Formal Language (3C)

- Recursively Enumerable Language

Please send corrections (or suggestions) to youngwlim@hotmail.com.

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Recursive Enumerable Language

There are three equivalent definitions
of a **recursively enumerable** language:

A **recursively enumerable language** is
a **recursively enumerable** subset
in the set of all possible words
over the **alphabet** of the language.

https://en.wikipedia.org/wiki/Context-free_language

Recursive Enumerable Language

A recursively enumerable language is a formal language
for which there exists a **Turing machine**
(or other computable function)
which will **enumerate** all valid strings of the language.

Note that if the language is infinite,
the enumerating algorithm provided can be chosen
so that it avoids repetitions, since we can test
whether the string produced for number n is "already" produced
for a number which is less than n.
If it already is produced,
use the output for input n+1 instead (recursively),
but again, test whether it is "new".

https://en.wikipedia.org/wiki/Context-free_language

Recursive Enumerable Language

A **recursively enumerable language** is a formal language
for which there exists a **Turing machine** (or other computable function)
that will halt and accept when presented with any string
in the language as input but may either **halt** and
reject or **loop forever** when presented
with a string not in the language.

Contrast this to recursive languages,
which require that the Turing machine halts in all cases.

All regular, context-free, context-sensitive
and recursive languages are recursively enumerable.

https://en.wikipedia.org/wiki/Context-free_language

Recursive Enumerable Language Example

The halting problem is recursively enumerable but not recursive.
Indeed one can run the Turing Machine and accept if the machine halts,
hence it is recursively enumerable.
On the other hand the problem is undecidable.

Some other recursively enumerable languages that are not recursive include:

Post correspondence problem
Mortality (computability theory)
Entscheidungsproblem

https://en.wikipedia.org/wiki/Context-free_language

References

[1] http://en.wikipedia.org/
[2]