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

Suppose A is regular w/ pumping length p.

$\cancel{a^p b^p a^p} \notin A$

Consider $s = a^p b^p a^p b^p a^p b^p$

now $s \in A$ and $|s| > p$ so s can be split into 3 pieces $s = xyz$ s.t $xy^iz \in A$ for $i \geq 0$.

Consider the cases:

y is all a's

$xyyz \notin A$

one section has more a's

since $|xy| < p$, this is the only case.

$s = a^p a^p a^p$ $\quad s \in A$ ✓

eg. $\underbrace{aaa}_{y}aaa\,aaa$

$\underbrace{aaa}_{y}\underbrace{aaa}_{y}aaa\,aaa \in A$

$B = \{ a^{2^n} \mid n \geq 0 \}$ $\quad \Sigma = \{a\}$

$S = a^{2^p}$

y is at most p a's

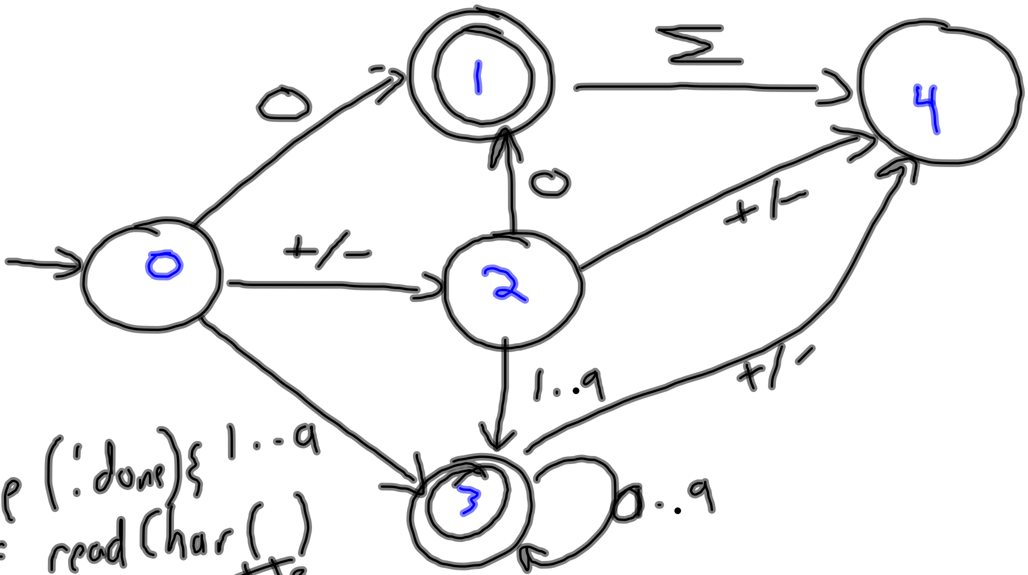
$xyyz \overset{\text{is at most}}{=} a^{2^p + p} < a^{2^p + 2^p}$

$= a^{2^{(p+1)}}$

so $xyyz \notin B$

DFA
Finite State Machines

$\Sigma = \{+, -, 0..9\}$



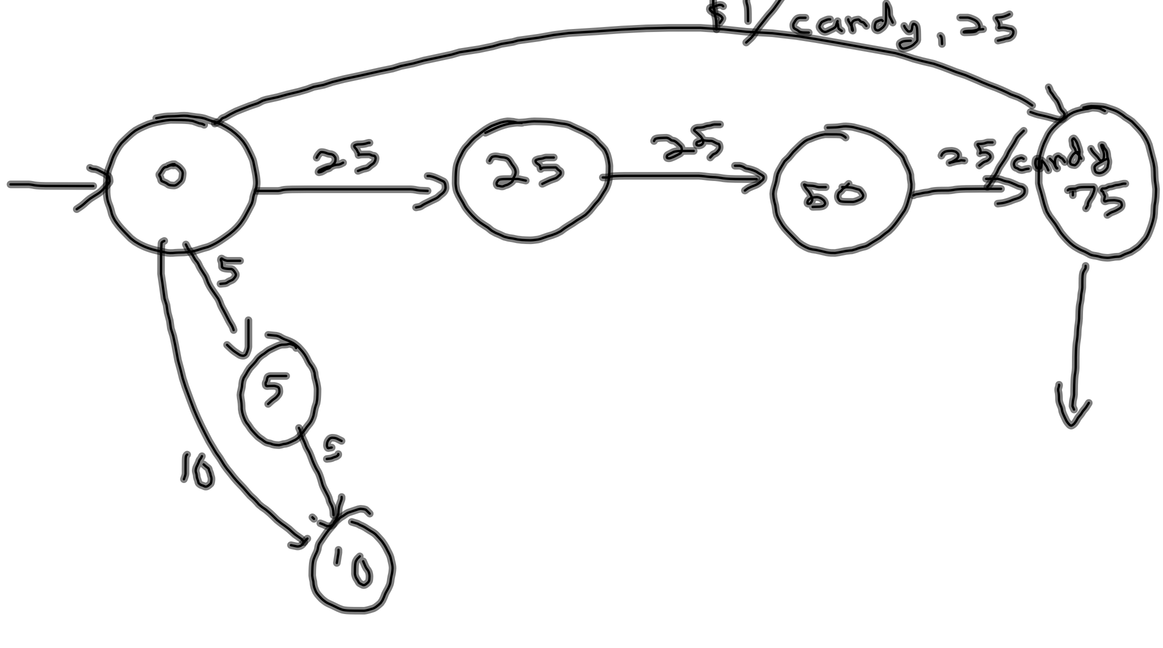

```
while(!done){
  c = readChar()
  switch(state){
    case 0:
      if(c=='0')
        state = 1;

    break;
```

Vending

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

$$\Gamma = \{candy, 25, 5, 10\}$$



$\{ w \mid w = w^R \}$

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

$$\left.\begin{matrix} 011110 \\ 101101 \end{matrix}\right\} \quad ww^R$$

$$010 \qquad w\Sigma w^R$$

$s = 0^p 1 0^p$