$A = \{ w w w \mid w \in \{a, b\}^* \}$

Suppose $A$ is regular w/ pumping length $p$.

Consider $S = a^p b a^p b a^p b a^p b$

Now $S \in A$ and $|S| > p$ so $S$ can be split into 3 pieces $S = x y z$ s.t. $x y z \in A$ for $i \geq 0$.

Consider the cases:

- $y$ is all as $x y y z \notin A$

  One section has more a's

Since $|x y| < p$, this is the only case.

$S = a^p a a^p \quad S \in A \land$

e.g. $a a a a a a a a$

\[ y \]

\[ a a a d a a g \quad a a a a a a a a \in A \]

\[ y \quad y \]
$$B = \left\{ a^n \mid n \geq 0 \right\} \quad \mathbb{Z} = \left\{ 0 \right\}$$

$$S = a^{2^p}$$

y is at most \( p \) as

$$x y y z \leq a^{2^p + 2^p} = a^{2^{p+1}}$$

so \( x y y z \neq B \)
DFA
Finite State Machines
\[ \Sigma = \{ +, -, 0..9 \} \]

```
while (done) {
    c = read_char();
    switch (state) {
        case 0:
            if (c == '0')
                state = 1;
            break;
```
Vending

\[ \Sigma = \{ 25, 5, 10, $1 \} \]

\[ \Gamma = \{ \text{candy}, 25, 5, 10 \} \]
$$\exists w \mid w = w^r$$

$$\Sigma = \{0, 1, 3\}$$

$$011110$$

$$101101$$

$$010$$

$$w^r \rightarrow w^r \rightarrow w^r$$

$$s = 0^p 10^p$$