RECALL DEF. of $L \in NP$:

(*) $\quad x \in L \iff \exists y \, (|y| \in |x|^c) \; R(x,y)$

DEFINE $\boxed{\text{MACHINE } U(e,x,y,z)}$ - 4 inputs

↳ (i) U simulates machine e on (x,y) for time $|z|$

(ii) IF THE SIMULATION STOPS, IT STOPS TOO WITH THE SAME OUTPUT

(iii) IF NOT, IT STOPS AFTER $|z|$ STEPS WITH OUTPUT 0.

CLAIM 1 : U IS P-TIME.

CLAIM 2 : $L_U := \{(e,t,z) \mid \exists y\, (|y| \le |z|)\ U(e,t,y,z) = 1\} \in NP$

CLAIM 3 : ANY L DEFINED AS IN (*) IS p-REDUCIBLE TO L_U

PRF: REDUCTION f:

$$x \longrightarrow \langle R \rangle, t, 1^{(|x|^d)}$$

$\langle R \rangle$: CODE OF MACHINE COMPUTING R

$1^{(|x|^d)}$: STRING OF $|x|^d$ 1s

WHERE $d \ge c$ IS SUCH THAT R IS COMPUTED IN TIME $\text{poly}(|x|, |y|) \le \text{poly}(|x|, |x|^c) \le |x|^d$. □