$(\underline{aa} + \underline{b})^*$ $\longrightarrow$ NFA - ϵ edges

$\underline{(FA)^*}$

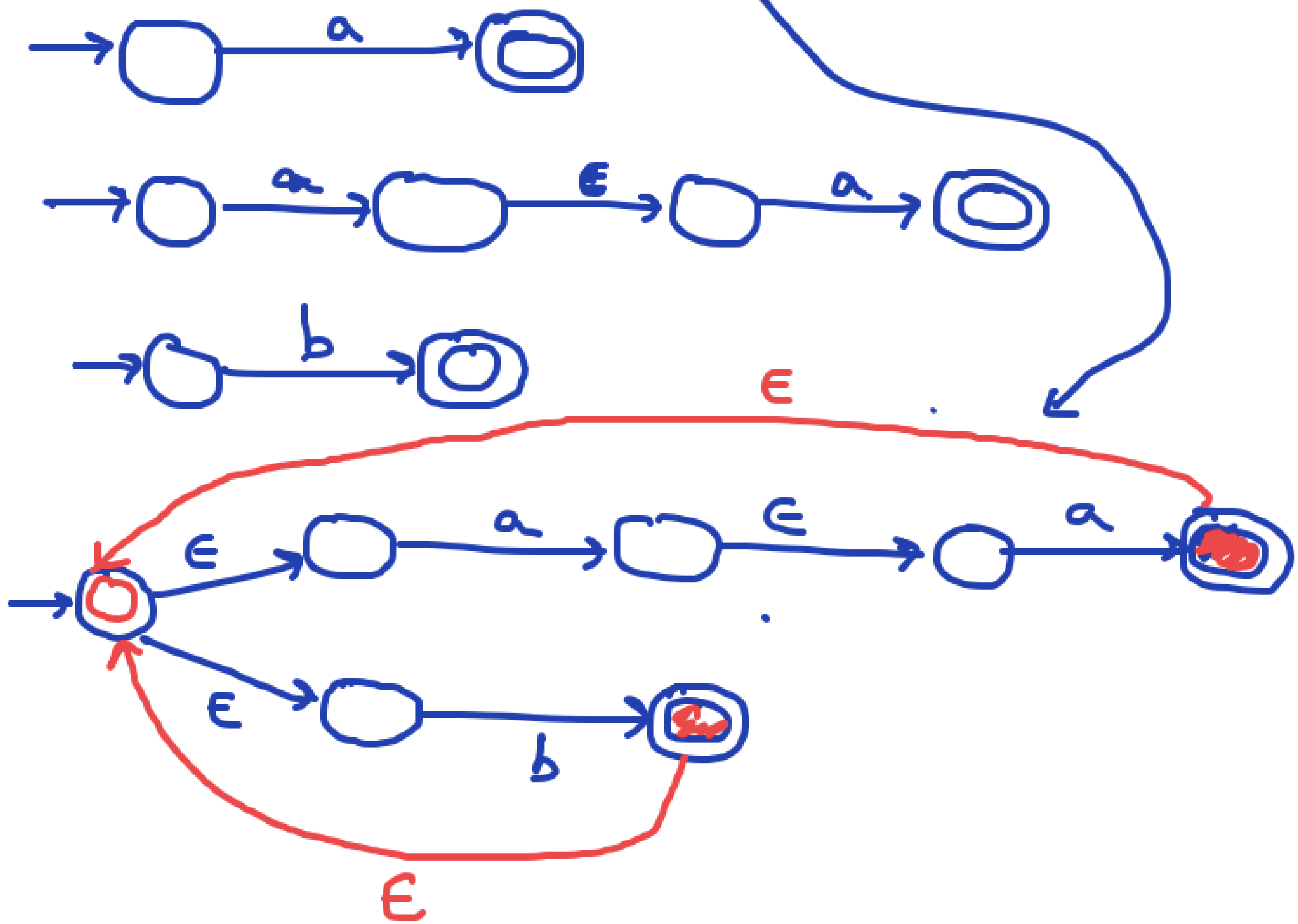
a :

aa:

b :

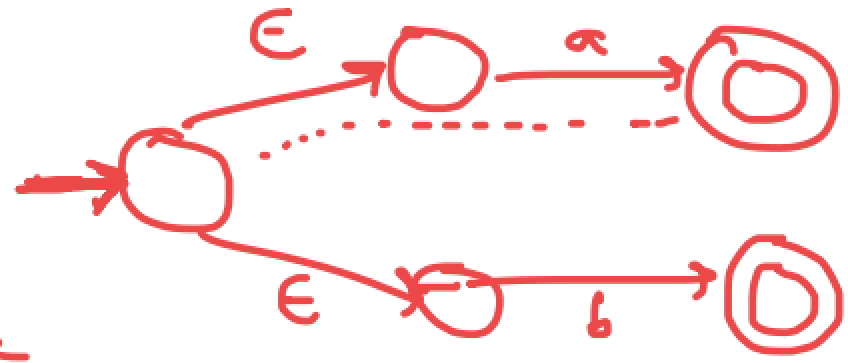
$(\underline{aa}+b)^*$:

$\{\underline{a}a, \underline{b}\}$

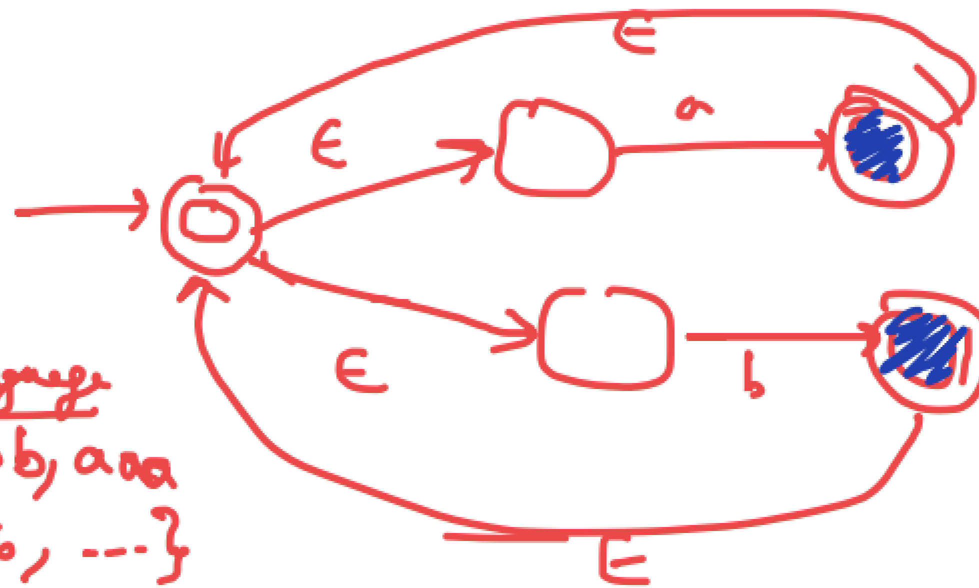


$a + b$

$\{a, b\}$ → finite language



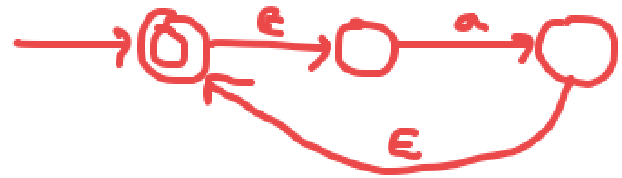
$(a+b)^*$



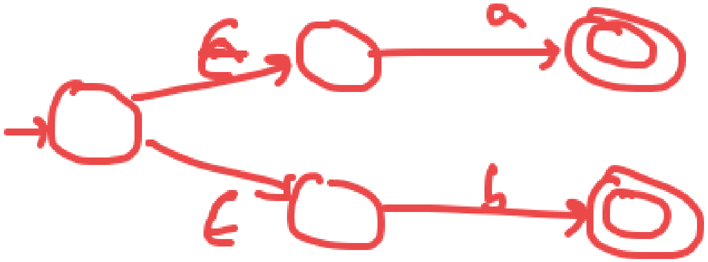
Infinite Language

$\{\epsilon, a, b, ab, ba, aa, bb, aaa, aab, \ldots\}$

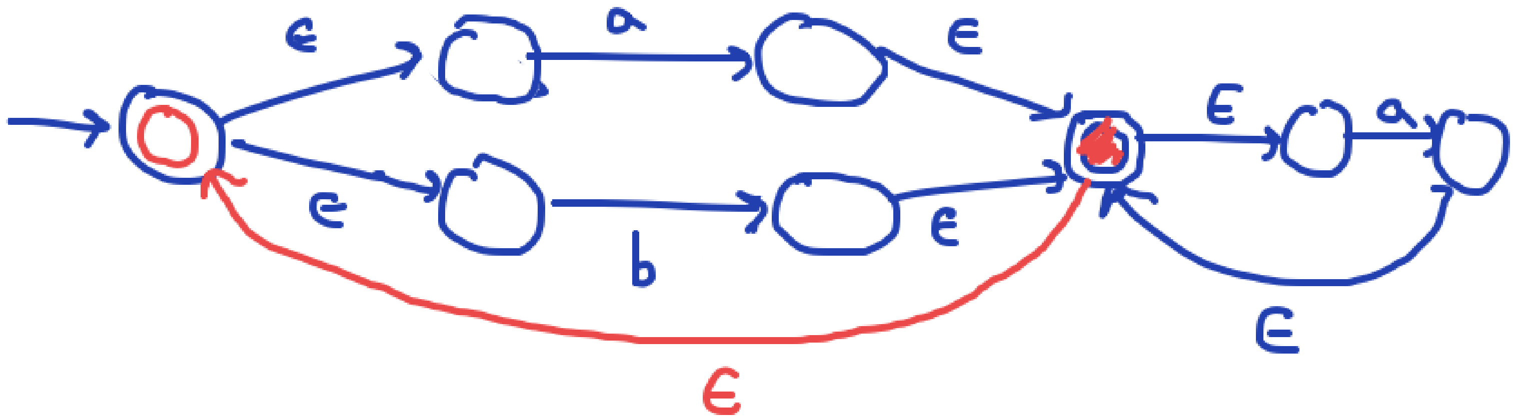
$((a+b)a^*)^*$



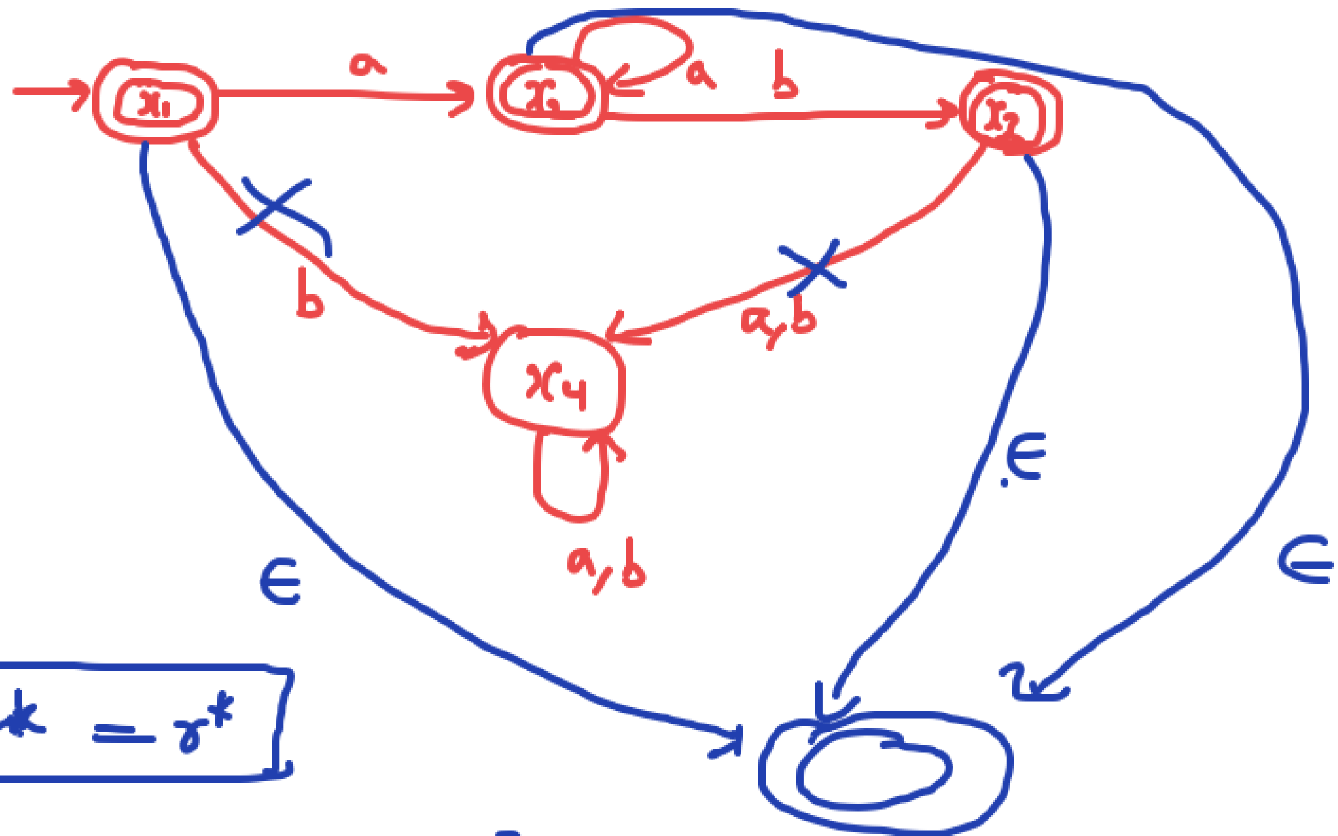
$a+b$



$(a+b)a^*$



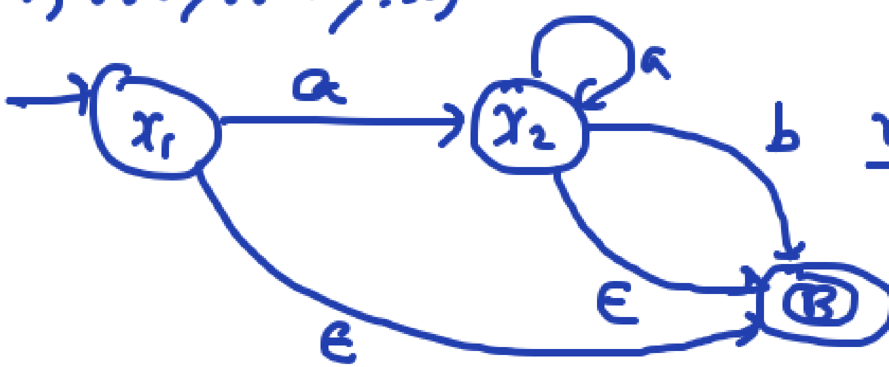
FA :



$$\boxed{\epsilon + rr^* = r^*}$$

$\{\epsilon, r, rr, rrr, rrrr, \ldots\}$

r^*



Three paths:

$$re: \underline{\epsilon + aa^*} + aa^*b$$

$$= a^* + aa^*b$$

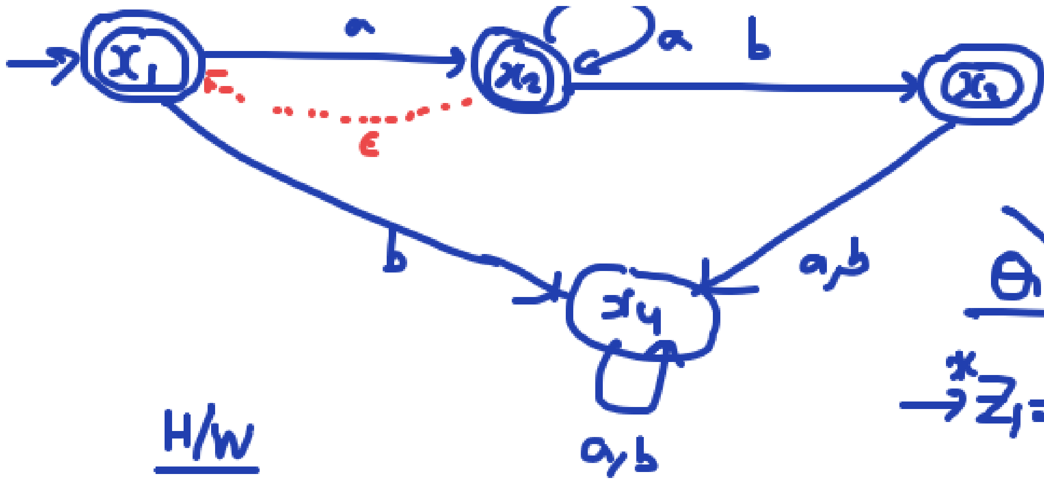
$\underline{(FA)^*} \longrightarrow (a^* + aa^*b)^*$

If r is a r.e and FA is finite automata that accepts the language defined by r. Then, $\exists$ an FA called $(FA)^*$ that accepts the language defined by r^*

$$FA \longleftrightarrow \underline{\text{regular expression}} \longleftrightarrow \text{regular set / regular language}$$

<u>Regular languages</u> are closed under <u>Union</u>, <u>Complementation</u>, Intersection, concatenation, Kleene's star

$FA_1 \cup FA_2$ (Union), FA_1' or FA_2 (Complementation), $FA_1 \cap FA_2$ (Intersection), $FA_1 \cdot FA_2$ (concatenation), FA_1^* (Kleene's star)

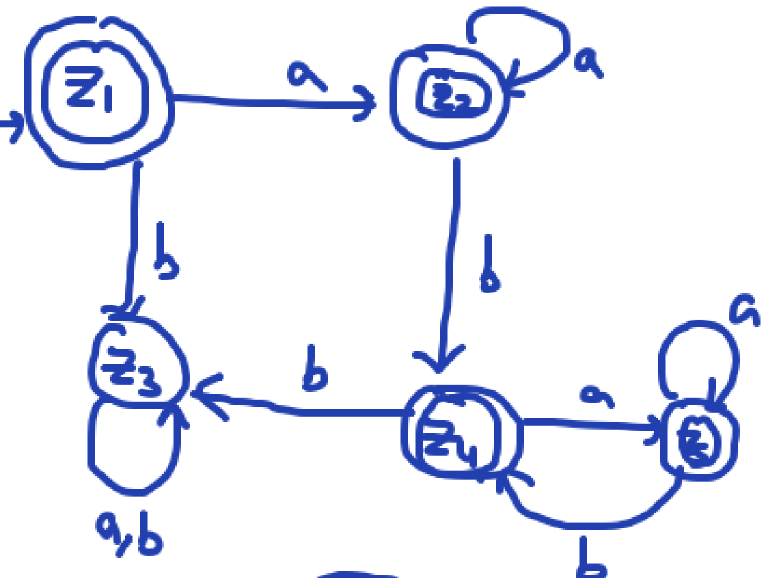


$$r.e = a^* + aa^*b$$

$$r^* = (a^* + aa^*b)^*$$

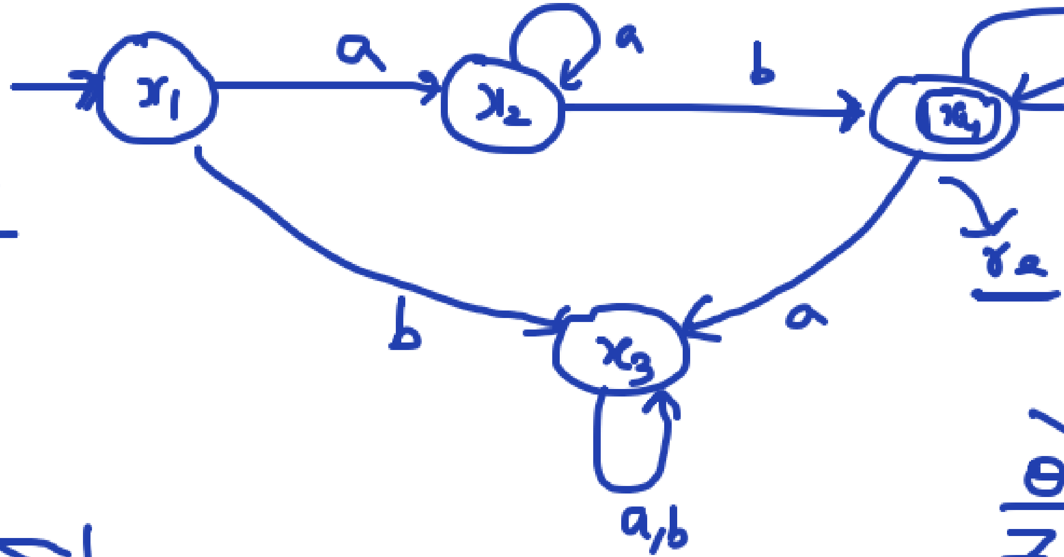
θ \ Σ	a	b
$\rightarrow {}^*Z_1 = x_1$	$x_2 \mid x_1 = Z_2$	$x_4 = Z_3$
$^*Z_2 = x_1 \mid x_2$	$x_2 \mid x_1 = Z_2$	$x_4 \mid x_3 \mid x_1 = Z_4$
$Z_3 = x_4$	$x_4 = Z_3$	$x_4 = Z_3$
$^*Z_4 = x_1 \mid x_3 \mid x_4$	$x_1 \mid x_2 \mid x_4 = Z_5$	$x_4 = Z_3$
$^*Z_5 = x_1 \mid x_2 \mid x_4$	$x_1 \mid x_2 \mid x_4 = Z_5$	$x_1 \mid x_3 \mid x_4 = Z_4$

H/W



FA → RE

E.g



construct $(FA)^*$

re aa^*bb^*

$(aa^*bb^*)^*$

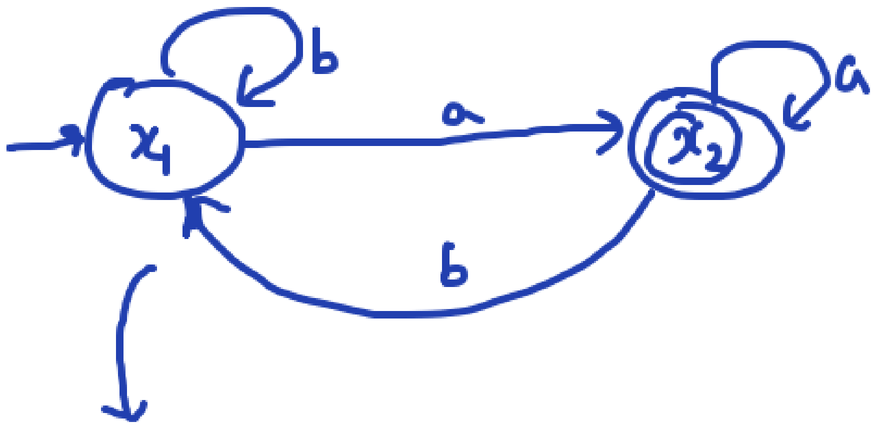
H/W

Θ \ Σ	a	b
$\rightarrow * z_1 = x_1$	$z_2 = x_2$	$z_3 = x_3$
$z_2 = x_2$	$z_2 = x_2$	$z_4 = x_4 \mid x_1$
$z_3 = x_3$	$z_3 = x_3$	$z_3 = x_3$
$* z_4 = x_1 \mid x_4$	$x_2 \mid x_3 = z_5$	$x_3 \mid x_4 \mid x_1 = z_6$

Θ \ Σ	a	b
$z_5 = x_2 \mid x_3$	$x_2 \mid x_3 = z_5$	$x_1 \mid x_4 \mid x_3 = z_6$
$* z_6 = x_1 \mid x_4 \mid x_3$	$x_2 \mid x_3 = z_5$	$x_1 \mid x_3 \mid x_4 = z_6$

$FA_1 \cdot FA_1 \longrightarrow FA_1^*$

Ques



$\{a, aa, aba, baa, ba, bba, \ldots\}$

b, bb, bbb, ...

a b

r.e $(a+b)^*a$

$\overset{*}{\rightarrow} Z_1 = x_1$

r^* $((a+b)^*a)^*$

FAIL

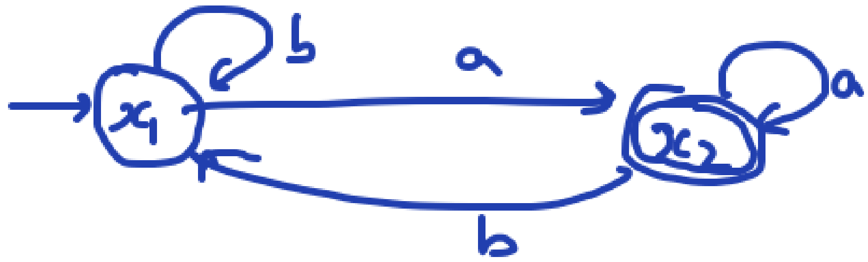
Incomplete

Initial State readabl

Problem

Real Algorithm (Initial state reenterable)

$(FA)^*$



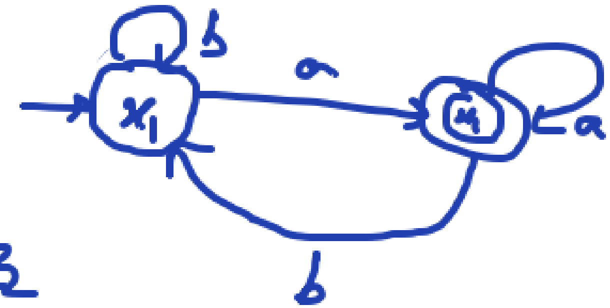
find power set

$2^2 \nearrow \{\{\ \}, \{x_1\}, \{x_2\}, \{x_1, x_2\}\}$

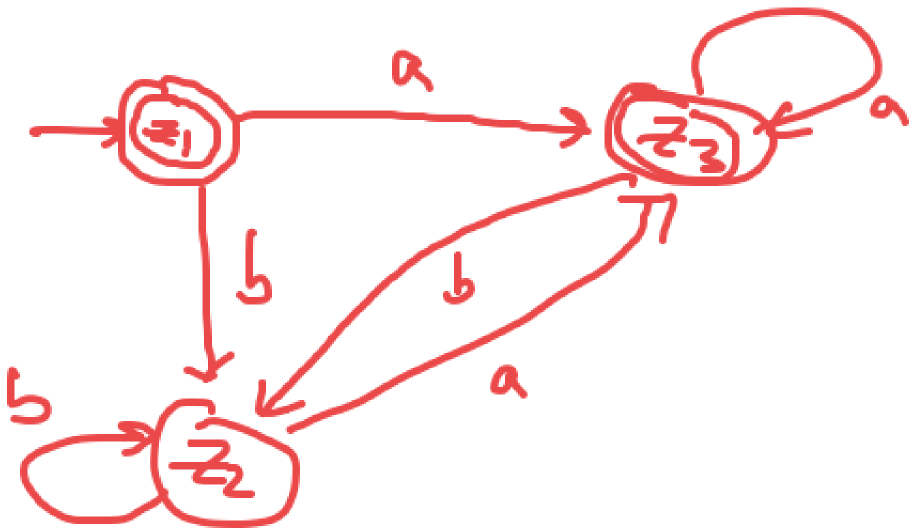
$*$ cancel all the subsets that contain the final state but doesn't contain the initial state

$$\boxed{\{\{\}, \{x_1\}, \{x_1, x_2\}\}}$$

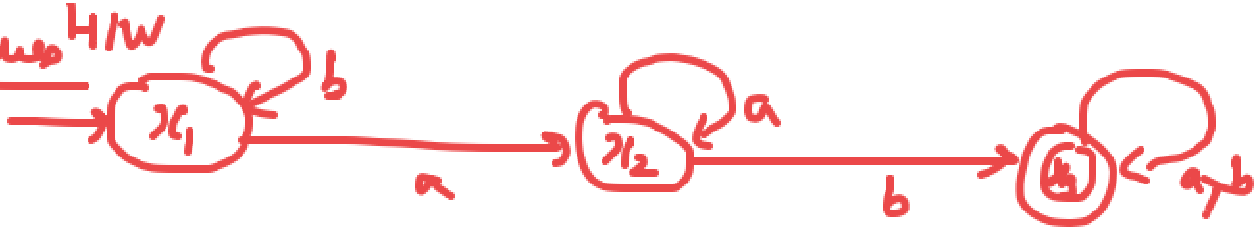
	a	b
$\rightarrow * \; Z_1 = \{\}$	? Z_3	? Z_2
$Z_2 = \{x_1\}$	$x_2 \mid x_1 = Z_3$	$x_1 = Z_2$
$* \; Z_3 = \{x_1 \mid x_2\}$	$x_1 \mid x_2 = Z_3$	$x_1 = Z_2$



$$((a+b)^*a)^*$$



Ques H/W



$(FA)^*$