Quiz 3

- Closed book. Closed notes. No calculator.
- Separate into groups of no more than three persons.

Draw the complete state diagrams for linear feedback shift registers (LFSRs) using the following polynomials. Does either LFSR generate an m-sequence?
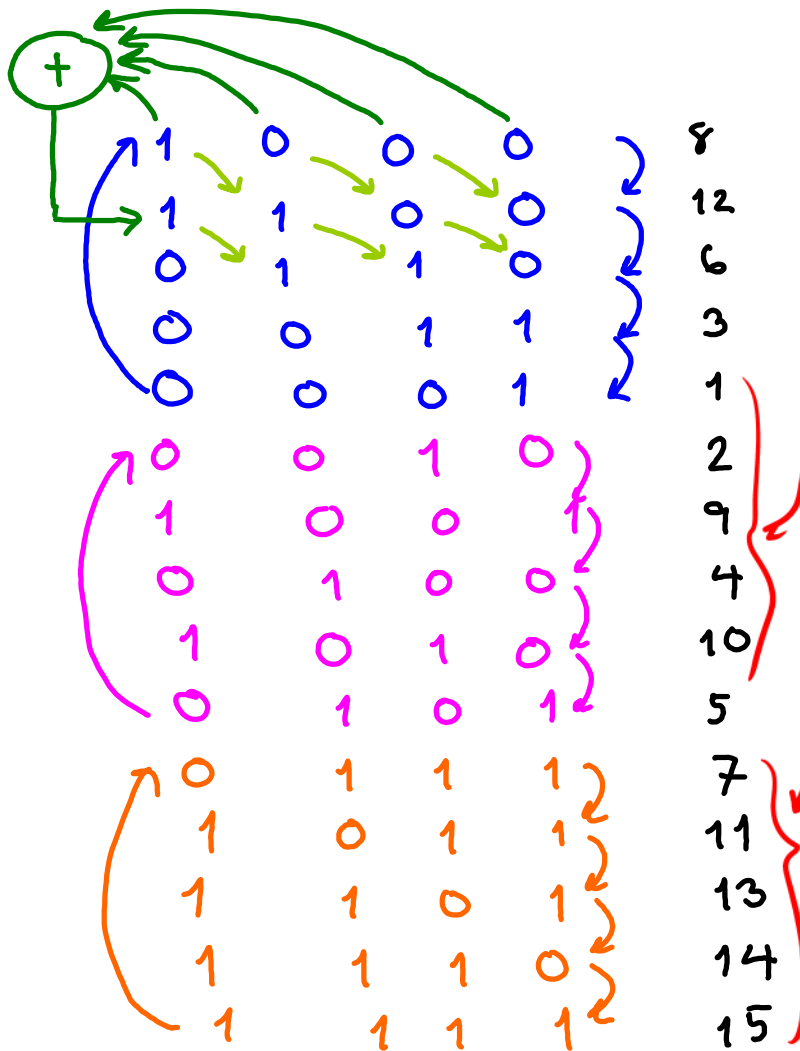
- $x^4+x^3+x^2+x+1$
- x^4+x^3+1

Remark: This was an actual final exam problem @ Cornell

Quiz 3 Solution

① $1 + x + x^2 + x^3 + x^4$

1	0	0	0	8
1	1	0	0	12
0	1	1	0	6
0	0	1	1	3
0	0	0	1	1

0	0	1	0	2
1	0	0	1	9
0	1	0	0	4
1	0	1	0	10
0	1	0	1	5

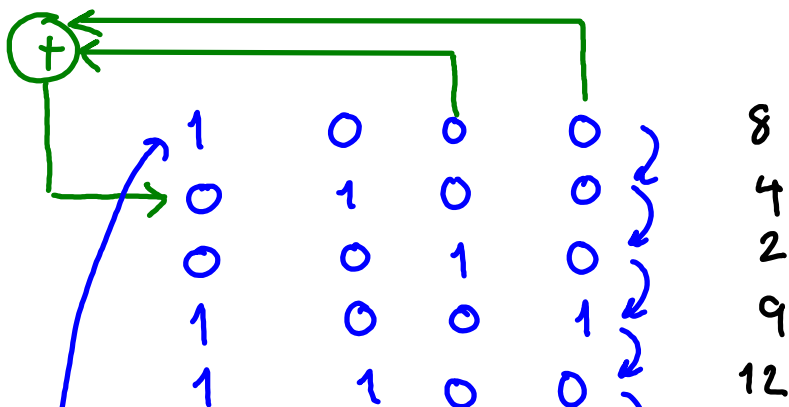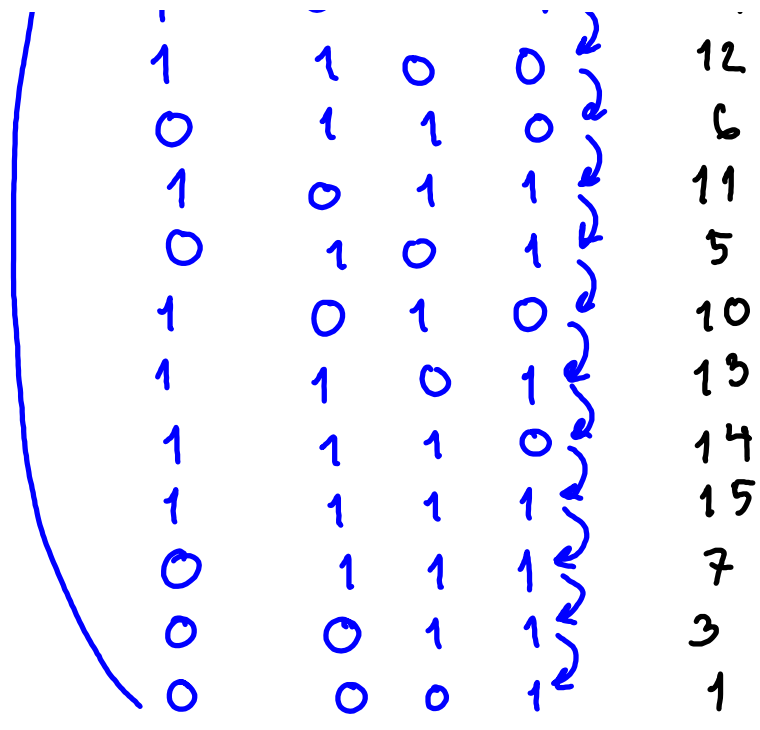|				
0	1	1	1	7
1	0	1	1	11
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

Note that because the question says "complete" state diagrams, we need to show these two cycle as well.

It does not generate m-sequence because no cycle goes through all non-zero states.

② $1 + x^3 + x^4$

1	0	0	0	8
0	1	0	0	4
0	0	1	0	2
1	0	0	1	9
1	1	0	0	12

$$
\begin{pmatrix}
1 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 \\
1 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 \\
1 & 0 & 1 & 0 \\
1 & 1 & 0 & 1 \\
1 & 1 & 1 & 0 \\
1 & 1 & 1 & 1 \\
0 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1
\end{pmatrix}
\quad
\begin{matrix}
12 \\
6 \\
11 \\
5 \\
10 \\
13 \\
14 \\
15 \\
7 \\
3 \\
1
\end{matrix}
$$

It $\boxed{\text{generates}}$ an m-sequence because the cycle covers all non-zero state.