

Lecture 3

Turing Machine

$$\Omega : K \times \Sigma \rightarrow (K \cup \{h, y, n\}) \times \Sigma \times \{\leftarrow, \rightarrow, -\}$$

$M(x)$

where M is a TM and x is an input word

Output	Condition
"yes"	after finitely many steps, the "yes" state is reached
"no"	after finitely many steps, the "no" state is reached
y	where $y \in \Sigma^*$, is a tape word after k steps and M has entered the "h" state
\nearrow	no halting state is reached

Overview of Computing Tasks

	compute $f : \mathbb{N}^k \rightarrow \mathbb{N}$	Handling L's
Always terminates	total recursive functions	(always terminates with y/n) Decidable L's Recursive L's
$M(x) = y$ or $M(x) = \nearrow$	(partially) recursive functions	$M(x) = yes, x \in L$ $M(x) = \nearrow, x \notin L$ "Semi-decidable" L's Recursively enumerable L's

Proposition 3.1

1. If L is recursive, then L is also recursively enumerable
2. If L is recursive, then L^C is also recursive
3. L is recursive, iff L and L^C are recursively enumerable (rec. en.)