CSE211-Formal Languages and Automata Theory

U4L8_Uncomputable Functions and Rice's Theorem

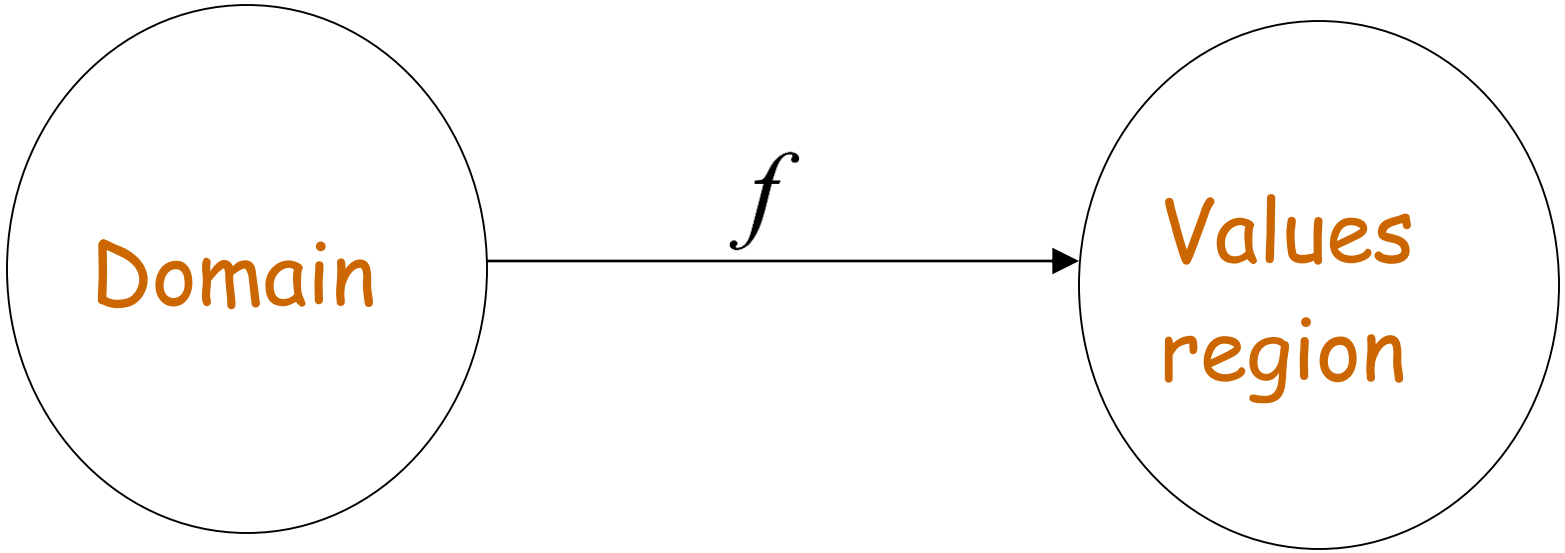
Dr. P. Saravanan
School of Computing
SASTRA Deemed University

Agenda

- Uncomputable functions
- Property of a Language
- Non-Trival Property
- Rice Theorem

Uncomputable Functions

Uncomputable Functions



A function is uncomputable if it cannot be computed for all of its domain

Definition:

Non-trivial properties of recursively enumerable languages:

Any property possessed by some (not all) recursively enumerable languages

Properties of Languages

- Any set of languages is a *property* of languages.
- Example: The infiniteness property is the set of infinite languages.

Properties of Langauges – (2)

- As always, languages must be defined by some descriptive device.
- The most general device we know is the TM.
- Thus, we shall think of a property as a problem about Turing machines.
- Let L_P be the set of binary TM codes for TM's M such that L(M) has property P.

Trivial Properties

- There are two (*trivial*) properties P for which L_P is decidable.
  1. The *always-false property*, which contains no RE languages.
  2. The *always-true property*, which contains every RE language.

Some non-trivial properties of recursively enumerable languages:

- L is empty
- L is finite
- L contains two different strings of the same length

Rice's Theorem

Rice's Theorem:

Any non-trivial property of
a recursively enumerable language
is undecidable

Exercise

- Construct the TM that decides L={w#w |w belongs to {0,1}*

References

John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, *Introduction to Automata Theory, Languages, and Computation*, Pearson, 3rd Edition, 2011.

Peter Linz, *An Introduction to Formal Languages and Automata*, Jones and Bartle Learning International, United Kingdom, 6th Edition, 2016.

Next Class: Unit IV

Introduction to Complexity

Thank you.