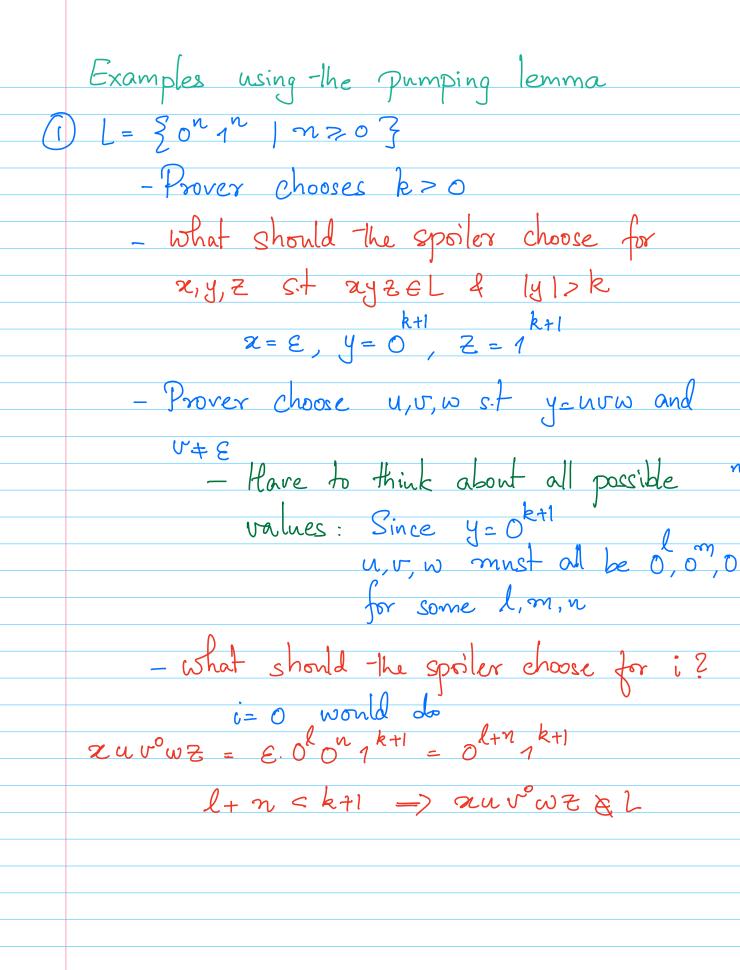
Formalizing the proof: The Pumping Lemma Let L be a regular language Jinteger R > 0 S.t Hx, y, Z S.t xyzel The size of and 1y12k, Ju,v,w s.t y=uvw
the DFA
accepting L V+E, & +i>o 2uviwz EL for all strings in L. and the part of the loops substrings of those substring that loops and can be pumped Proof: Lis regular. JM=(Q, E, S, 20, F) s.t L(m)=L. let 1Q1=k let a,y,z e I \* s.t ayzel & ly1>k Suppose 8 (20, x) = 9 Let y= y, y2 ... yr r>k 2 = 5(9, y, y, y) By PHP 7 &, t s.+ 2 = 2 in {21, 22, ..., le}  $= \begin{cases} \delta(2, y_1 ... y_s) = 2 \\ \delta(2, y_1 ... y_s) = 2 \\ \delta(2, y_{s+1} ... y_t) = 2 \end{cases}$   $Choose \quad u = y_1 ... y_s$   $U = y_{s+1} ... y_t$   $w = y_{t+1} ... y_t$  $\delta(Q_{1,1}^{n}) = Q, \ \delta(Q, Y_{1}, Y_{2}) = Q' \ \delta(Q', Y_{sti}, Y_{2}) = Q' \ \delta(Q', Y_{tti}, Y_{2}) \in F$ 

Contrapositive form:
If  # k >0, J x,y,z sit xyzel and lyl>k
s.t \u,v,w s.t y=nvw, v=E, 3 i>0
then L is not regular.
Pumping lemma as a game
Prover: wants to prove that L is regular
Spoiler: wants to show that the prover is
Prover
Choose R -> Find 2,4,7 s.t
2yzeL and ly zk
Find u,v,w s.t
y= uvw ->  Iv1+0  Find izo st
2 muin 2 E L
If the spoiler has a winning strategy, then the language is not regular
-the language is not regular



Using closure properties L = { we {0,13\* | #1(w) = #0(w) } L'= {0<sup>n</sup>1<sup>n</sup> | n z 0} L'= {0<sup>i</sup>1<sup>o</sup> | i,j z 0}

regular

L'= L 0 L' 

if L is regular, -then

not regular regular it leads to a contradictor