

①  $A_{TM}$  is undecidable / proof by diagonalization

②  $HALT_{TM}$  " / proof by reduction  
 $A_{TM} \leq_m HALT_{TM}$

③  $E_{TM}$  " / proof by reduction  
 $A_{TM} \leq_m HALT_{TM}$

④  $EQ_{TM}$  " / proof by reduction  
 $E_{TM} \leq_m EQ_{TM}$

⑤ REGULAR<sub>TM</sub> " / proof by reduction  
 $A_{TM} \leq_m REGULAR_{TM}$

$REGULAR_{TM} = \{ \langle M \rangle \mid L(M) \text{ is regular} \}$

$S(\langle M \rangle) = \text{Accept if } L(M) \text{ is regular}$

$A_{TM}$   $w$  is a word and  $M$  a TM  
Does  $M$  accept  $w$ ?

$M_2$  " $x = 0^n 1^n$ " for some  $n$  accept  
run  $M_1$  on  $w$  and accept if  
 $M$  accepts  $w$

if  $M$  accept  $w$ ,  $L(M_2) = \Sigma^*$

if  $M$  doesn't accept  $w$ ,  $L(M_2) = \emptyset$

$S(\langle M_2 \rangle) = \text{accept}$ , then  $M$  accept  $w$

" = rejects, " " rejects  $w$

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4.8

Consider  $n \in \mathbb{N}$

produce  $f(n) \rightarrow i, j, k$

$f(i, j, k) \leftrightarrow \mathbb{N}$

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4.2

$EQ_{DFA, REGULAR} = \{$

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