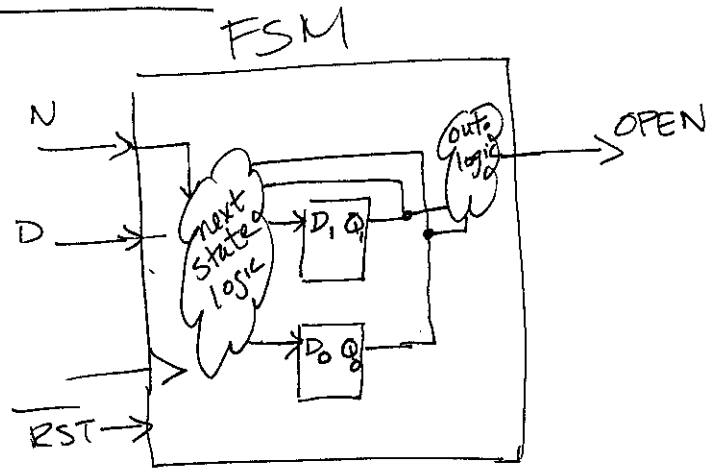


- release gum only after 15¢ deposited
- no change
- no nickel & dime @ once (N=1, D=1)



# STATE ENCODING - BCD (COMPACT)

STATE	$Q_1$	$Q_0$
0¢	0	0
5¢	0	1
10¢	1	0
REL	1	1



## SYMBOL. TRANS. TAB.

CURR ST.	$Q_1 Q_0$	$N D$	NEXT STATE	$D_1 D_0$	$T_1 T_0$
0¢	0 0	0 0	0¢	0 0	0 0
"	0 0	1 0	5¢	0 1	0 1
"	0 0	0 1	10¢	1 0	1 0
5¢	0 1	0 0	5¢	0 1	0 0
"	0 1	1 0	10¢	1 0	1 1
"	0 1	0 1	REL	1 1	1 0
10¢	1 0	0 0	10¢	1 0	0 0
"	1 0	1 0	REL	1 1	0 1
"	1 0	0 1	REL	1 1	0 1
REL	1 1	XX	0¢	0 0	1 1

$P_1 =$   
 $D_0 =$  } see next page.

could use other flip-flops

CURR STATE	$Q_1$	$Q_0$	OPEN
0¢	0	0	0
5¢	0	1	0
10¢	1	0	0
REL	1	1	1

$$OPEN = Q_1 \cdot Q_0$$

## K-MAP FOR D1

		ND			
$Q_1, Q_0$		00	01	11	10
00			1	X	
01			1	X	1
11				X	
10		1	1	X	1

$$D_1 = Q_1 \bar{Q}_0 + \bar{Q}_1 Q_0 N + \bar{Q}_1 \bar{Q}_0 \bar{D}$$

## K-MAP FOR D0

		ND			
$Q_1, Q_0$		00	01	11	10
00				X	1
01		1	1	X	
11				X	
10		1	X		1

$$D_0 = \bar{Q}_0 N + Q_1 \bar{Q}_0 D + \bar{Q}_1 Q_0 \bar{N}$$

## STATE ENCODING - ONE HOT

STATE	$Q_0$	$Q_5$	$Q_{10}$	$Q_R$
0¢	1	0	0	0
5¢	0	1	0	0
10¢	0	0	1	0
REL	0	0	0	1

## OUTPUT LOGIC

$$\text{OPEN} = Q_R$$

## NEXT STATE LOGIC

$$D_0 = Q_R + Q_0 \bar{N} \bar{D}$$

$$D_5 = Q_0 \bar{N} \bar{D} + Q_5 \bar{N} \bar{D}$$

$$D_{10} = Q_0 \bar{N} \bar{D} + Q_5 \bar{N} \bar{D} + Q_{10} \bar{N} \bar{D}$$

$$D_R = Q_5 \bar{N} \bar{D} + Q_{10} (N + D)$$