Lab. Script 8

Sequential Circuits Project[1]

A series decoder is a circuit whose input data comes in series and whose outputs represent their decoding. The size (in number of bits) of the word to decode may be fixed or variable. For a variable length code, it is important to ensure that if $a_0a_1a_2...a_k$ is a code word, then this should not contain any other word $a_0a_1a_2...a_j$ where (j <k) (no prefix property).

Using JK flip-flops, design and implement a Mealy machine to decode the variable size code presented in the following table:

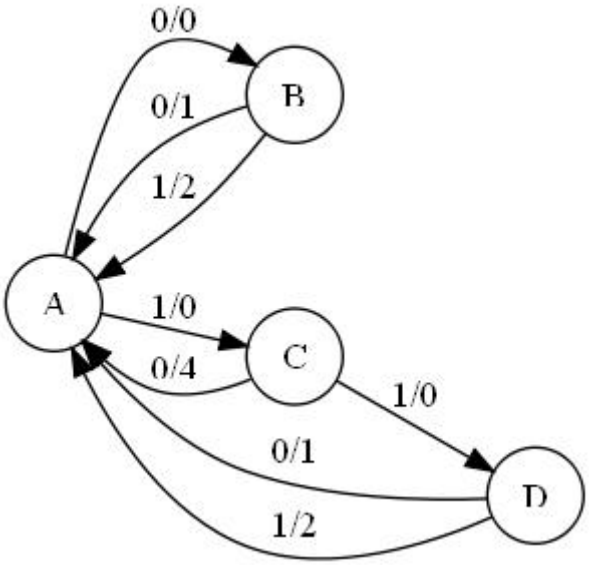
Input (series)	**Outputs** (parallel)
00	001
01	010
10	100
110	001
111	010

To project purposes:

1. Build the respective states diagram.
2. Determine the necessary number of states variables and build a states' attribution table.
3. Build a transitions table.
4. Using Karnaugh Maps determine the flip-flops excitation equations.
5. Using Karnaugh Maps determine the circuit output equations.
6. Present the circuit's logic diagram differentiating the combinatorial logic.

[1] Adapted from "Sistemas Digitais II", José Sousa, IPS

RESOLUTION



2 Flip-Flop's type D

States' Attribution Table

A	00
B	01
C	10
D	11

States' Transition Table

EP			ES		FF		Outputs		
Q1	Q0	X	Q1	Q0	D1	D0	S2	S1	S1
0	0	0	0	1	0	1	0	0	0
0	0	1	1	0	1	0	0	0	0
0	1	0	0	0	0	0	0	0	1
0	1	1	0	0	0	0	0	1	0
1	0	0	0	0	0	0	1	0	0
1	0	1	1	1	1	1	0	0	0
1	1	0	0	0	0	0	0	0	1
1	1	1	0	0	0	0	0	1	0

Note: output “one-Hot”

Karnaugh Maps of 3 variables

- Excitation Equations

D1

Q1Q0 / X	00	01	11	10
0	0	0	0	0
1	1	0	0	1

$$D_1 = \overline{Q}_0 \cdot X$$

D0

Q1Q0 / X	00	01	11	10
0	1	0	0	0
1	0	0	0	1

$$D_0 = \overline{Q}_1 \cdot \overline{Q}_0 \cdot \overline{X} + Q_1 \cdot \overline{Q}_0 \cdot X$$