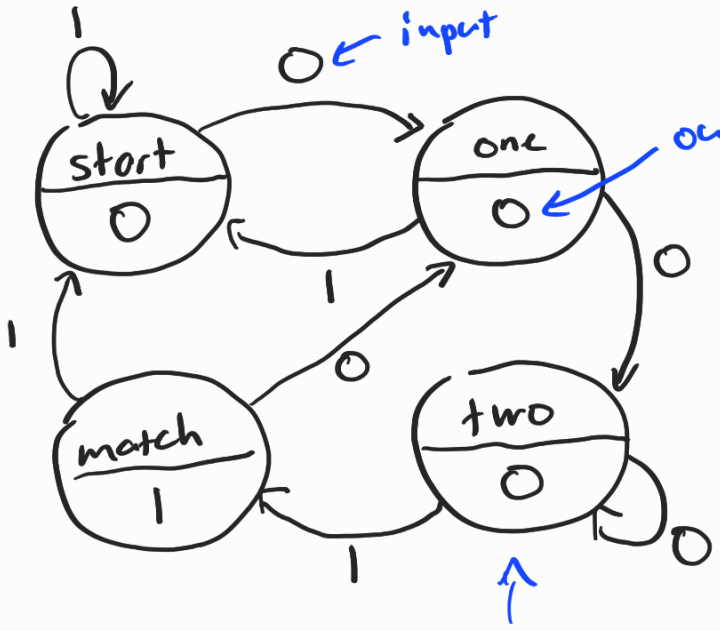
inputs: S
output: X



0 1 0 0 1 0 1 1 0 0 1
S o s o t m o s s o t m
↓ ↓
1 1

State encodings

n states

binary encoding $\lceil \log_2 n \rceil$ flip flops

s_1	0	0
s_2	0	1
s_3	1	0
s_4	1	1
⋮	⋱	⋮

gray encoding

s_1	0	0	0
s_2	0	0	1
s_3	0	1	1
	0	1	0
s_4	1	1	0
s_5	1	⋱	

one-hot coding
1 flip flop per state

s_1	0	0	0	1
s_2	0	0	1	0
s_3	0	1	0	0
s_4	1	0	0	0

2D state table

current state	next state S=0	next state S=1	output → X
start	one	start	0
one	two	start	0
two	match	start	0
match	one	start	1 ←

State encoding (gray encoding)

state	Q_1	Q_0
start	0	0

one	0	1	
two	1	1	
match	1	0	

1D table

current state name	Q_1	Q_0	S	next state D_1	next state D_0	output X
	0	0	0	0	1	0
start	0	0	1	0	0	0
	0	1	0	1	1	0
one	0	1	1	0	0	0
	1	1	0	1	1	0
two	1	1	1	1	0	0
	1	0	0	0	1	1
match	1	0	1	0	0	1

$X = Q_1 \overline{Q_0}$

$D_1 = \overline{Q_1} Q_0 \overline{S} + Q_1 Q_0 \overline{S} + Q_1 Q_0 S$

$= \overline{Q_1} Q_0 \overline{S} + Q_1 Q_0$

$= Q_0 (\overline{Q_1}\,\overline{S} + Q_1)$

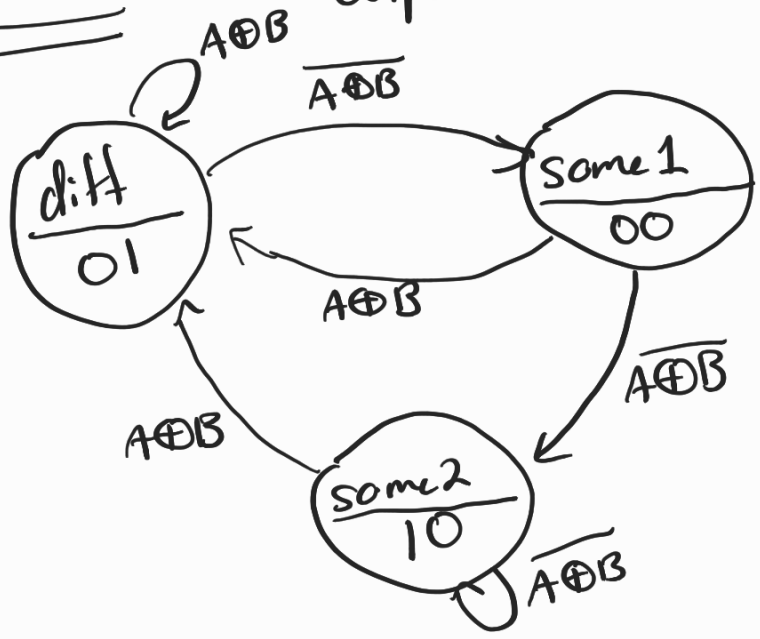
$= Q_0 (\overline{S} + Q_1)$

$D_0 = \overline{S}$

Task 2

inputs : A, B

outputs : X, Y



2D table

current state	next state AB=00	AB=01	AB=10	AB=11	outputs X	Y
diff	some1	diff	diff	some1	0	1
some1	some2	diff	diff	some2	0	0
some2	diff	diff	diff	some2	1	0

same2

State encoding (match outputs)

	Q_1	Q_0
diff	0	1
same1	0	0
same2	1	0

ID table

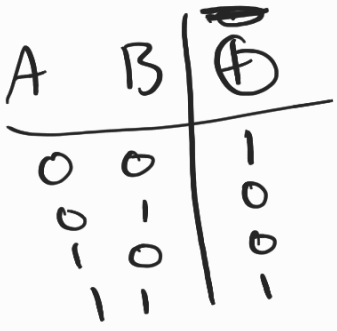
name	current state Q_1	current state Q_0	Inputs A	Inputs B	Next state D_1	Next state D_0	outputs X	outputs Y
diff	0	1	0	0	0	0	0	1
	0	1	0	1	0	1	0	1
	0	1	1	0	0	1	0	1
	0	1	1	1	0	0	0	1
same1	0	0	0	0	1	0	0	0
	0	0	0	1	0	1	0	0
	0	0	1	0	0	1	0	0
	0	0	1	1	1	0	0	0
same2	1	0	0	0	1	0	1	0
	1	0	0	1	0	1	1	0
	1	0	1	0	0	1	1	0
	1	0	1	1	1	0	1	0

$D_1 = (\overline{A \oplus B})\,\overline{Q_0}$

$D_0 = A \oplus B$

$X = Q_1$

$Y = Q_0$


A
B
F
0 0 1
0 1 0
1 0 0
1 1 1