

Introduction

In phase 2 of our CSE 231 project we have to include a sequential circuit to the previously created combinational circuit. The main purpose is to create a circuit that will sequentially print out the entire code given to us without requiring any ~~user~~ user input. I have decided to use JK Flip-Flops and my previously built "Simplified Sum of Products" combinational circuit. I will be explaining my reasoning in the next segment.

Cost - Analysis

The reason I chose JK-Flip Flop and simplified SOP is because the total circuit becomes the cheapest. All permutations have a couple of fixed costs: Such as ~~a~~ a clock input, 7-segment display and an IC 7404 Hex Inverter (NOT gate)

$$\begin{array}{l} \text{Calculation: IC 7404} \rightarrow 1 \times \text{Th. } 25.59 \\ \text{7-segment display} \rightarrow 1 \times \text{Th. } 9.85 \\ \hline \text{Total} = \text{Th. } 35.44 \end{array}$$

The rest of the circuit consists of 3 JK-Flip-Flops which we can get from 2x IC 4027. ~~We I~~ I needed 12, 2-input AND gates which I got from 3x IC 7408 (Quad 2-input AND gates). I also needed 8, 2-input OR gates which I got from 2x IC 7432 (Quad 2-input OR gates)

Calculation

$$2 \times \text{IC } 4027 \rightarrow 2 \times \text{Th. } 20.90$$

$$3 \times \text{IC } 7408 \rightarrow 3 \times \text{Th. } 23.59$$

$$2 \times \text{IC } 7432 \rightarrow 2 \times \text{Th. } 27.59$$

$$\text{Total} = \text{Th. } 167.75$$

Therefore, the total cost of this circuit is $(167.75 + 35.44)$

$= \text{Th. } 203.19$. This is an estimated price based on component prices taken ~~an~~ from "robo dca bd.com"

This is the cheapest one possible. The second cheapest one would be with a NOR gate circuit for the combinational part at around Th. 241.35.

These is the cost analysis, next part is how I built it.

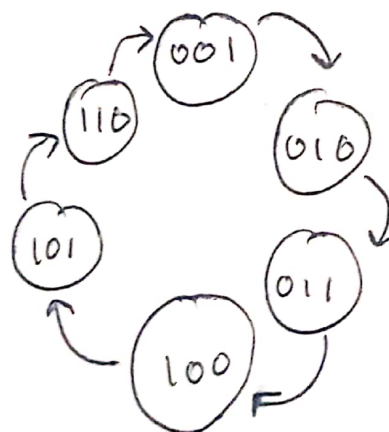
State Table

I constructed a State Table where my states were A, B, C. ~~The output Q of my~~

Current State			Next State			JK Flip Flop Input function					
A	B	C	A	B	C	J _A	K _A	J _B	K _B	J _C	K _C
x	x	x	x	x	x	x	x	x	x	x	x
0	0	1	0	1	0	0	x	1	x	x	1
0	1	0	0	1	1	0	x	x	0	1	x
0	1	1	1	0	0	1	x	x	1	x	1
1	0	0	1	0	1	x	0	0	x	1	x
1	0	1	1	1	0	x	0	1	x	x	1
1	1	0	0	0	1	x	1	x	1	1	x
x	x	x	x	x	x	x	x	x	x	x	x

State Diagram

A visual of the state table



(As there is no input/output the arrows are not labeled)

K-maps of the state table

$$J_A = BC$$

	C'	C
$A'B'$	x	0
$A'B$	0	1
AB	x	x
AB'	x	x

$$K_A = B$$

	C'	C
$A'B'$	x	x
$A'B$	x	x
AB	1	x
AB'	0	0

$$J_B = C$$

	C'	C
$A'B'$	x	1
$A'B$	x	x
AB	x	x
AB'	0	1

$$K_B = A + C$$

	C'	C
$A'B'$	x	x
$A'B$	0	1
AB	1	x
AB'	x	x

$$J_C = 1$$

	C'	C
$A'B'$	x	x
$A'B$	1	x
AB	1	x
AB'	1	x

$$K_C = 1$$

	C'	C
$A'B'$	x	1
$A'B$	x	1
AB	x	x
AB'	x	1