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Eliminating ϵ- Transitions:

Given any ϵ-NFA, we find a DFA D that accepts the same language as E.

Let $E = (Q_E, \Sigma, \delta_E, q_0, F_E)$, then equivalent DFA
$D = (Q_D, \Sigma, \delta_D, q_0, F_D)$

- Q_D is the set of subsets of Q_E. Only accessible states of D are the ϵ-closed subsets of Q_E i.e $S \subseteq Q_E$ s.t. $S = ECLOSE(S)$.
- $q_D = ECLOSE(q_0)$
- $F_D = \{ S \mid S$ is in Q_D and $S \cap F_E \neq \phi \}$.
- $\delta_D(S, a)$ is computed as:

Let $S = \{p_1, p_2 \dots p_K\}$

$$\bigcup_{i=1}^{K} \delta_E(p_i, a) = \{r_1, r_2 \dots r_m\}$$

$i = 1, 2, 4, 5 \rightarrow \{q_1\}, \{q_2\}, \{q_4, \{q_5\}\}, \{q_0, q_1\}$
$\{q_3, q_5\}$

Initial state

	+ -	.	0, 1 ... 9
$\rightarrow \{q_0, q_1\}$ $\delta(\{q_0, q_1\}, \pm)$	$\{q_1\}$	$\{q_2\}$	$\{q_1, q_4\}$
$\{q_1\}$	ϕ	$\{q_2\}$	$\{q_1, q_4\}$
$\{q_2\}$	ϕ	ϕ	$\{q_3, q_5\}$
$\{q_1, q_4\}$	ϕ	$\{q_2, q_3, q_5\}$	$\{q_3, q_5\}$
$\{q_3, q_5\}$	ϕ	ϕ	$\{q_3, q_5\}$

Minimization of Finite Automata:

Dead state: A state q is called dead state if q is not a final state for all inputs to this state, the transitions are confined to that state i.e. $q \notin F$ and $\delta(q, \Sigma) \to q$.

Inaccessible state: States that can never be reached from the initial state are called inaccessible state.

Equivalent States: 2 states q_i and q_j of a finite automata M are equivalent, if $\delta(q_i, x)$ and $\delta(q_j, x)$ both produce final states or both of them produce non-final states for all $x \in \Sigma^*$

Minimization of DFA:

	0	1
$\to q_0$	q_1	q_2
q_1	q_2	q_3
q_2	q_2	q_4
$* q_3$	q_3	q_3
$* q_4$	q_3	q_4
$* q_5$	q_4	q_4
	~~q_5~~ q.	

Let $S_0 = \{q_0, q_1, q_2 - q_5\}$.

All these sets are 0-equivalent.

Two states

Divide S_0 into 2 parts:

$Q_1 = \{q_0, q_1, q_2\}$, $Q_2 = \{q_3, q_4, q_5\}$

$S_1 = \{Q_1, Q_2\}$

$S_2 = \{\{q_0\}, \{q_1, q_2\}, \{q_3, q_4, q_5\}\}$

q_0 is single state, Hence cannot be divided further.

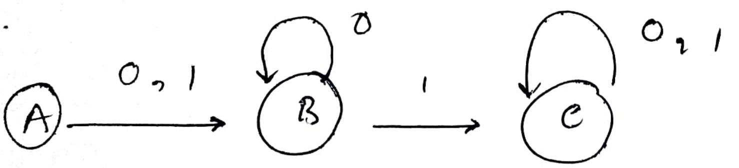
Similarly, $S_3 = \{\{q_0\}, \{q_1, q_2\}, \{q_3, q_4, q_5\}\}$

S_2 and S_3 are equivalent.

In minimised automata, there are 3 states:

	0	1
$\{q_0\}$	$\{q_1\}$	$\{q_2\}$
$\{q_1, q_2\}$	$\{q_2\}$	$\{q_3, q_4\}$
$\{q_3, q_4, q_5\}$	$\{q_3, q_4, q_5\}$	$\{q_3, q_4, q_5\}$

$\{q_1\}$; $\{q_2\}$, $\{q_3, q_4\}$ does not exist as a state. These are subsets of the states.



Equivalence Relation:

A relation R is equivalence relation if it is reflexive, transitive and symmetric.

Right Variant: An equivalence relation R on strings of symbols from some alphabet Σ is said to right variant if for all $x, v \in \Sigma^*$, with xRv and all $w \in \Sigma^*$ we have $xwRyw$

The above definition state that an equivalence relation has the right variant property if 2 equivalent strings (x and y) that are in the language will be still equivalent if a third string is appended to right of both of them