EGR 270
Fundamentals of Computer Engineering
File: Modseq1.opj

Modified Sequence Counter (using a 555 timer for the clock)

Note: This example is a modified version of Modseq.opj where the clock has been replaced by a 555 timer circuit.

Purpose: A counter has been designed to count in the sequence 0, 2, 1, 3, 7, 5, 6, and repeat using JK flip-flops and the excitation table method. See the attached sheet for the details of the design.

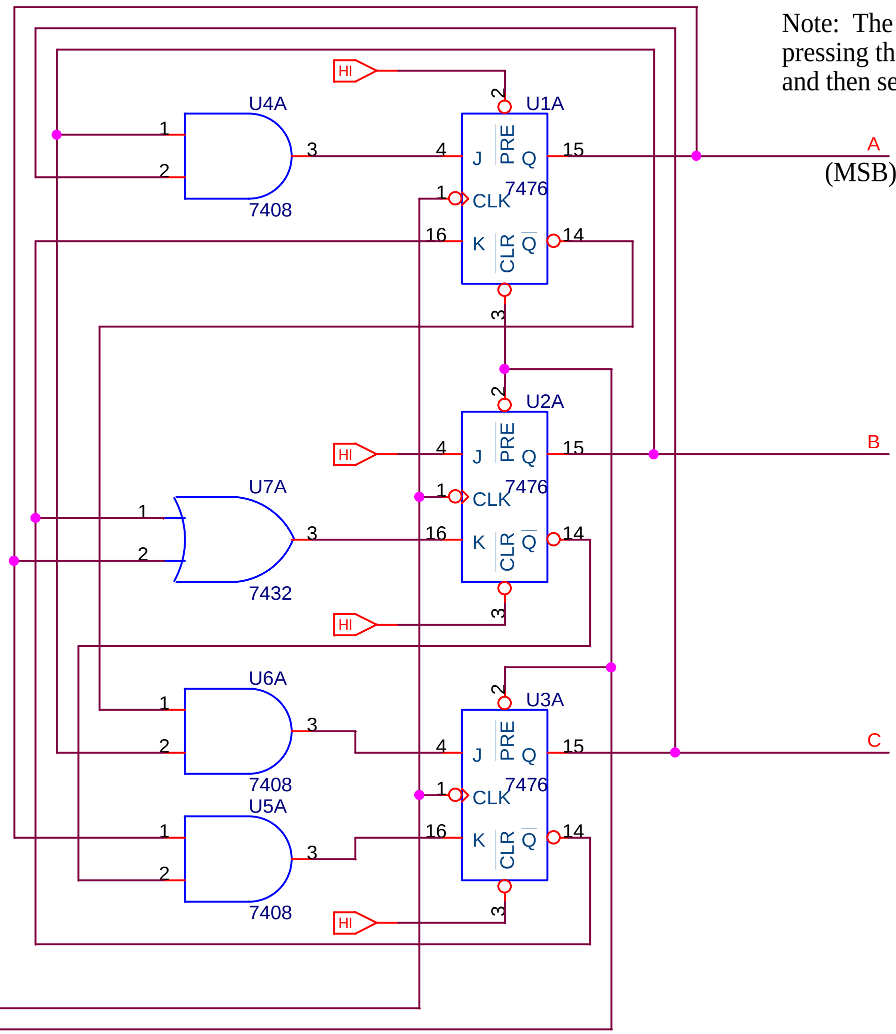
A 555 timer was used to generate a 1kHz input to clock the counter. Additionally, PSPICE requires that synchronous devices be initialized, so a Digital Clock is used to briefly provide a LOW pulse to initialize the counter to 3 (use ClearA, Preset B, and PresetC to preset to 011). The unused Preset and Clear lines must be tied HIGH.

Analysis: A TRANSIENT analysis with a final time of 10ms is used to show ten output counts since the period of the clock is 1ms (1/1kHz).

Note: The results of the design by the excitation table method are as follows:

JA = BC   KA = C'
JB = 1   KB = A + C'
JC = A' + B KC = A + B'

Note: The HI input is available by pressing the GND icon on the toolbar and then selecting $D_HI/SOURCE



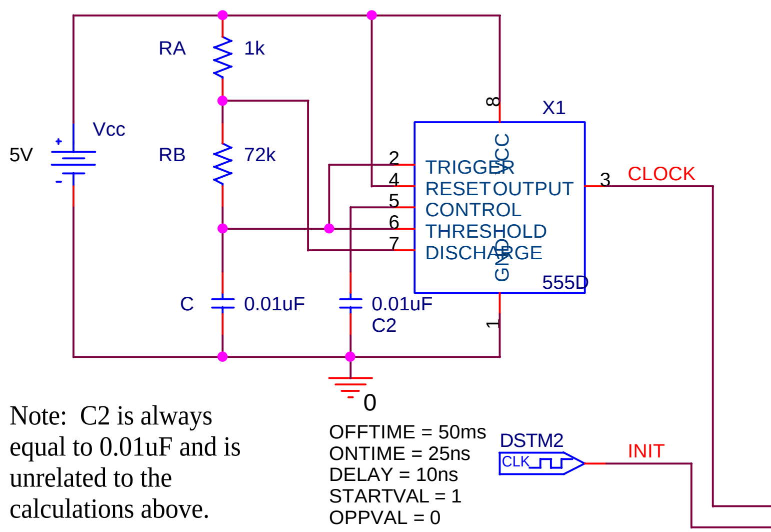
The 555 timer below is configured as a 1 kHz clock (astable operation) based on the following:

T_HIGH = 0.693(RA + RB)C = 0.693(73000)(0.01uF) = 0.5059 ms

T_LO = 0.693(RB)C = 0.693(72000)(0.01uF) = 0.499 ms

Period = T = T_HIGH + T_LO = 0.5059 ms + 0.499 ms = 1.005 ms

Frequency = f = 1/T = 1/1.005 ms = 995 Hz

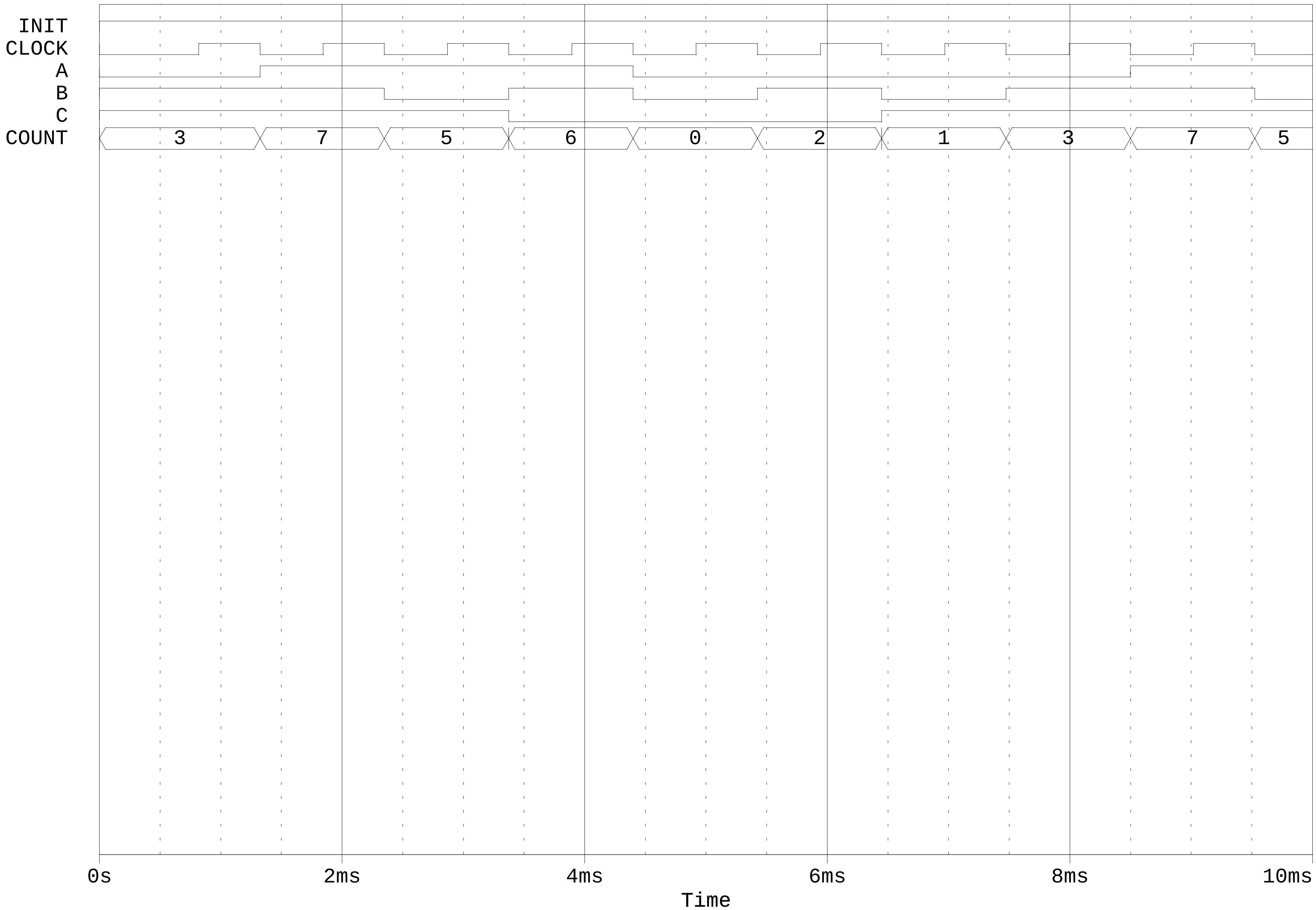


Note: C2 is always equal to 0.01uF and is unrelated to the calculations above.

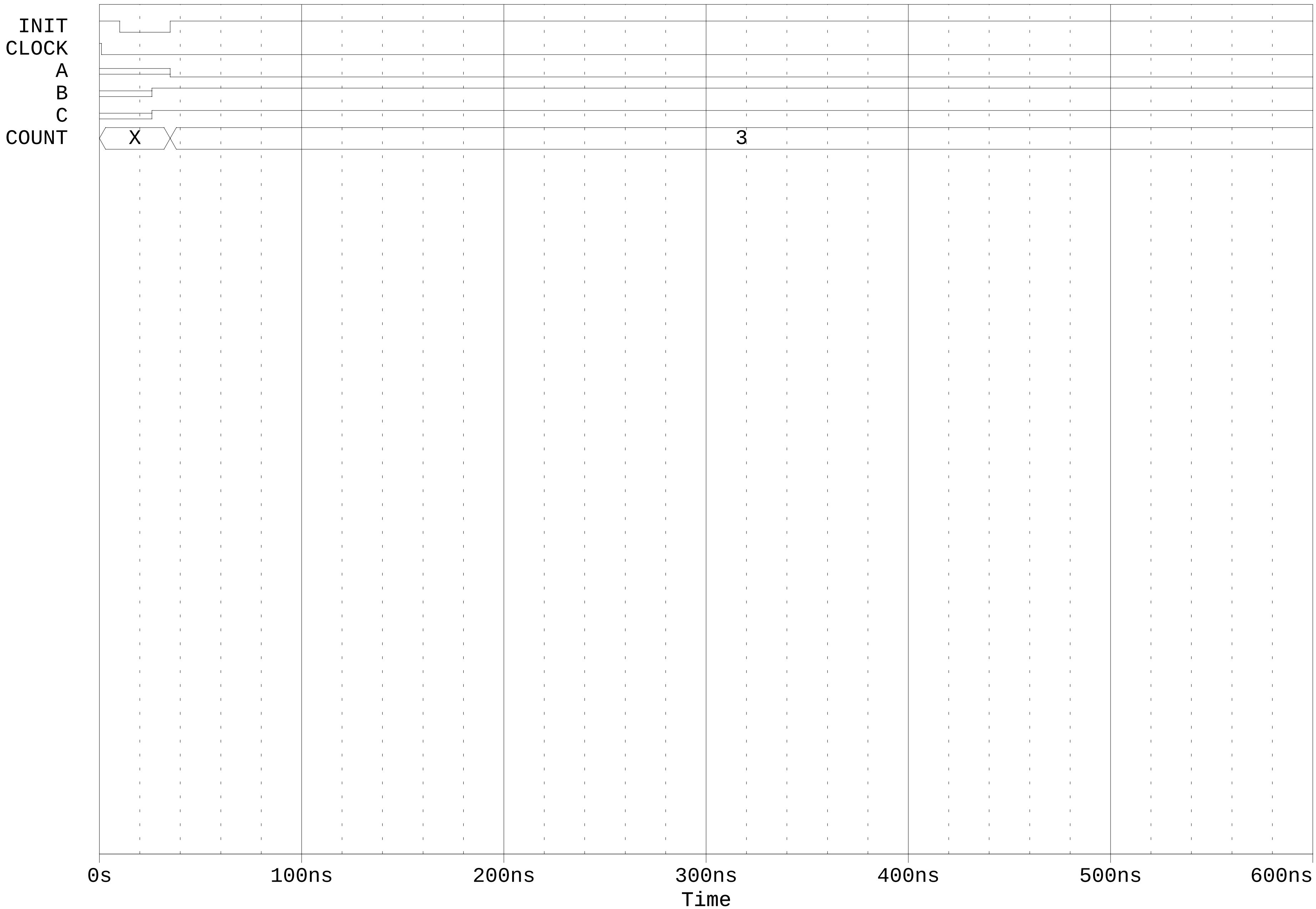
** circuit file for profile: Transient

Date/Time run: 04/04 18:39:50 Temperature: 27.0

(A) Modified Sequence Counter using a 555 Timer as a clock to count 0,2,1,3,7,5,6 and repeat



(A) Zooming in on the initialization pulse which initializes the counter to count 3



Example: Design a modified sequence counter using the excitation table method that will count in the sequence 0,2,1,3,7,5,6, and repeat. Treat unused count 4 as a "don't care". Use JK flip-flops.

Circuit Excitation Table

Present State			Next State			Flip-flop Inputs					
A	B	C	A	B	C	JA	KA	JB	KB	JC	KC
0	0	0	0	1	0	0	X	1	X	0	X
0	0	1	0	1	1	0	X	1	X	X	0
0	1	0	0	0	1	0	X	X	1	1	X
0	1	1	1	1	1	1	X	X	0	X	0
1	0	0	X	X	X	X	X	X	X	X	X
1	0	1	1	1	0	X	0	1	X	X	1
1	1	0	0	0	0	X	1	X	1	0	X
1	1	1	1	0	1	X	0	X	1	X	0

JK Flip-flop Excitation Table

Q(t)	Q(t+1)	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

Flip-flop Input Functions and Circuit Output Functions

A \ BC	00	01	11	10
0	0	0	1	0
1	X	X	X	X

$JA = BC$

A \ BC	00	01	11	10
0	1	1	X	X
1	X	1	X	X

$JB = 1$

A \ BC	00	01	11	10
0	0	X	X	1
1	X	X	X	0

$JC = A'B$

A \ BC	00	01	11	10
0	X	X	X	X
1	X	0	0	1

$KA = C'$

A \ BC	00	01	11	10
0	X	X	0	1
1	X	X	1	1

$KB = A + C'$

A \ BC	00	01	11	10
0	X	0	0	X
1	X	1	0	X

$KC = AB'$