David Papp

1. a) $w = \{a^{2^n}\}$

If w is sufficiently long, then w can be split into 3 pieces xyz. Then xy^iz where $i \geq 0$ must also appear in the language.

Let $m = 2^n$. The difference between the next value in the language and this one is

$2^{(n+1)} - 2^n = 2^n$, which is increasing.

Let $n = 3$

Then $s = a^{2^n} = a^8$

$a^{2^p} = xyz$

$y > 0$

$|xy| \leq p$

$xy^iz \in L$

Let $s = aaaa$

$\{aa\}\{a\}^i\{a\}$ Fails when $i = 2$

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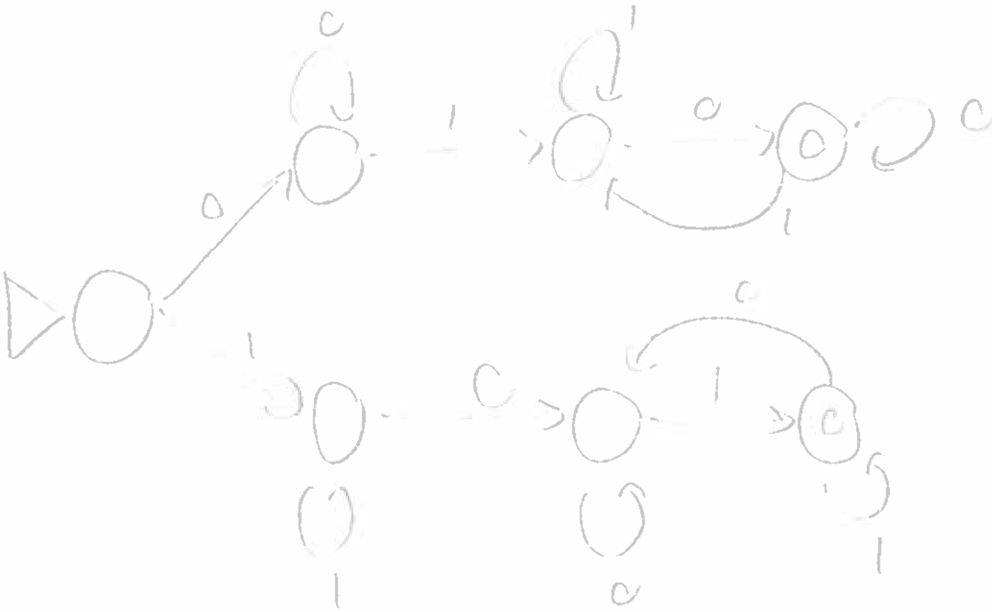
$\{aaa\}^i\{a\}$ Fails when $i = 2$

$\{a\}^i\{aaa\}^i$ Fails when $i = 2$

$\{aaaa\}^i$ Fails when $i = 3$

b)



c) ww^R

let $(w)^p (w_R)^p$ must also be in language

note: this essentially boils down to the same problem as $0^N 1^N$ which is not regular.

let $s = (w)^p (w_R)^p$

$w = xy^iz$

[illegible] $w^1 w^2 w_{inv}^p$ $x+y+z$ p

[illegible] $w^2 w^2 w_{inv}^p$ $x+2y+z \neq p$

Not in language

3. $a^n b^n$