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(8) Appendix - The detailed design worksheet

8.1 Inputs, outputs, and states of the system

Inputs:

Reset:

{True (T), False (F)}

Coin:

{Empty (E), Nickel (N), Dime (D)}

Outputs:

Release Gum (RG):

{T, F}

Return Nickel (RN):

{T, F}

States:

Init	initial
5c	amount deposited is 5 cents
10c	amount deposited is 10 cents
15c	amount deposited is 15 cents.

8.2 Encoding schemes of inputs, outputs, and states.

Inputs:

Reset	r
False	0
True	1

Coin	x_1x_0
Empty (E)	00
Nickel (N)	01
Dime (D)	11

Outputs:

RG	z_1
False	0
True	1

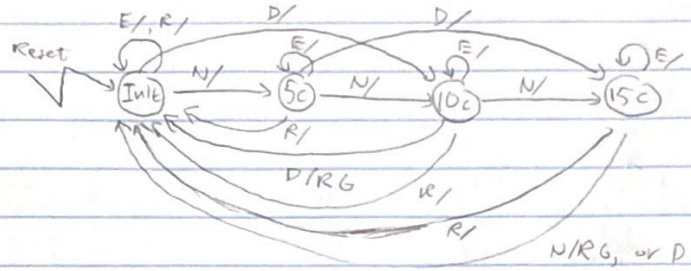
RN	z_0
False	0
True	1

States:

State	S_1S_0
Init	00
5c	01
10c	11
15c	10

Note: OR-AND network, JK Flip-flops.

8.3 the state diagram and the state table



State Table

PS	Inputs.					
$S_1 S_0$	$x_1x_0 = 00$	$x_1x_0 = 01$	$x_1x_0 = 11$	$x_1x_0 = 00$	$x_1x_0 = 01$	$x_1x_0 = 11$
00	00,00	01,00	11,00	0 -	0 -	1 -
01	01,00	11,00	10,00	0 -	1 -	1 -
11	11,00	10,00	00,10	-0	-0	-1
10	10,00	00,10	00,11	-0	-1	-1
	NS Outputs RG RN			$J_1 K_1$		

$x_1x_0 = 00$	$x_1x_0 = 01$	$x_1x_0 = 11$
0 -	1 -	1 -
-0	-0	-1
-0	-1	-1
0 -	0 -	0 -

$J_0 K_0$

PS \ NS	0	1
0	0 -	1 -
1	-1	-0
	J(+)	K(+)

8.4 Minimization Procedure

J_1 \ x_1x_0 / S_1S_0	00	01	11	10
00	0	0	1	-
01	0	1	1	-
11	-	-	-	-
10	-	-	-	-

K_1 \ x_1x_0 / S_1S_0	00	01	11	10
00	-	-	-	-
01	-	-	-	-
11	0	0	1	-
10	0	1	1	-

$J_1 = (x_0)(S_0 + x_1)$

$K_1 = (x_0)(S_0' + x_1)$

$J_0 = (S_1')(x_0)$

$K_0 = (x_0)(S_1 + x_1)$

J_0 \ x_1x_0 / S_1S_0	00	01	11	10
00	0	1	1	-
01	-	-	-	-
11	-	-	-	-
10	0	0	0	-

K_0 \ x_1x_0 / S_1S_0	00	01	11	10
00	-	-	-	-
01	0	0	1	-
11	0	1	1	-
10	-	-	-	-

Outputs

RG

S_1S_0 \ x_1x_0	00	01	11	10
00	0	0	0	–
01	0	0	0	–
11	0	0	1	–
10	0	1	1	–

RN

S_1S_0 \ x_1x_0	00	01	11	10
00	0	0	0	–
01	0	0	0	–
11	0	0	0	–
10	0	0	1	–

$RG = x_0 S_1 (S_0' + x_1)$ $\quad RN = x_1 S_0' S_1$

8.5 Final minimal expressions and schematic ← next page.

$J_1 = (x_0)(S_0 + x_1)$

$K_1 = (x_0)(S_0' + x_1)$

$J_0 = (S_1')(x_0)$

$K_0 = (x_0)(S_1 + x_1)$

$RG = x_0 S_1 (S_0' + x_1)$

$RN = x_1 S_0' S_1$