$L = \{a^n b^n : n \geq 1\}$ is not regular.

$L = \{ab\}$

$\{\underline{ab, aabb, aaabbb}, \ldots$

<u>Step1</u> : Assume L is regular. Then there is an FA with n States accepting L.

<u>Step2</u> : Let $w = a^n b^n$. Then $|w| = \underline{2n} > n$ $\quad \underline{n \geq 1}$

By pumping lemma, we write $w = xyz$ with $|xy| \leq$ and $|y| > 0$.

<u>Step3</u> We want to find i so that $xy^iz \notin L$

$|xy| \le n$ (number of states) $\qquad w = a^n b^n$

$|w| = 2n \geq n$

$w = x\ y\ z \qquad k \neq 0 \quad \because |y| > 0$

$$\underbrace{a^{n-k}}_{x}\ \underbrace{a^{k}}_{y}\ \underbrace{b^{n}}_{z}$$

pumped string $\quad a^{n-k} (a^k)^2 b^n \qquad (i = 2)$

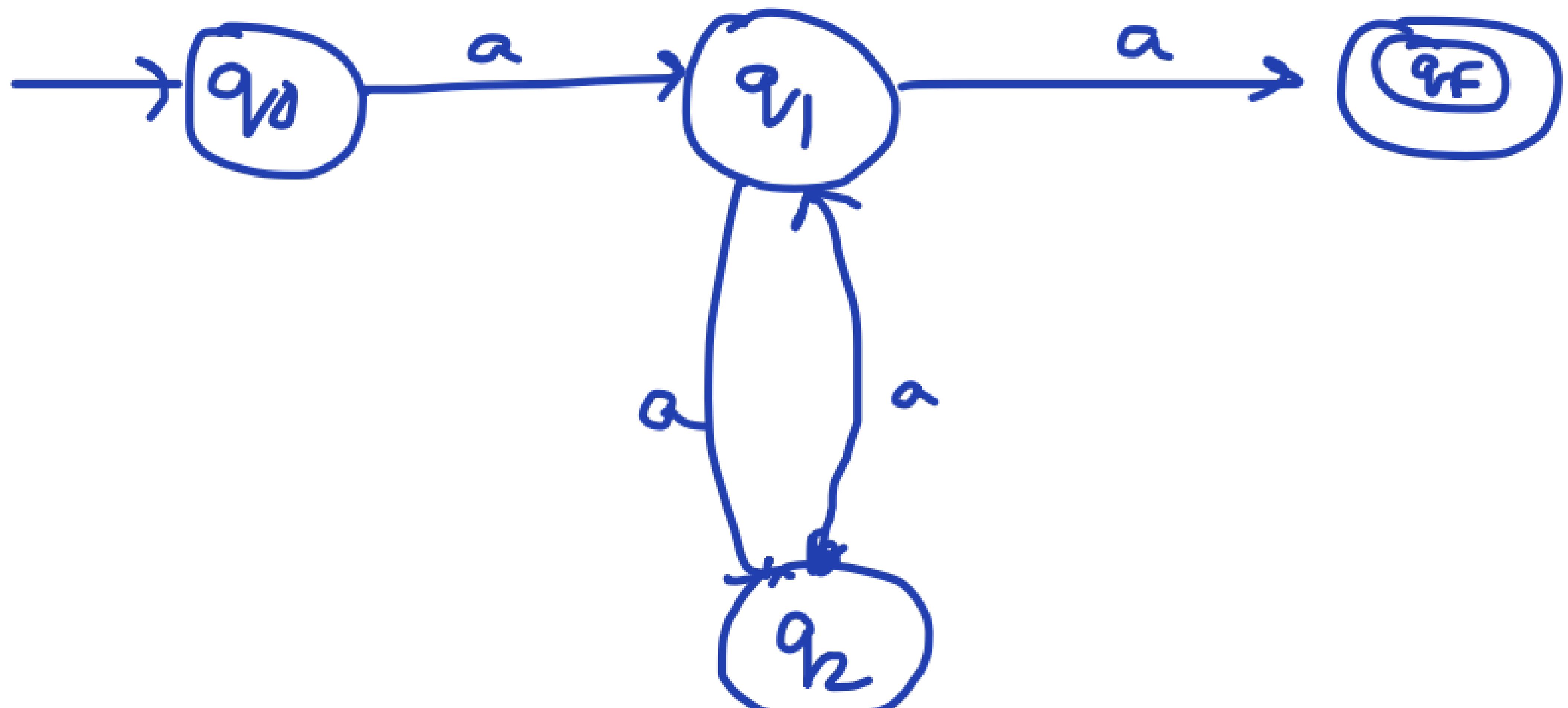
$$a^{n-k} a^{2k} b^n$$

$$a^{n+k} b^n \notin L$$

Contradiction $\therefore$ hence L is non-regular

$\{aa, aaaa, aaaaaa, \ldots\}$

$a(a^2)^i a \;,\; i \geq 0$



$$\boxed{a a^* \, b b^* \, c c^*}$$

$a^m b^{2n} c^{3p}$

$aa^* \; b(bb)^* b \;\; ccc(ccc)^*$

$aa^* \; bb(bb)^* \; ccc(ccc)^*$

25

29

Show that $L = \{a^p \mid p \text{ is a prime number}\}$ is not regul

Step 1: ~~Assume~~ L is regular. Let n be the number of st
in ~~the~~ the FA accepting L

Step 2: Let p be a prime number greater than n [$p >$

$|w| = p$ Let $w = a^p$ By pumping Lemma, w can be written let $y = a^{m}$ for $m \geq 1$ and

$1 \leq |y| \leq n$

Step3 : ~~let~~ Pump y $(i = p+1)$

$$|xy^iz| = |xyz| + |y^{i-1}|$$

$$= p + (i-1)m$$

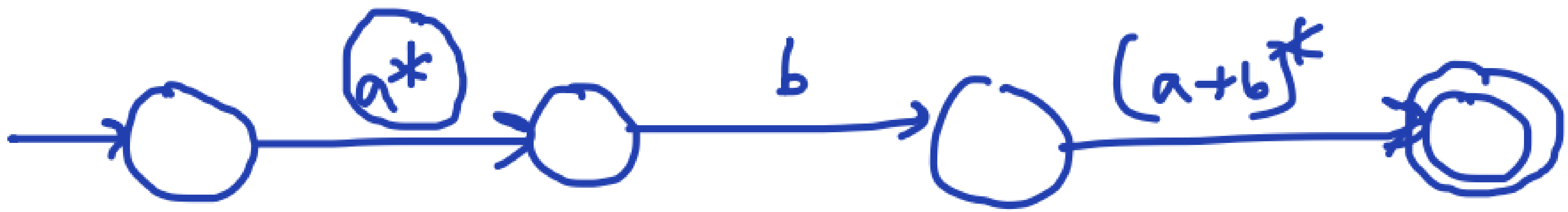
$$= p + pm$$

$xy^iz \notin L$

nues: L defined by regular expression $E = a^* b (a+b)^*$

$G = (V, T, S, P)$

$= \{b, ab, ba, bb, \ldots$



ull
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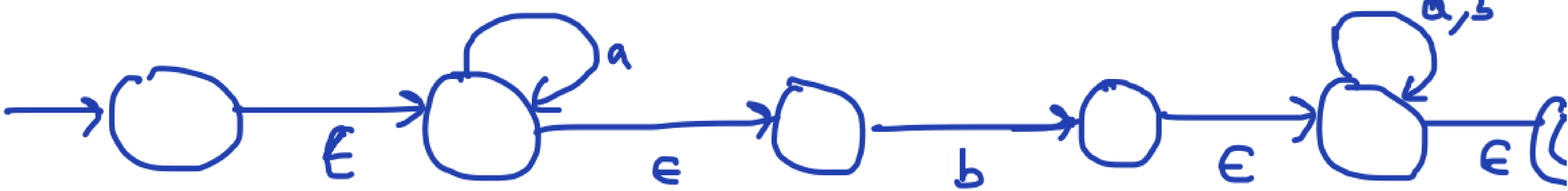
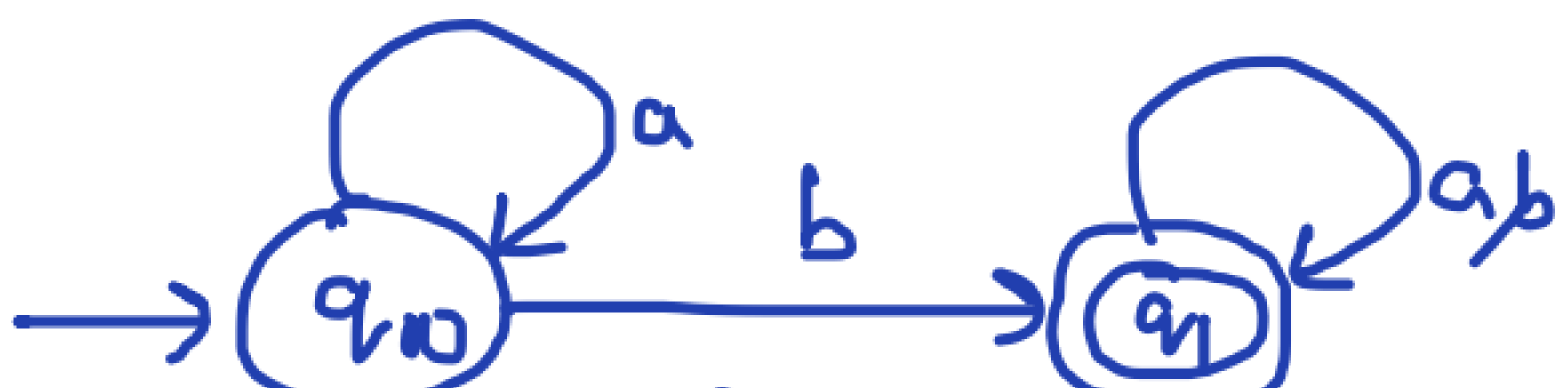
FA



NFA
-edge



$S \rightarrow b$

$S \rightarrow aS$

$S \rightarrow bS_1$

$S_1 \rightarrow aS_1$

$S_1 \rightarrow bS_1$

$S_1 \rightarrow \epsilon$

aaba

S

To Sedmo

$a^* b^*$

$G = (\{S, A, B\}, \{a, b\}, S, P)$

$G = (\{S\}, \{a, b\}, S, P)$

$S \Rightarrow$

$\Rightarrow$

$\Rightarrow$

$\Rightarrow$

$S \rightarrow b$

$S \rightarrow aS$

$S \rightarrow Sa$

$S \rightarrow Sb$

$S \rightarrow b$

$S \rightarrow AbB$

$A \rightarrow aA \mid \epsilon$

$B \rightarrow aB \mid bB \mid \epsilon$