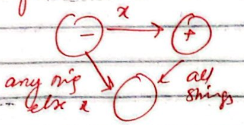
• Every language that can be defined by R.E can also be defined by F.A.

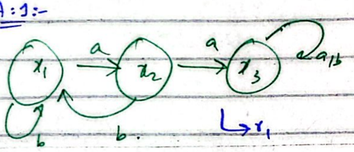
1 → If $R.E = x$, then F.A.



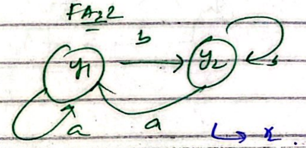
2 → If there are 2 R.E, will take union of both them $(r_1 + r_2)$

then can make 1 F.A from 2 F.A's.

FA:1:-



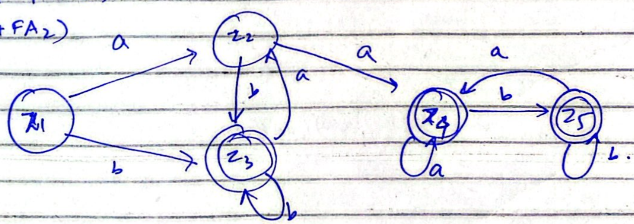
FA:2



combining both of them:

R.E $(r_1 + r_2)$

$(FA_1 + FA_2)$



Transition state

Old state	a	b
$-x_1y_1 = z_1$	$x_2y_1 = z_2$	$x_1y_2 = z_3$
$x_2y_1 = z_2$	$x_3y_1 = z_4$	$x_1y_2 = z_3$
$x_1y_2 = z_3$	$x_2y_1 = z_2$	$x_1y_2 = z_3$

$x_3y_1 = z_4$	$x_3y_1 = z_4$	$x_3y_2 = z_5$
$x_3y_1 = z_5$	$x_3y_1 = z_4$	$x_3y_2 = z_5$

simplified form

old state	a	b
$-z_1$	z_2	z_3
z_2	z_4	z_3
$+z_3$	z_2	z_3
$+z_4$	z_4	z_5
$+z_5$	z_4	z_5

x_3, y_2 where comes become final cq

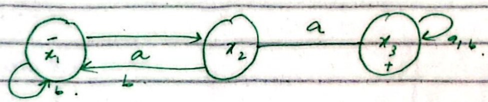
we're taking union not concatenating

3) concatenation :

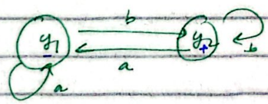
$r_1 \cdot r_2 \Rightarrow FA1 \cdot FA2$

If there is an F.A called FA1 & FA2, that accepts language r_1 and r_2 respectively, if there is r_1 and r_2, then there is an F.A called FA3, that accept language defined by FA1.FA2

FA1



FA2



∴ with final state of x with initial state of y.

$r_1 \cdot r_2 \neq r_2 \cdot r_1$

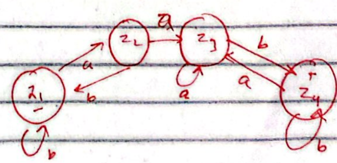
old state	a	b
$-x_1 = z_1$	$x_2 = z_2$	$x_1 = z_1$
$x_2 = z_2$	$x_3 y_1 = z_3$	$x_1 = z_1$
$x_3 y_1 = z_3$	$x_3 y_1 = z_3$	$x_3 y_1 y_2 = z_4$
$+x_3 y_1 y_2 = z_4$	$x_3 y_1 = z_3$	$x_3 y_1 y_2 = z_4$

$x_3 \to b \Rightarrow x_3$

$y_1 \to b = y_2$

$y_1 y_2$

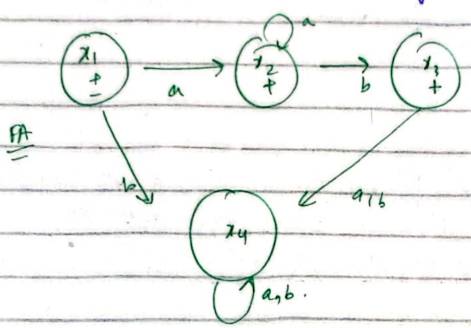
old state	a	b
$-z_1$	z_2	z_1
z_2	z_3	z_1
z_3	z_3	z_4
$+z_4$	z_3	z_4



4
→ Kleene closures

$(r_1)^* \Rightarrow (FA)^*$

If r is R·E and FA is finite automata, that accept exactly the language defined by r, than there is FA called $(FA)^+$ that accept language defined by r^*.



∴ with final state always write initial state.
∴ Initial state will always be final state.

Old state	a	b
$-\ x_1 = z_1$	$x_2 x_1 = z_2$	$x_4 = z_3$
$+\ x_2\, x_1 = z_2$	$x_2\, x_1 = z_2$	$x_3 x_4 = z_4$ (x_1)
$x_4 = z_3$	$x_4 = z_3$	$x_4 = z_3$
$+\ x_3\, x_4 = z_4$ (x_1)	$\underbrace{x_4 x_4}_{\text{none}} x_2 x_1 = z_5$	$x_4 x_4 x_4 \Rightarrow x_4 = z_3$
$+\ x_4 x_2 x_1 = z_5$	$x_4 x_2 x_1 = z_5$	$x_4 x_3 x_1 = z_4$

⇒

Old state	a	b
$+-\ z_1$	z_2	z_3
$+\ z_2$	z_2	z_4
z_3	z_3	z_3
$+\ z_4$	z_5	z_3
$+\ z_5$	z_5	z_4