TM's and DFA's.

TM

Q, Γ

$\delta: Q \times \Gamma \longrightarrow Q \times \Gamma \times \{L, R\}$

$q_0 \in Q$

$F \subseteq Q \mid q_A, q_R.$

$L = \{0^n 1^n\}$

$$\boxed{00 \cdots 0} \boxed{1 \quad 1 \quad 1 \quad 1}$$

- If first is 0, erase it   and look for first 1
  ↳ (else reject) ⟵———————————   and mark it

  go back to first blank, next 0.

$L = \{a^i b^j c^k \mid i + j = k\}$

— first   mark repeat

Find next a, erase, find c, mark] repeat

Find next b, erase, find c, mark] repeat

if not empty — reject.

if unexpected character — reject.

Back to DFA's

$Q, \Sigma, \delta: Q \times \Sigma \to Q, q_0, F.$

L_1 is regular (recognised by DFA)

L_2 is regular

$\implies L_1 \cap L_2$ is regular

How about $L_1 \cup L_2$?

$L_1 \cup L_2 = \overline{\overline{L_1} \cap \overline{L_2}}$

L is regular $\implies \overline{L}$ is regular $(F = \overline{F})$

L is regular $\Rightarrow$ $\bar{L}$ is regular $(\bar{F} = F)$

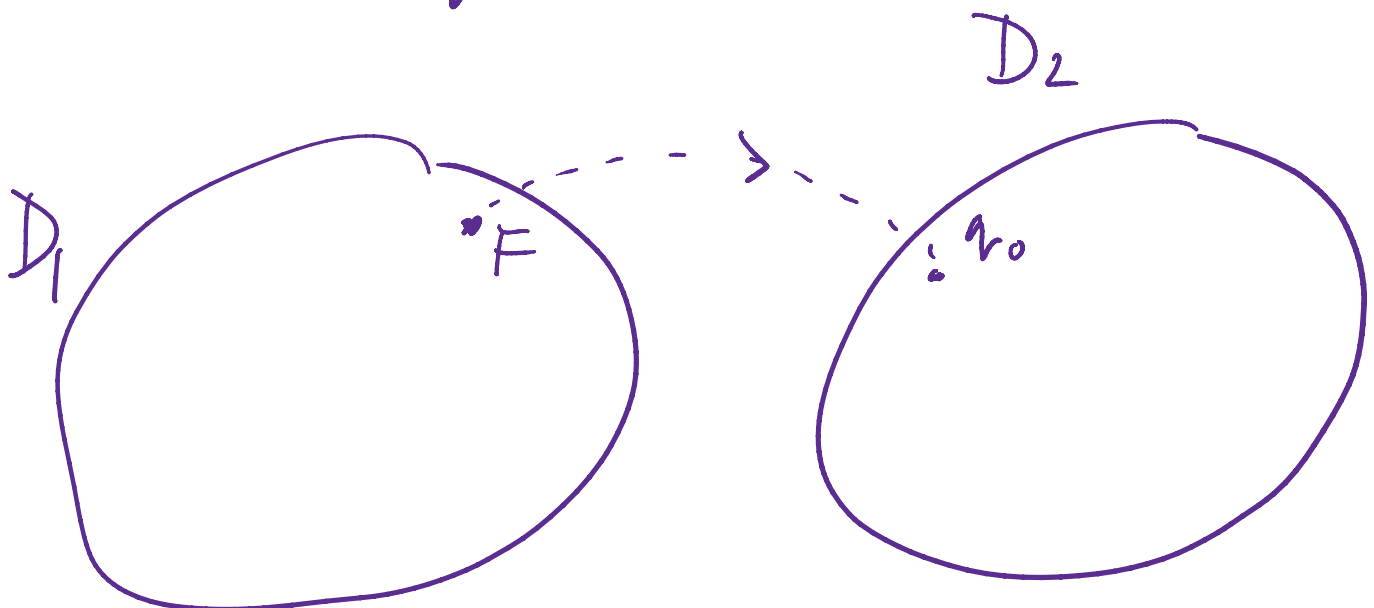So same construction as $L_1 \cap L_2$, but..

$Q = Q_1 \times Q_2$

$\delta((q_1, q_2), a) = \left(\delta_1(q_1, a), \delta_2(q_2, a)\right)$

$q_0 = (q_{01}, q_{02})$

$F = \{(q_1, q_2) : q_1 \in F_1 \text{ or } q_2 \in F_2\}$.

How about $L = \{ab \mid a \in L_1, b \in L_2\}$?

L_1, L_2 are regular.

jump?　　　"ε" transition

Can take when desired.

D accepts if $\exists$ some choice of ε's
that leads to __accept__.
(Note: empty string $\in L_1, L_2$).

Non-deterministic Finite Automaton (NFA)
　　　　　　　　　TM (NTM)... later

Is this more powerful?!
i.e. $\exists$ language L accepted by an NFA
　　　　　　　　but not by any DFA?