Digital Design

Week 4: Sequential Logic
Part II

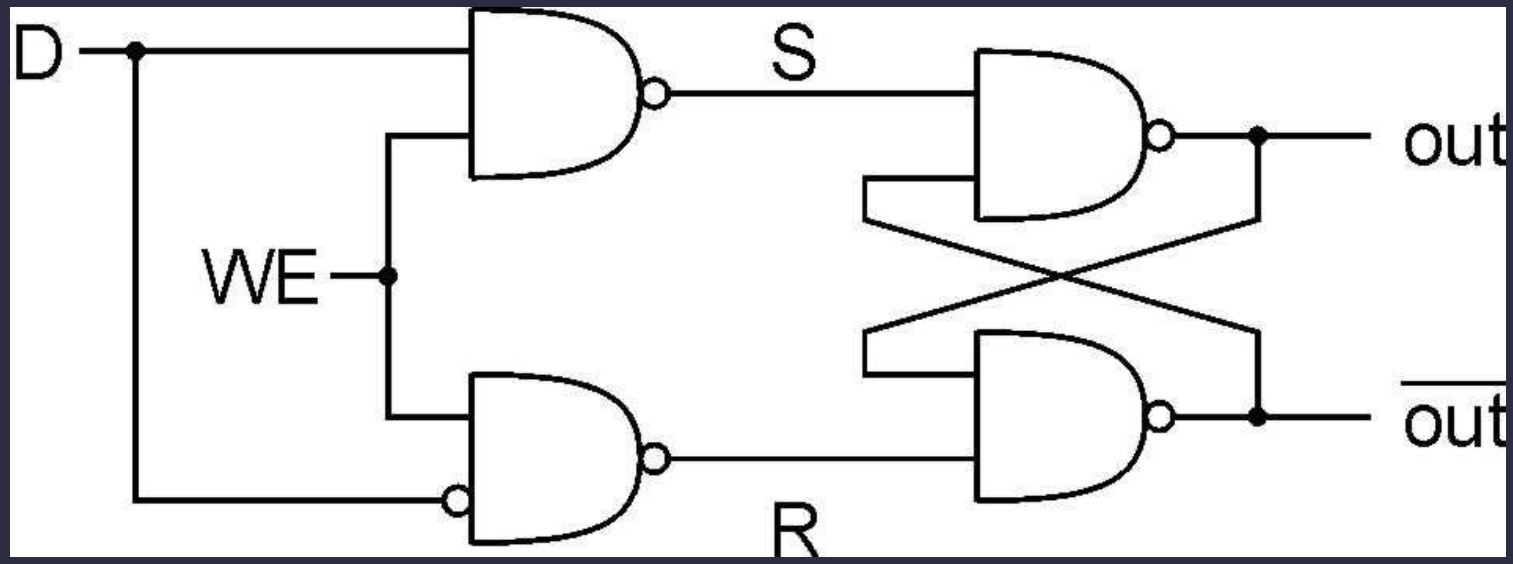
Fenerbahce University

Course

- Sequential Circuits
  - Clock Crystal
  - Clock Cycle
  - Type D Storages

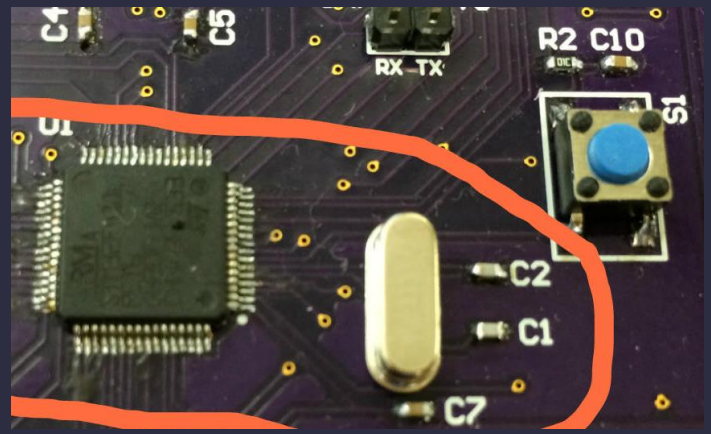
D Type Holders (D Latch)

- It has two entrances. These; D (data) and WE (Write Access)
  - WE = 1 encloses the value at input D.
    - S = NOT(D), R = D
  - WE = 0 keeps its previous value.

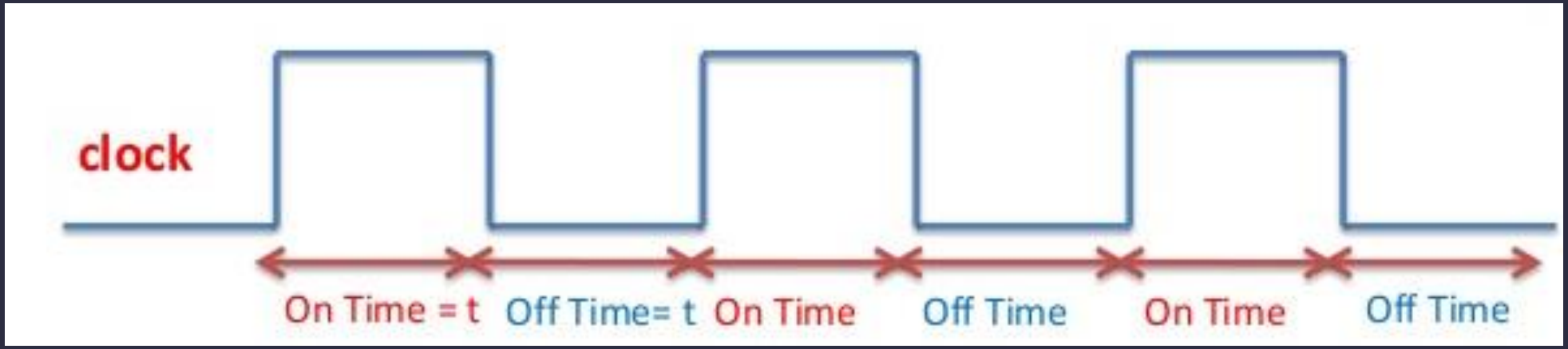


Clock Crystal

- It periodically generates a square-type signal.
- It's like someone is turning a switch on and off at regular intervals...



Clock

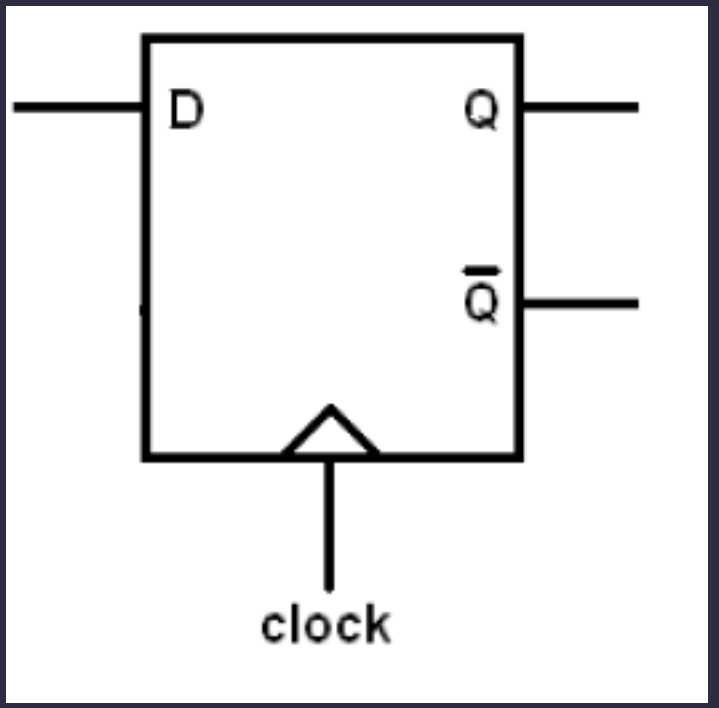


- Clock signal given in the figure repeats itself in 2t time/period.
- Each period of clock called clock cycle.

- It means Frequency = 1/Period.

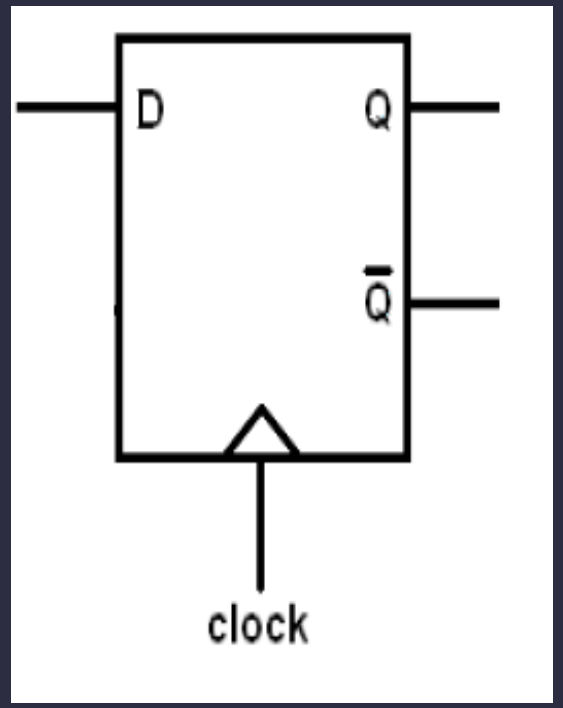
D Type Register (D Register , Flip-Flop)

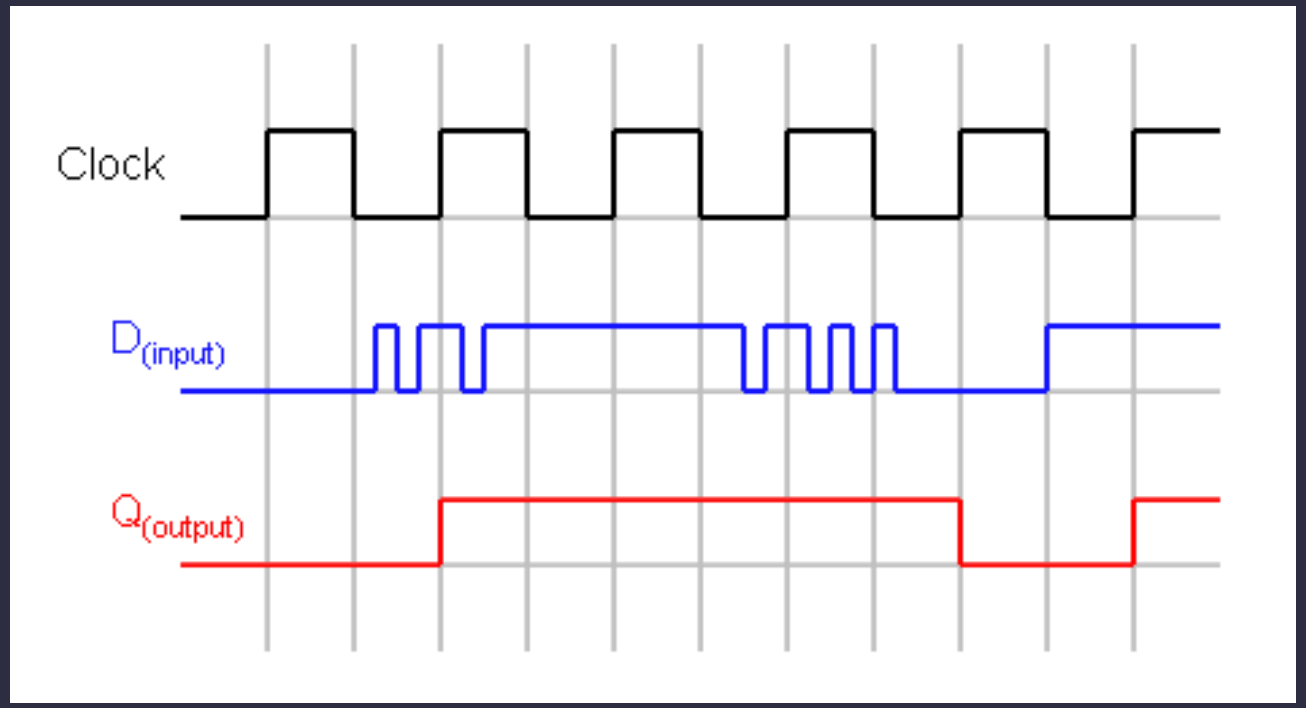
- When the rising or falling edge of the clock signal comes to itself, it transfers the value at the D input to the Q output.
- In other cases, the value at output Q does not change, even if input D changes.



D Type Register (D Register , Flip-Flop)

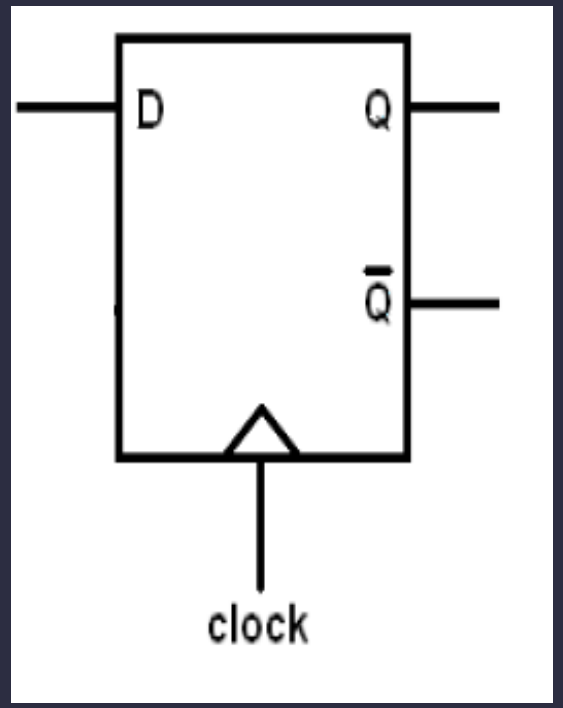
- Rising edge D-Type Storage Inputs and Outputs

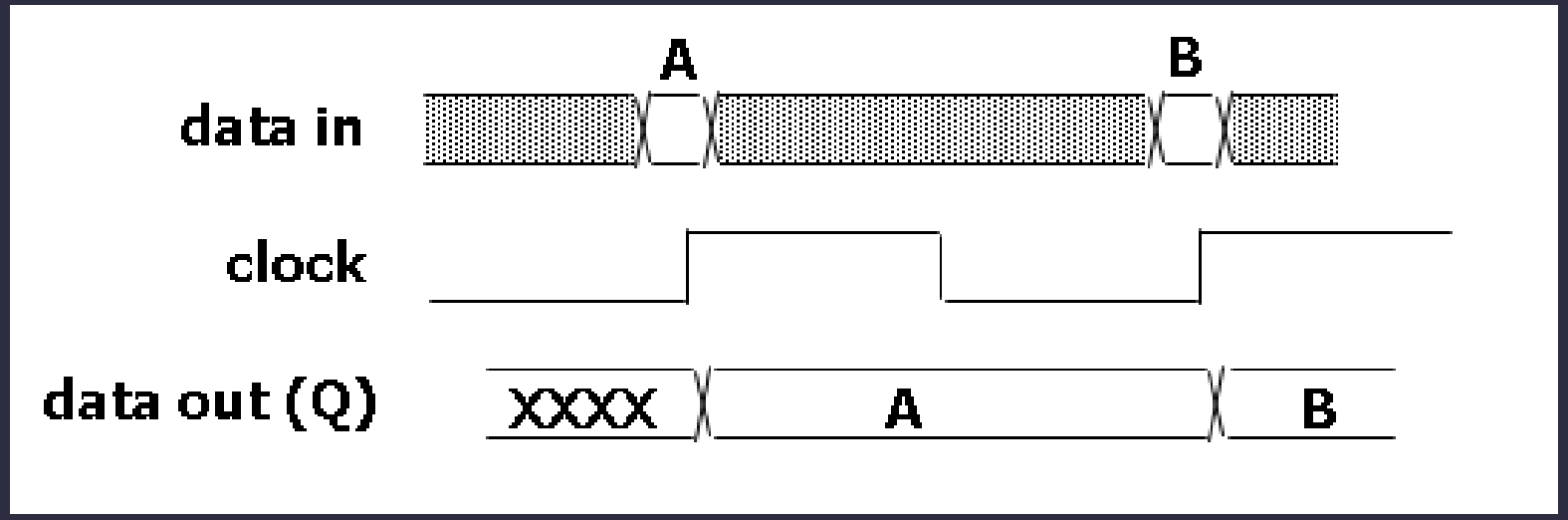




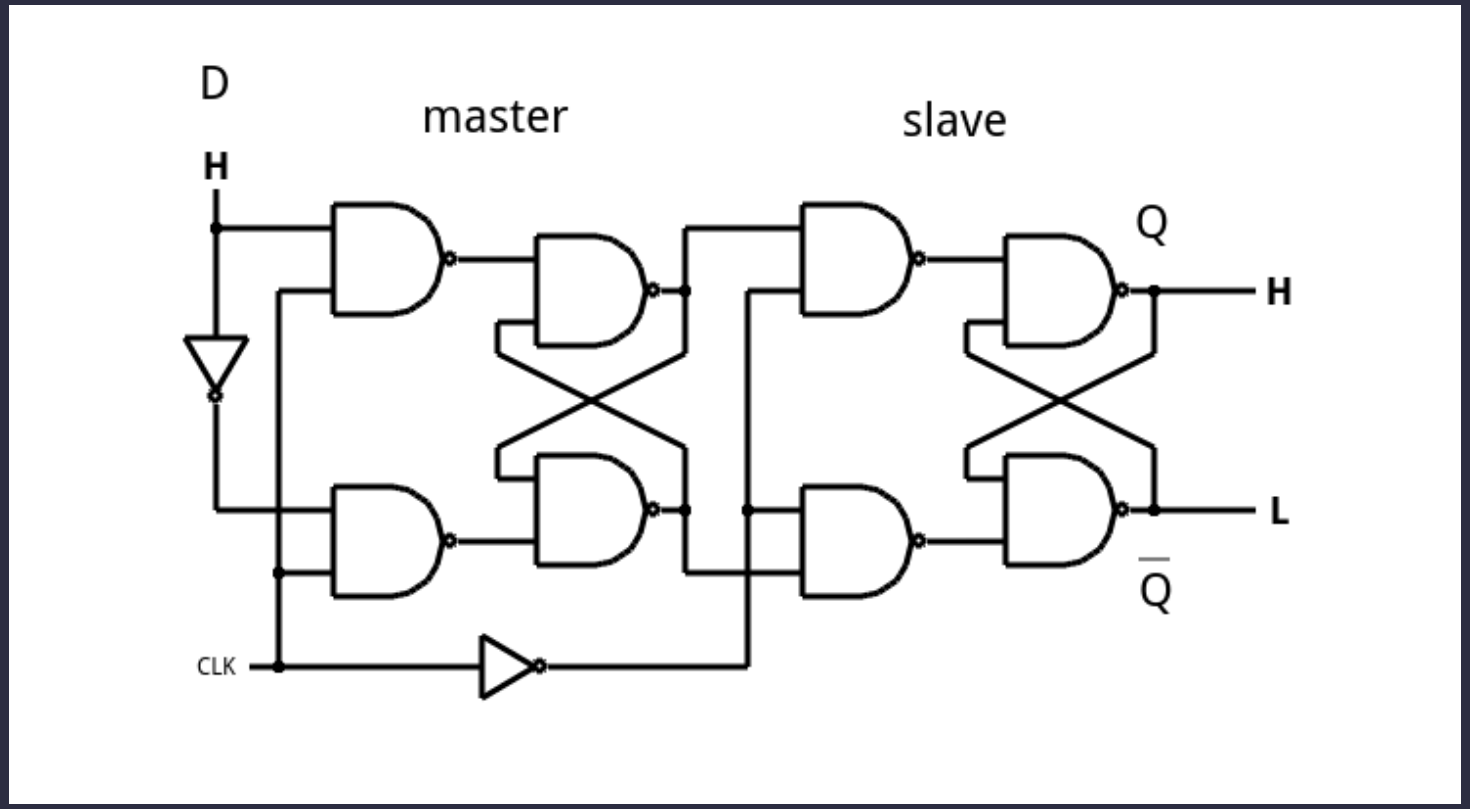
D Type Register (D Register , Flip-Flop)

- Rising edge D-Type Storage Inputs and Outputs





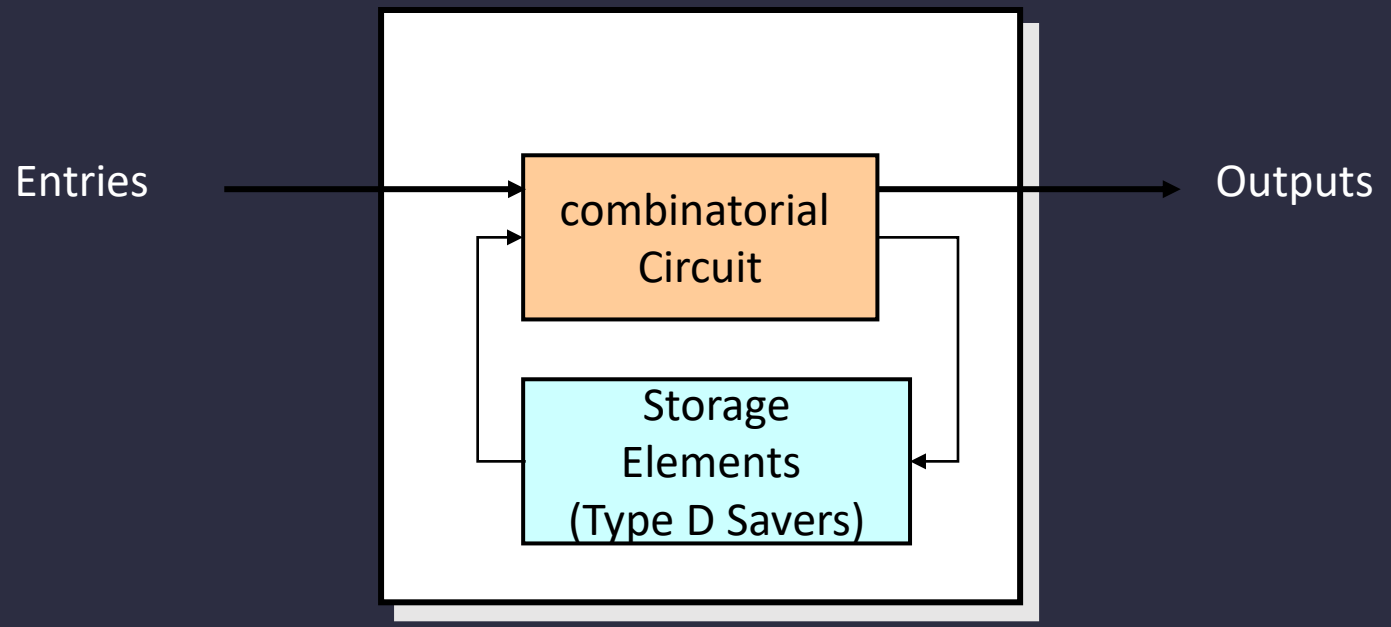
D Type Register (D Register , Flip-Flop)



D Type Storage

Sequential Circuits

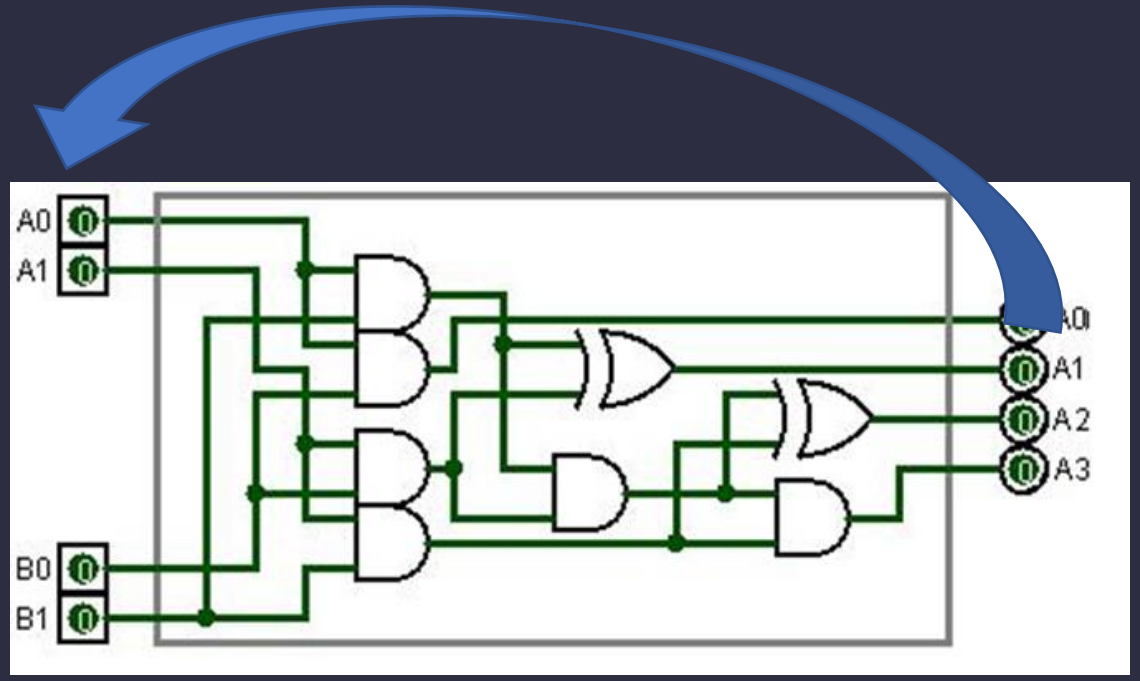
- Combinational circuits and storage elements.
- With the use of storage elements, the previous values produced by the circuit can also be used.



Sequential Circuits

- When is it necessary?

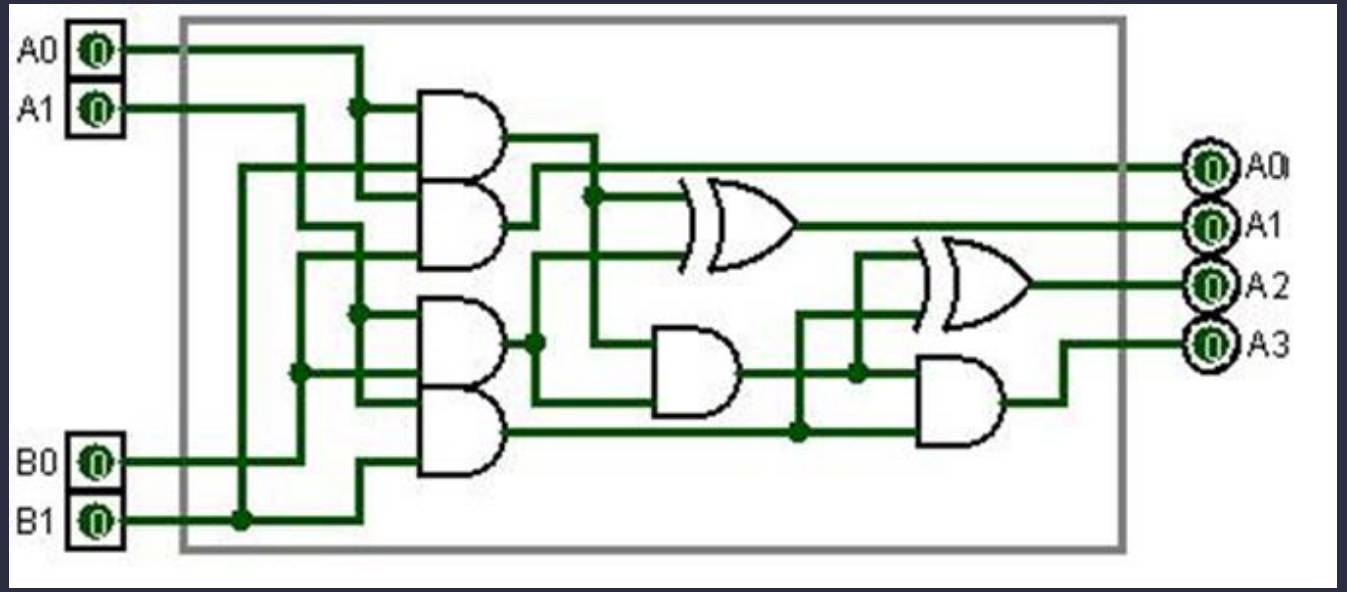
- If the result produced by a circuit will be fed as an input to the circuit;



Sequential Circuits

- When is it necessary?

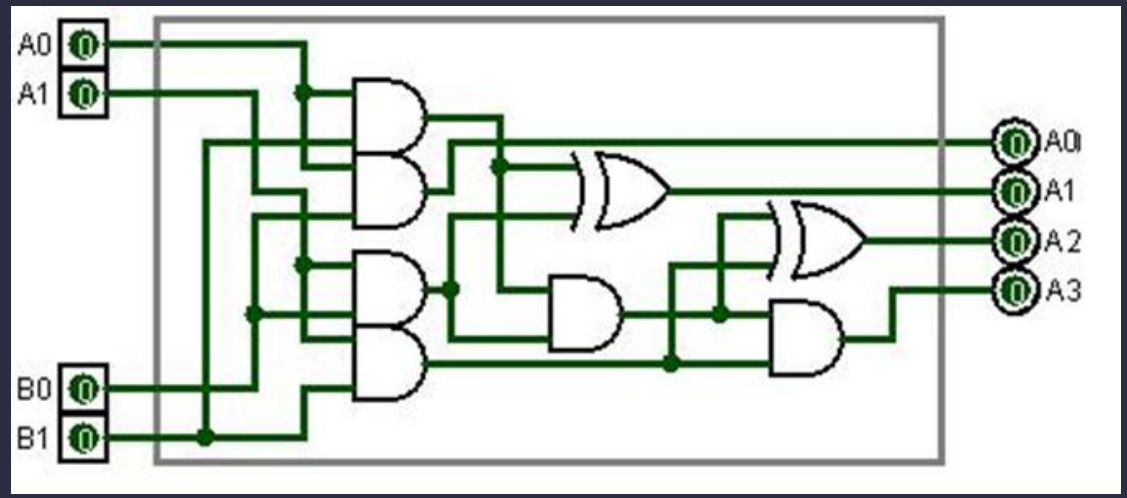
- In order for the circuit to produce correct results, all inputs must remain constant.



Sequential Circuits

- When is it necessary?

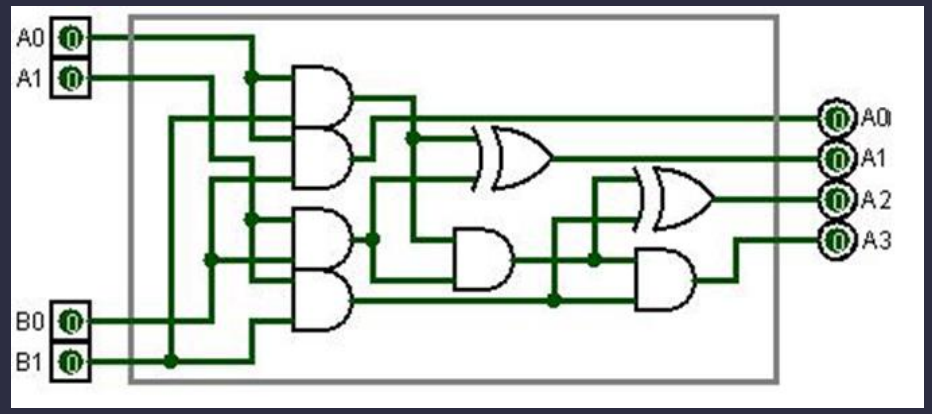
- Each output in this example comes from different logic gate paths.



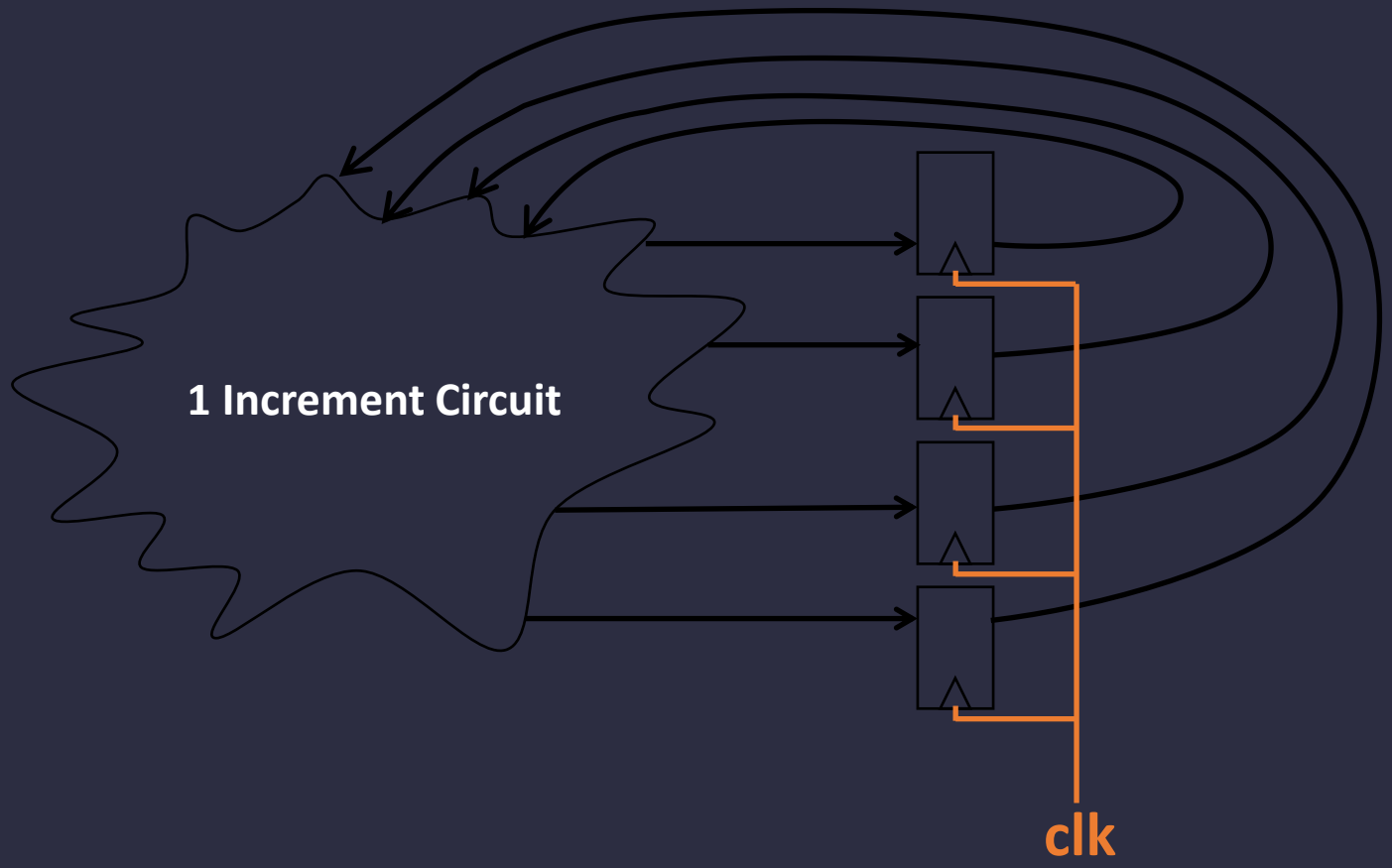
Sequential Circuits

- When is it necessary?

- Therefore, when we connect the output signals directly to the input, the input is changed before the circuit correct output values.
- Correct results can never be captured.



Sequential Circuits

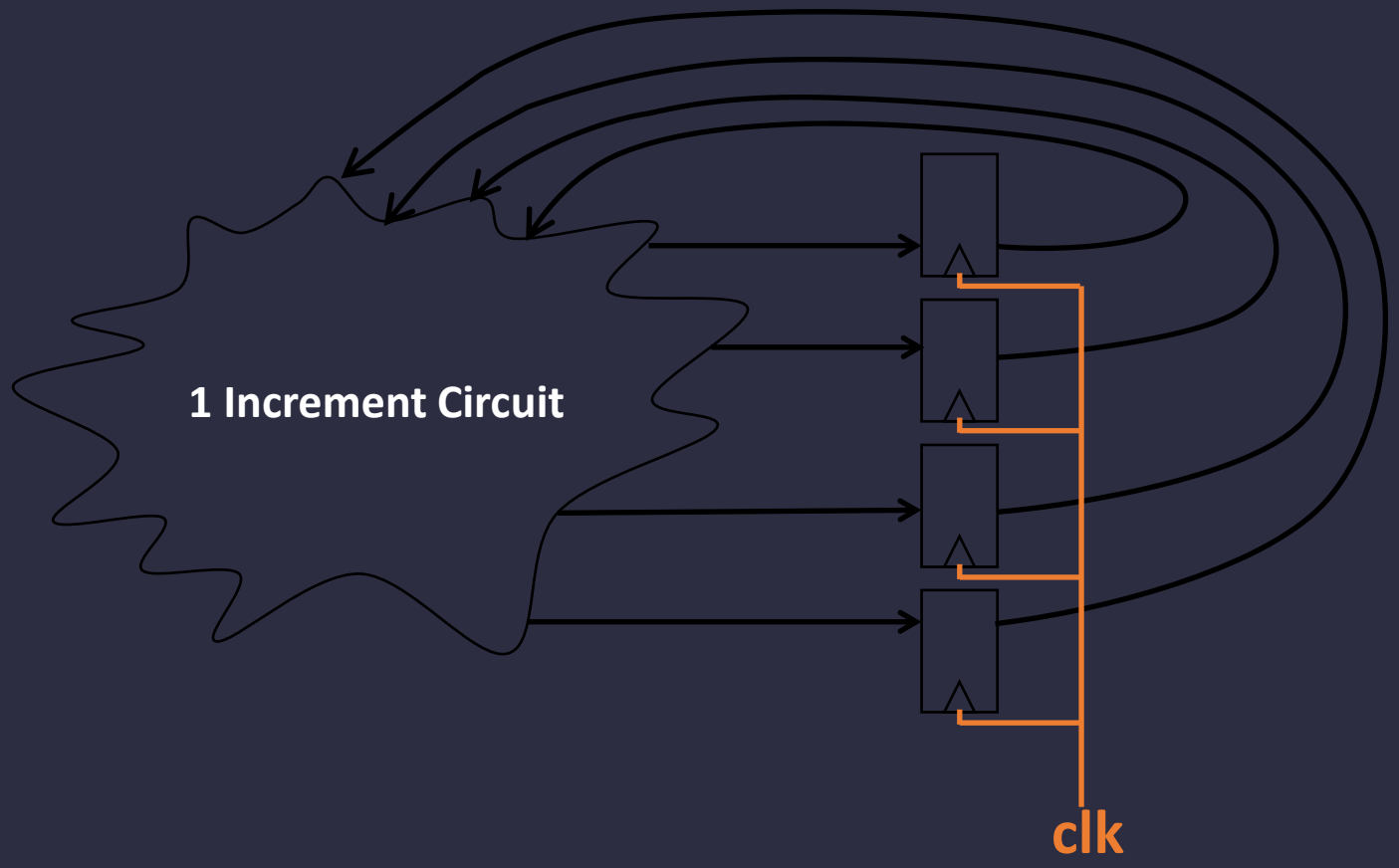


4 Bit 1 increment circuit.

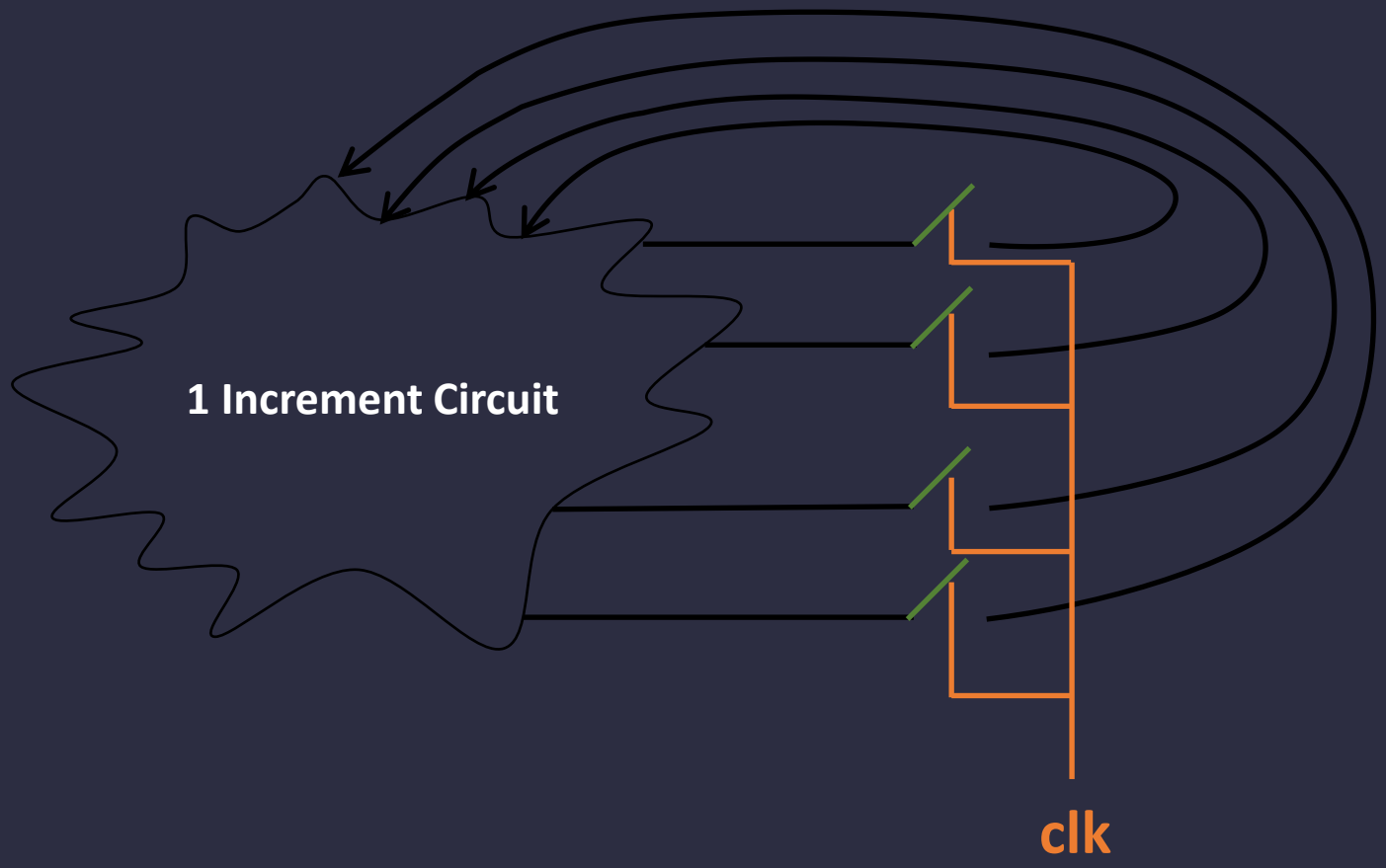
Sequential Circuits

Clock input is as much as the slowest output produced by the circuit

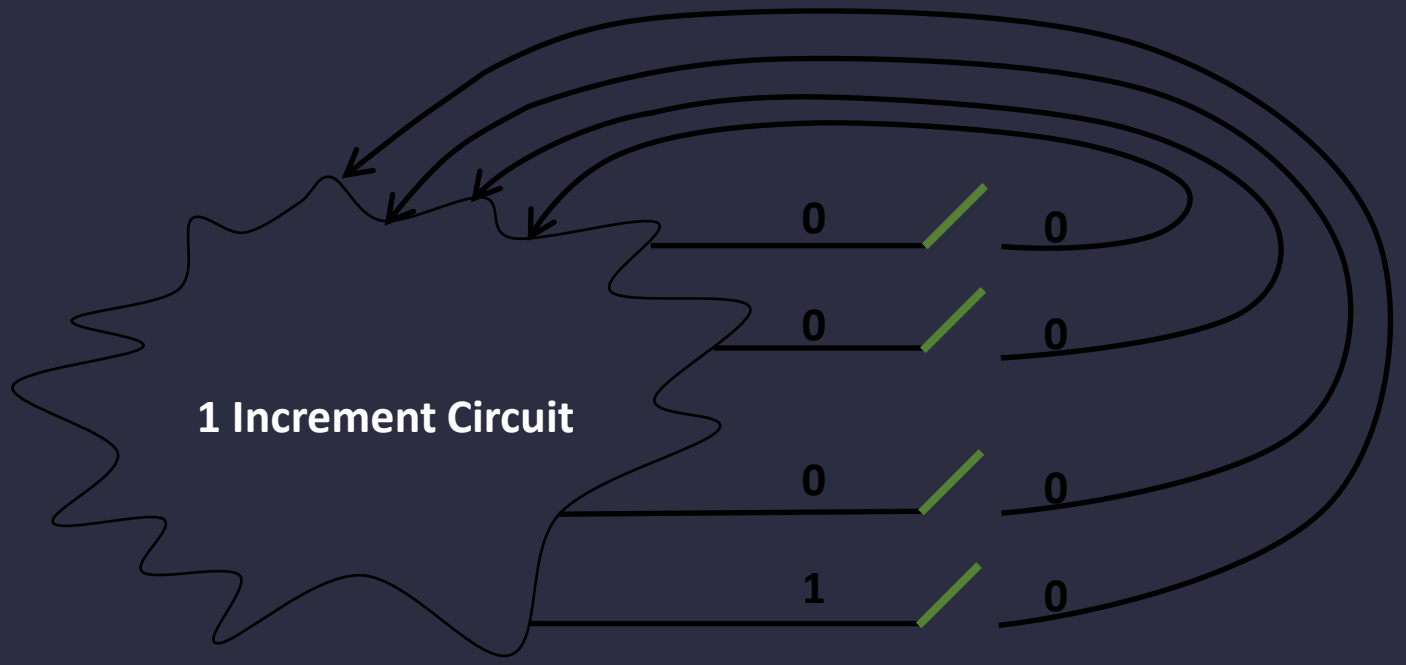
All outputs of the circuit will be fed back to the circuit by waiting until the slowest output output.



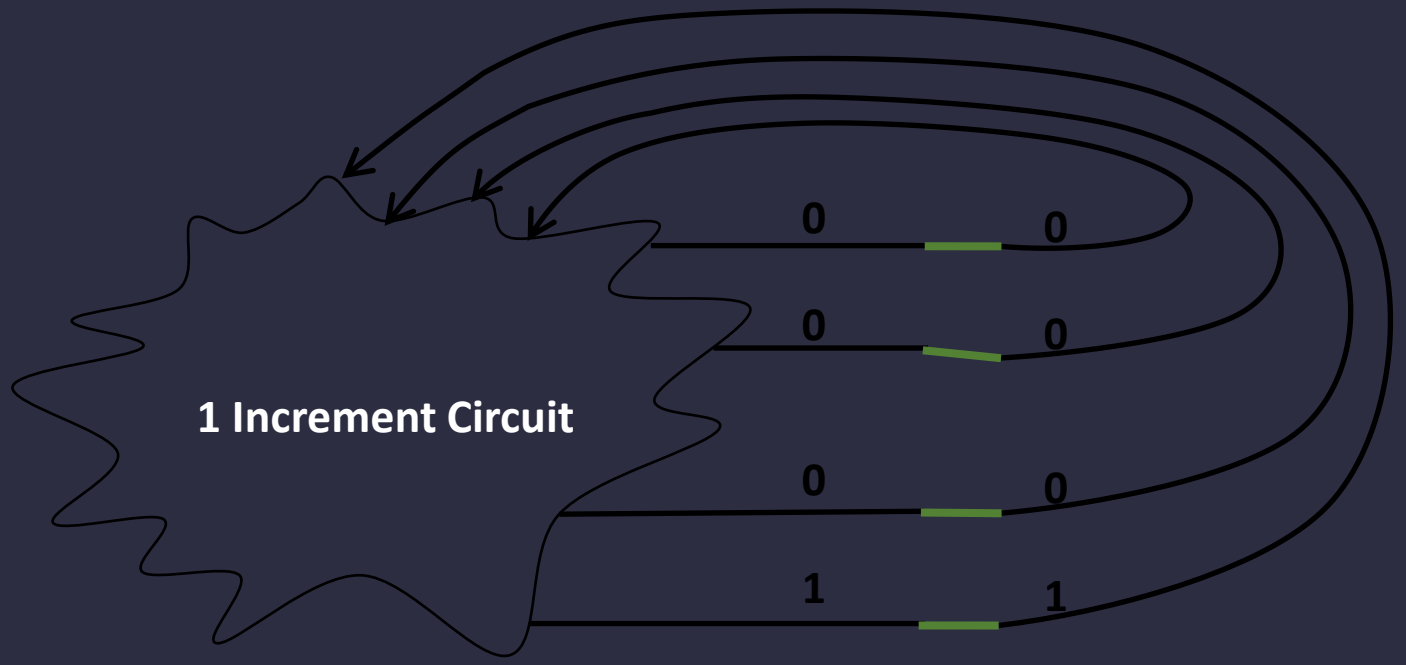
Sequential Circuits



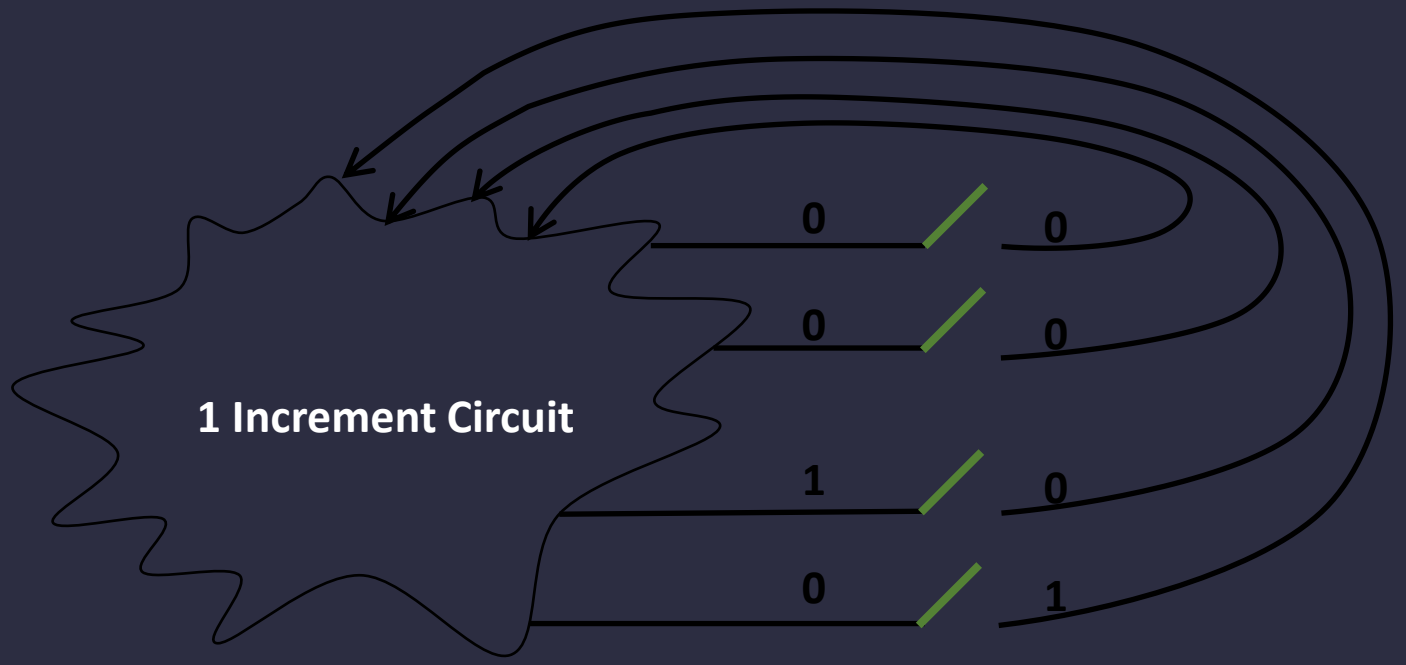
Sequential Circuits



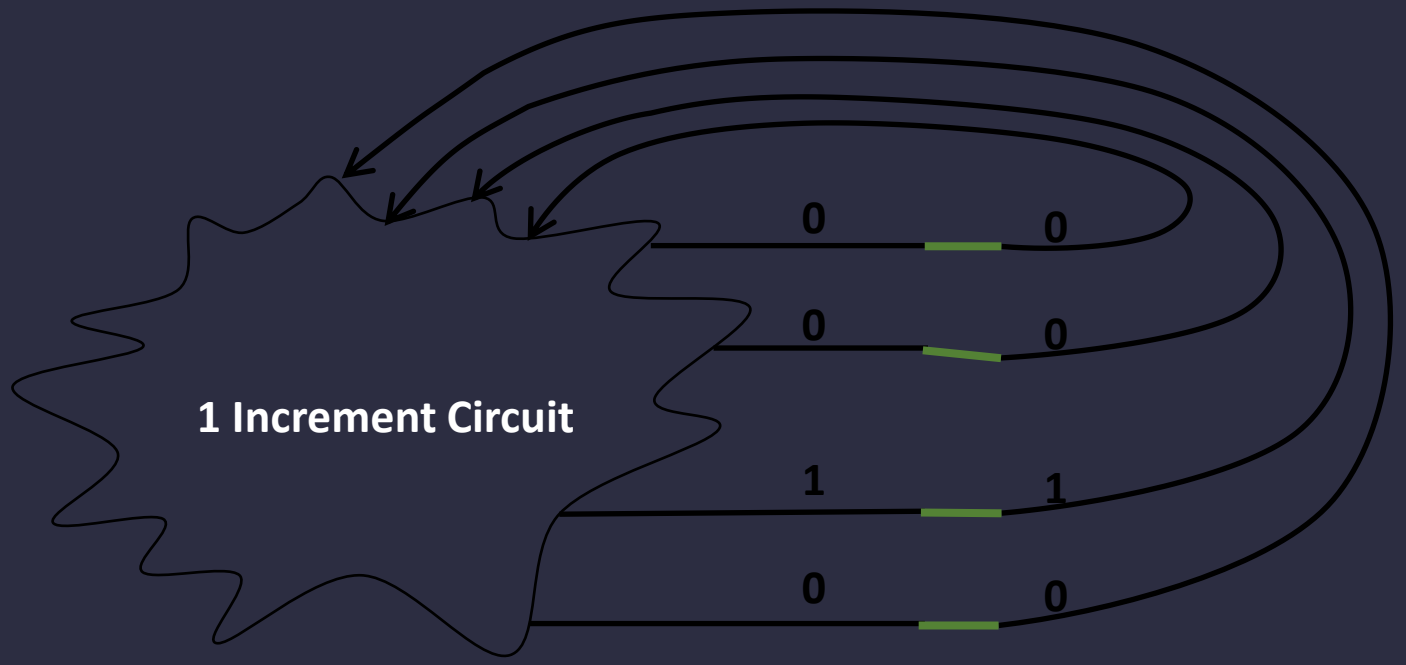
Sequential Circuits



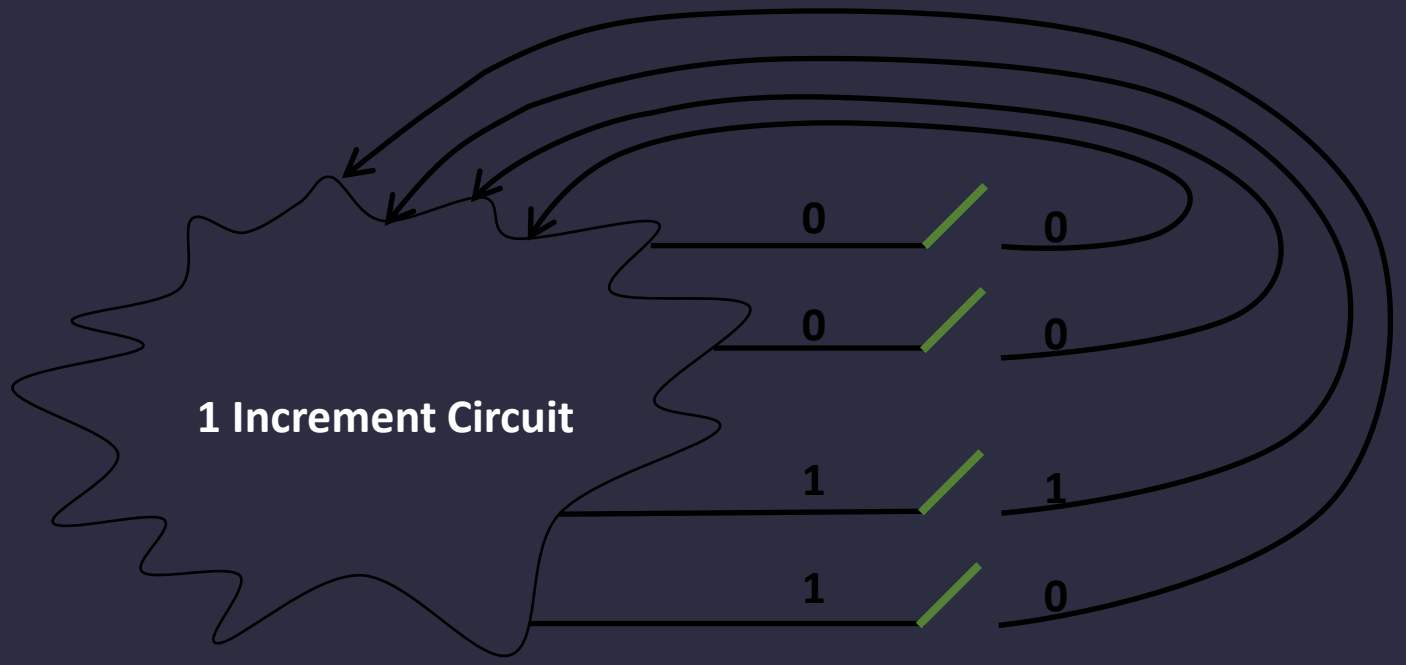
Sequential Circuits



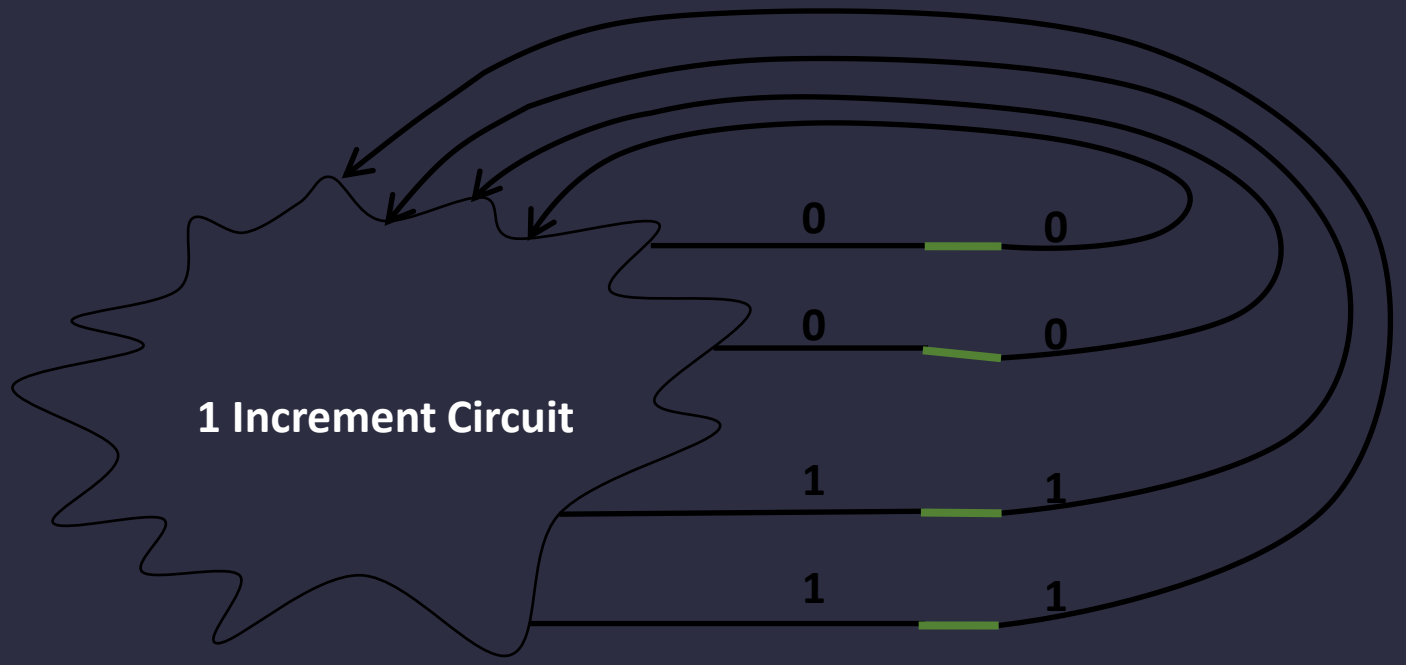
Sequential Circuits



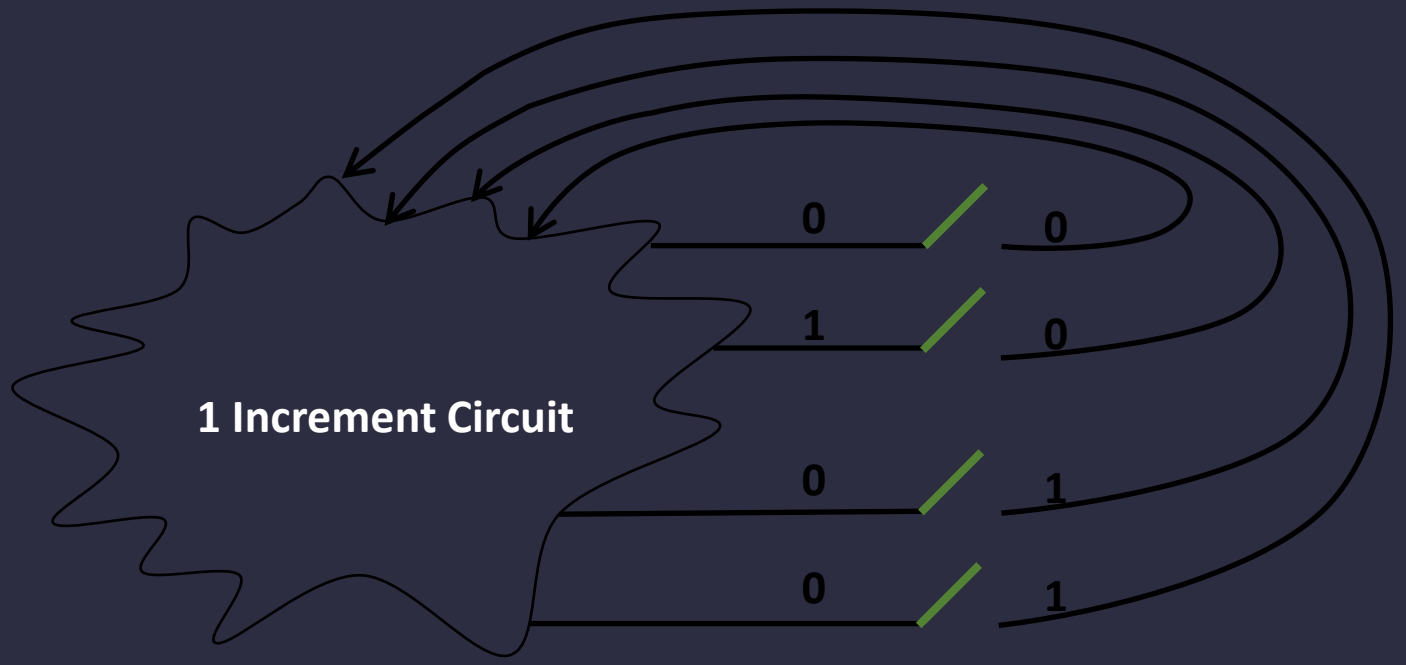
Sequential Circuits



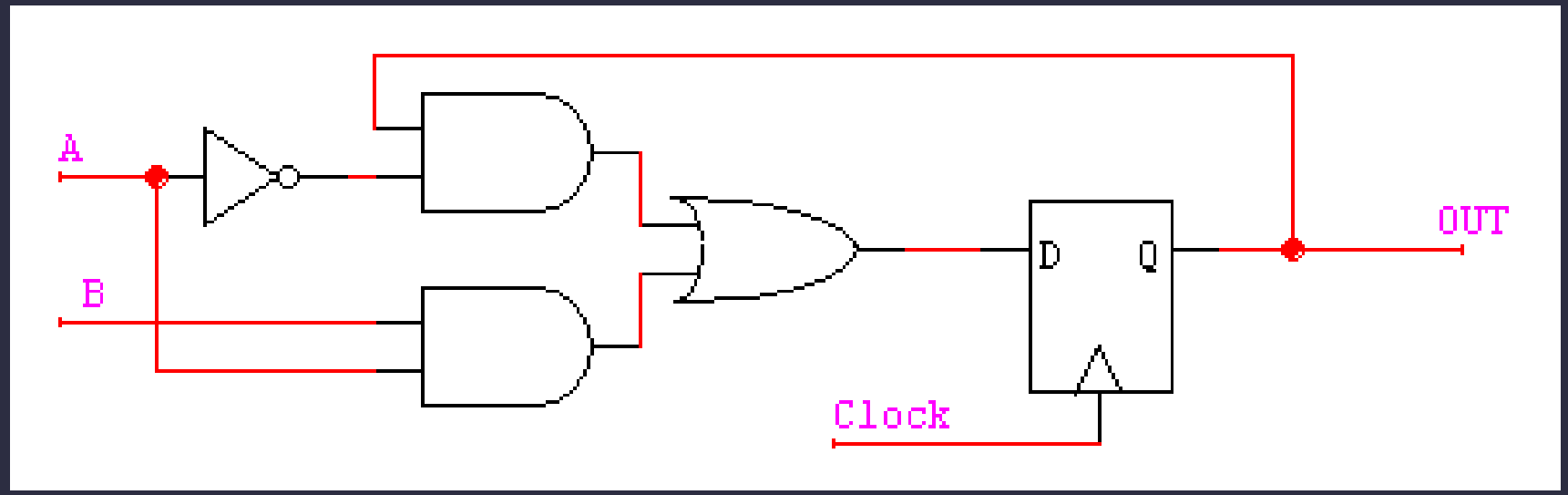
Sequential Circuits



Sequential Circuits



Sequential Circuits



Combinational Circuit and Sequential Circuit with Register