Design components

Saturday, May 9, 2020 8:01 PM

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Down counter using JK ff, for sequence:

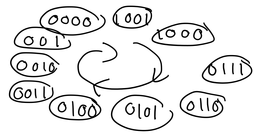
9 → 8 → 7 → 6 → 5 → 4 → 3 → 2 → 1 → 0

JK:

q	q^+	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

J K	CLK	Q
0 0	↑	no change 0 X
0 1	↑	rest 1 X
1 0	↑	set = 1 X 1
1 1	↑	flip / toggles X 0

only interested in sequence up to 9 and 0



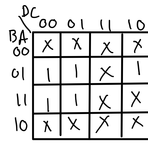
Truth table:

	D	C	B	A	D^+	C^+	B^+	A^+	JD KD	JC KC	JB KB	JA KA
0	0	0	0	0	1	0	0	1	1 X	0 X	0 X	1 X
1	0	0	0	1	0	0	1	0	0 X	0 X	0 X	X 1
2	0	0	1	0	0	0	1	1	0 X	0 X	X 1	1 X
3	0	0	1	1	0	0	1	0	0 X	0 X	X 0	X 1
4	0	1	0	0	0	0	1	1	0 X	X 1	1 X	1 X
5	0	1	0	1	0	1	0	0	0 X	X 0	0 X	X 1
6	0	1	1	0	0	1	0	1	0 X	X 0	X 1	1 X
7	0	1	1	1	0	1	1	0	0 X	X 0	X 0	X 1
8	1	0	0	0	0	1	1	1	X 1	1 X	1 X	1 X
9	1	0	0	1	1	0	0	0	X 0	0 X	0 X	X 1

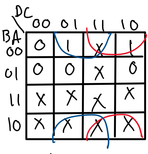
10 – 15 : (X), don't cares since sequence: 9 → 0

Using K-maps:

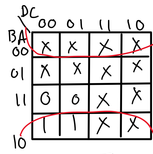
$J_A = 1$



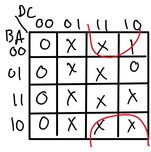
$K_A = 1$



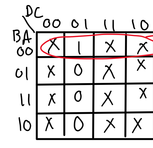
$J_B = C\bar{A} + D\bar{A}$



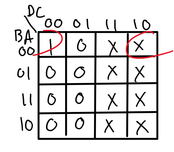
$K_B = \bar{A}$



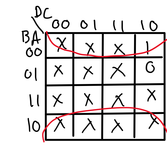
$J_C = D\bar{A}$



$K_C = \bar{B}\bar{A}$



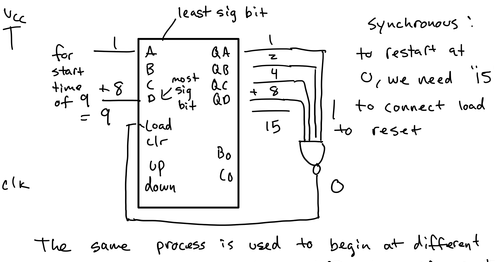
$J_D = \bar{A}\bar{B}\bar{C}$



$K_D = \bar{A}$

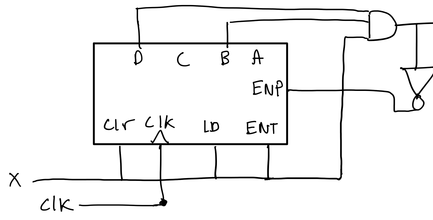
For third down counter, using 74193N:

For sequence: 9 8 7 6 5 4 3 2 1 0



The same process is used to begin at different input & can be reset at different specific counts

Diagram for 74161N, which will output 1 when the input has been one for nine consecutive nine or more consecutive clock inputs:



where Z is connected to the 74193N so it counts each user's chess moves beyond 0 - 9, for this specific design we limit the players availiable move to less than twenty. If someone were to alter the setting to the specific game, the 74161N can count beyond 20 by resetting the sequence so that the counter outputs 1 after the sequence is meet.