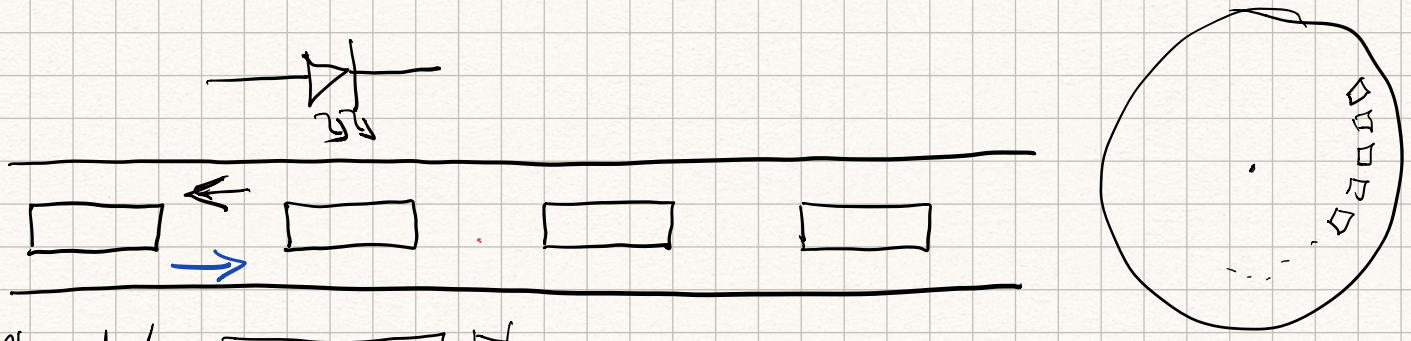
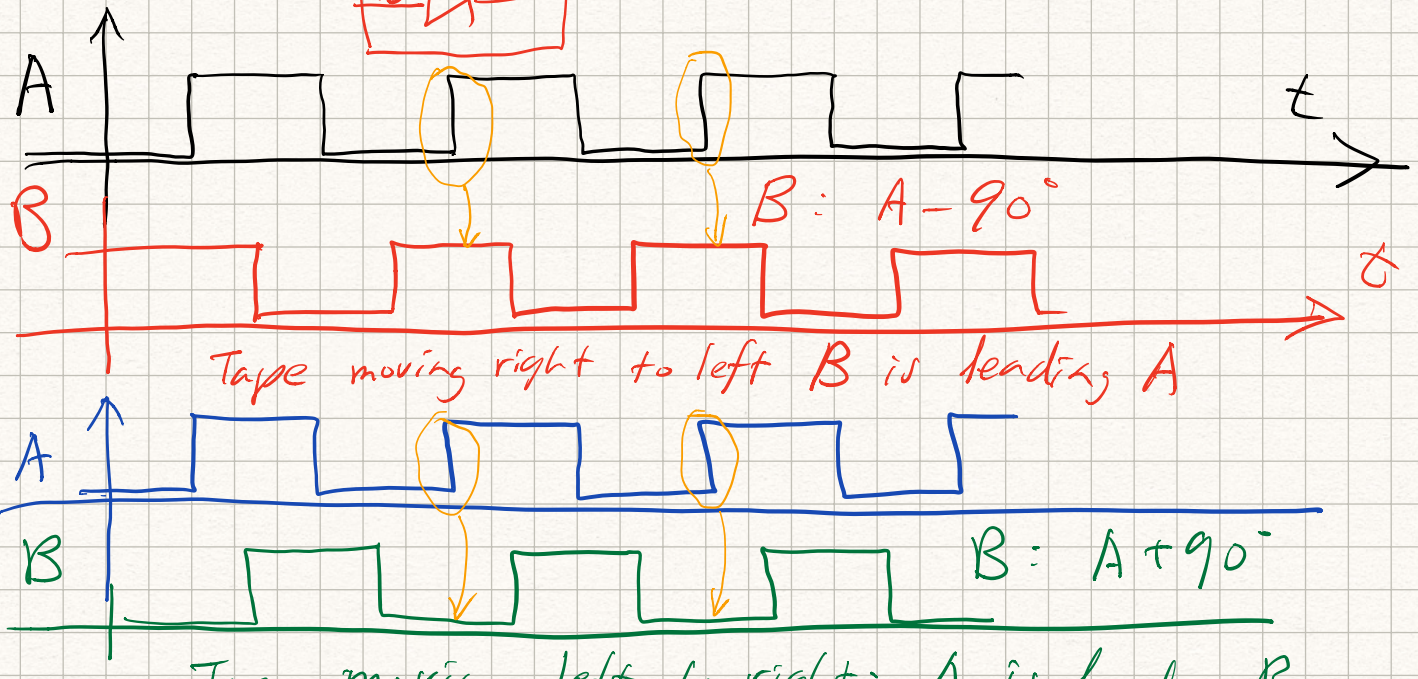
MECH 423 Lecture 14

Quadrature Encoders

- Measure speed, displacement & position.



Quarter offset from A



How to electronically determine direction?

- Look at the value of B at the transition of A

e.g. Rising edge of A, B=0 ⇒ A is leading B

Rising edge of A, B=1 ⇒ B is leading A

If we follow the encoder using the digital I/O of an MCU

Suppose: Motor speed = 1000 Hz (max)

Rotary encoder = 100 tics per rev.

10^5 interrupts per second

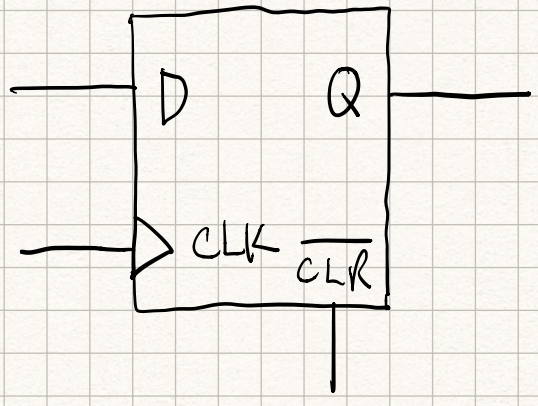
Suppose MCU clock speed 24 MHz

$\Rightarrow$ 240 clock cycles per interrupt.

$\sim$ 40 instruction cycles per interrupt.

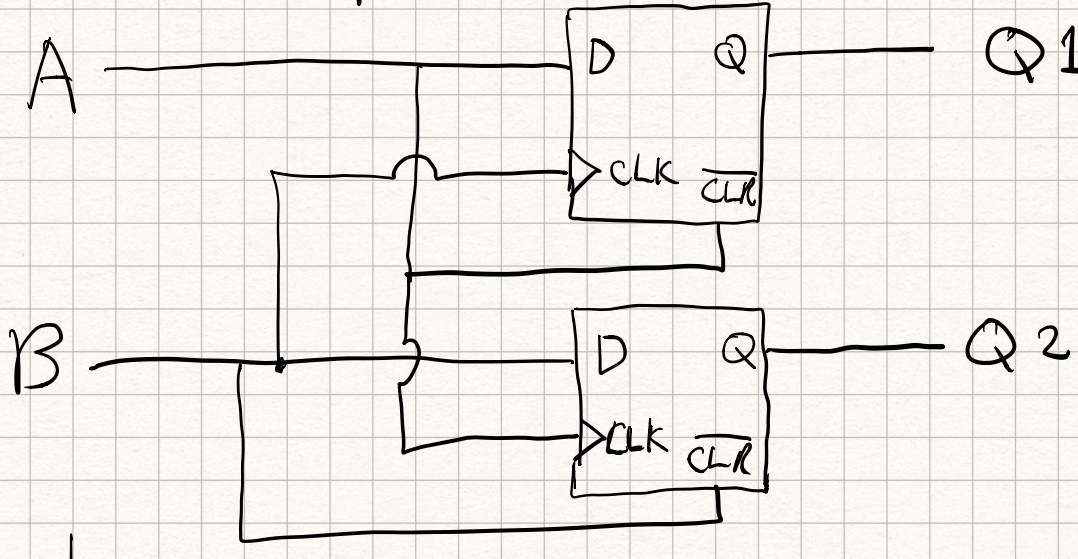
* An MCU can decode an encoder, but it won't be able to do much else.
  - Typically, a dedicated MCU is required.

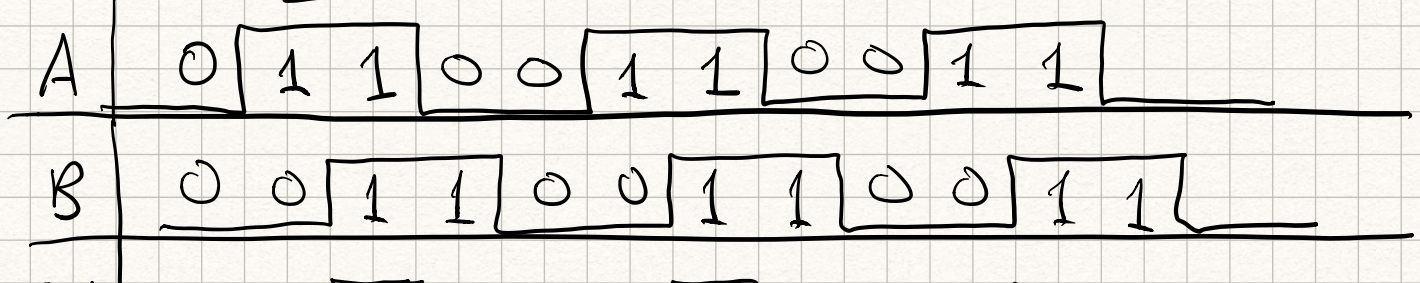
D flip-flop

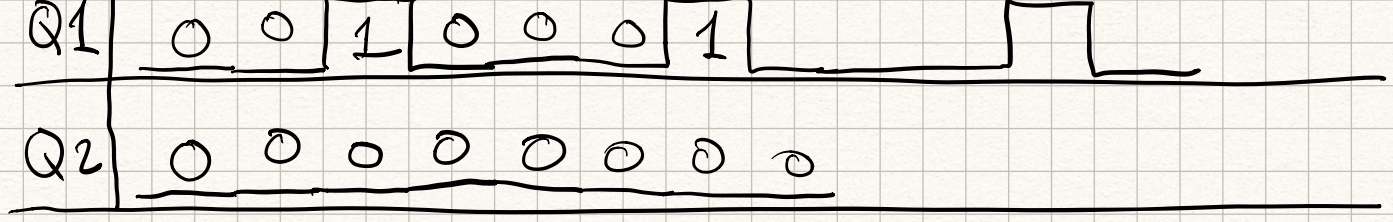


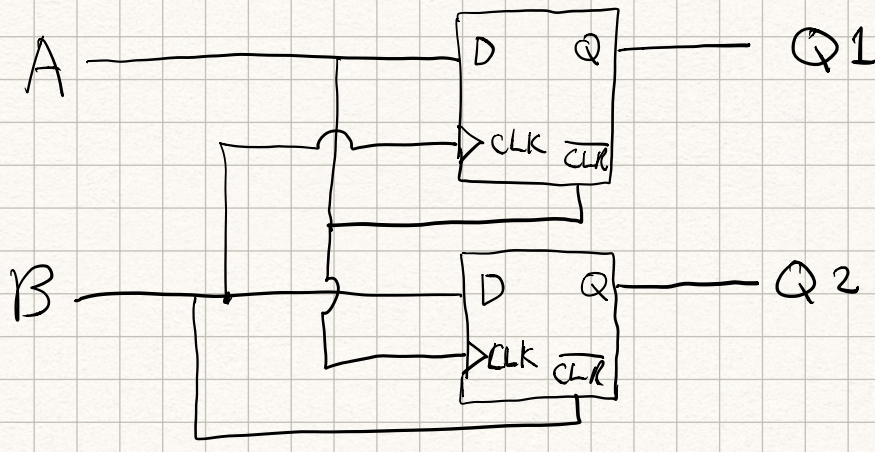
① Q = D at $\lrcorner\!\urcorner$ of the CLK

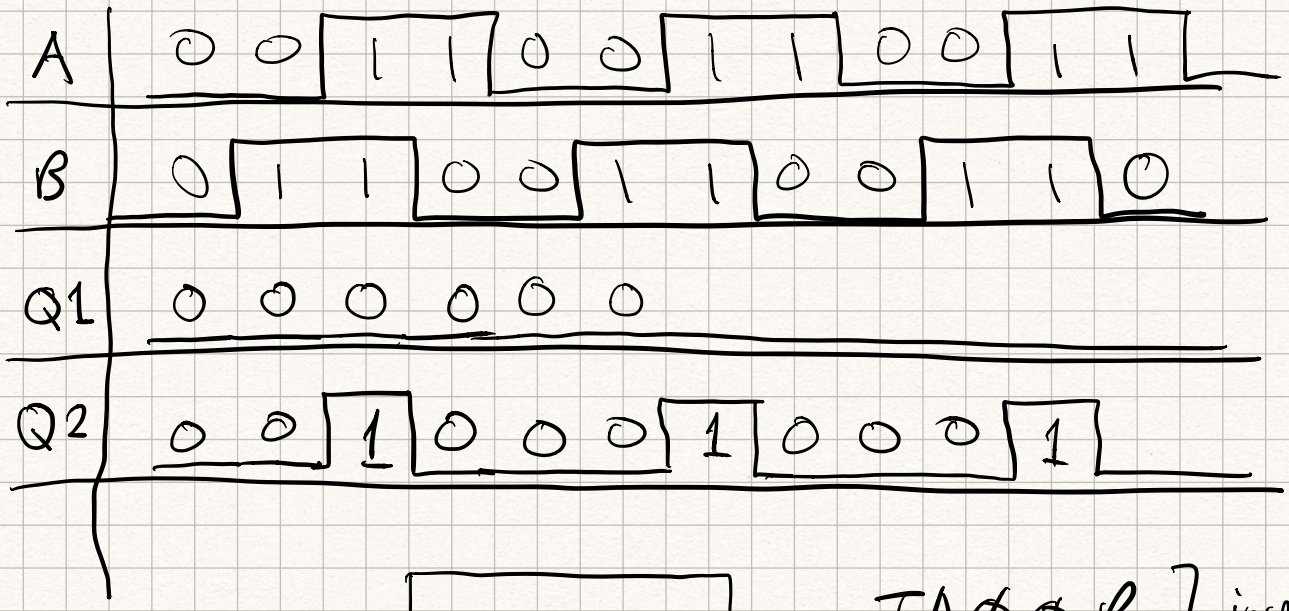
② Q = low when $\overline{CLR}$ = low

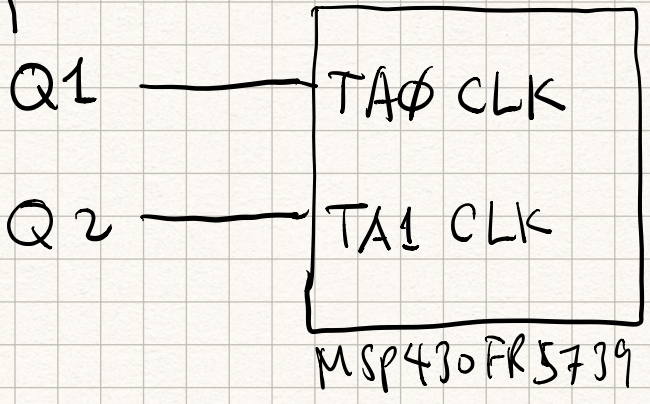










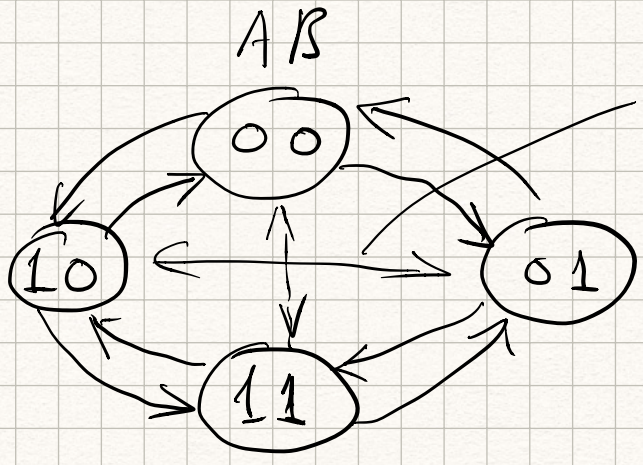


TAØ.ØR
TA1.ØR
} increment on Q1 & Q2 edges.

newPosition = TAØ.ØR - TA1.ØR

* Edge detection is noise prone
  — use a schmidt trigger input

* State diagram decoding



- Implemented using a CPLD