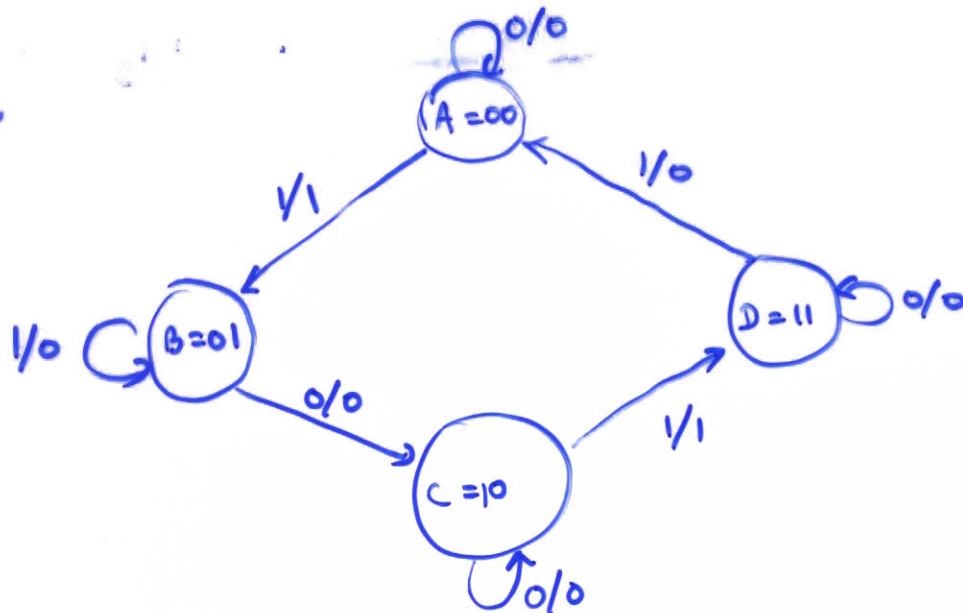


Application: Seq. ckt. design (flip-flop + combinational ckt.)

- Start with minimal state diagram (minimum no. of states) description



4 states = 2^2 states
 \Rightarrow 2 flip-flops

- Construct state table

| Present state | input | next state | output |
|---------------|-------|------------|--------|
| 00 | 0 | 00 | 0 |
| 00 | 1 | 01 | 1 |
| 01 | 0 | 10 | 0 |
| 01 | 1 | 01 | 0 |
| 10 | 0 | 10 | 0 |
| 10 | 1 | 11 | 1 |
| 11 | 0 | 11 | 0 |
| 11 | 1 | 00 | 0 |

Notation u : input, y : output, $x = (x_1, x_2)$ states, $x' = (x'_1, x'_2)$ next states

From state table: $x'_1 = (\bar{x}_1 x_2 \bar{u}) + (x_1 \bar{x}_2 \bar{u}) + (x_1 \bar{x}_2 u) + (x_1 x_2 \bar{u})$

$x'_2 = (\bar{x}_1 \bar{x}_2 u) + (\bar{x}_1 x_2 u) + (x_1 \bar{x}_2 u) + (x_1 x_2 \bar{u})$

$y = (\bar{x}_1 \bar{x}_2 u) + (x_1 \bar{x}_2 u)$

DNF simplification: $x'_1 = x_1 \bar{x}_2 + x_2 \bar{u}$, $x'_2 = \bar{x}_1 u + \bar{x}_2 u + x_1 x_2 \bar{u}$, $y = \bar{x}_2 u$

