Summary of Chapter 14

A set is countable if it can be placed in 1–1 correspondence with the positive integers.

Cantor showed by diagonalization that the set of subsets of the integers is not countable, as is the set of infinite binary sequences.

Every TM has an encoding as a finite binary string.

Since there is a canonical ordering of binary strings, an infinite language corresponds to an infinite binary sequence.

Hence almost all languages are not r.e.

The language S_{tm} (self-denial) is not r.e.

The acceptance language A_{tm} and hence the halting problem are r.e. but not recursive.

The proof uses self-reference.

Summary of Chapter 15

A reduction is a mapping that preserves membership.

A reduction can be used to show that one problem is undecidable given the undecidability of another problem.

Several problems about TMs are proven undecidable by reduction from the acceptance problem A_{tm}.