



RECURSIVELY DEFINING LANGUAGE

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EVEN language
EVEN is the set of all positive whole numbers divisible by 2.
EVEN is the set of all $2n$ where $n = 1\ 2\ 3\ 4\ \dots$

Another way we might try this:
The set is defined by these three rules:
Rule1: 2 is in EVEN.
Rule2: if x is in EVEN, then so is $x+2$.
Rule3: The only elements in the set EVEN are those that can be produced from the two rules above.

The last rule above is completely redundant.

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EVEN language

The set is defined by these three rules:

Rule1: 2 is in EVEN.

Rule2: if x is in EVEN, then so is $x+2$.

Rule3: The only elements in the set EVEN are those that

produced from the two rules above.

PROBLEM: Show that **1000000** is in this language.

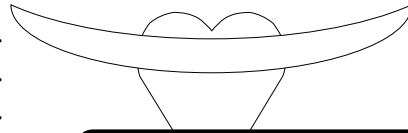
By Rule1, 2 is in EVEN.

By Rule2, $2+2=4$ is in EVEN.

By Rule2, $4+2=6$ is in EVEN.

By Rule2, $6+2=8$ is in EVEN.

By Rule2, $8+2=10$ is in EVEN.



PRETTY HORRIBLE !

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EVEN language

The set is defined by these three rules:

Rule1: 2 is in EVEN.

Rule2: if x,y are in EVEN, then so is $x+y$.

Rule3: The only elements in the set EVEN are those that

can be produced from the two rules above.

PROBLEM: Show that 10 is in this language.

By Rule1, 2 is in EVEN.

By Rule2, $2+2=4$ is in EVEN.

By Rule2, $4+4=8$ is in EVEN.

By Rule2, $8+2=10$ is in EVEN.

DECIDEDLY HARD

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POSITIVE language

The set is defined by these three rules:

Rule1: 1 is in POSITIVE.

Rule2: if x, y are in POSITIVE, then so is $x+y$, $x-y$, $x \times y$ and x/y where y is not zero.

Rule3: The only elements in the set POSITIVE are those that can be produced from the two rules above.

PROBLEM: What is POSITIVE language ?

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POLYNOMIAL language

The set is defined by these four rules:

Rule1: Any number is in POLYNOMIAL

Rule2: Any variable x is in POLYNOMIAL.

Rule3: if x, y are in POLYNOMIAL, then so is $x+y$, $x-y$, $x \times y$ and (x) .

Rule4: The only elements in the set POLYNOMIAL are those that can be produced from the three rules above.

PROBLEM: Show that $3x^2+2x-5$ is in POLYNOMIAL.

Proof:

Rule1: 2, 3, 5 are in POLYNOMIAL, Rule2: x is in POLYNOMIAL,

Rule3: $3x$, $2x$ are in POLYNOMIAL, Rule3: $3xx$ is in POLYNOMIAL,

Rule3: $3xxx+2x$, $3x^2+2x-5$ are in POLYNOMIAL. QED.

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ARITHMETIC EXPRESSIONS

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Language:

Let Σ be an alphabet for AE language.

$$\Sigma = \{ 0 1 2 3 4 5 6 7 8 9 + - * / () \}.$$

Define rules for this language.

Problems:

- Show that the language does not contain substring //.
- Show that $((3+4)-(2*6))/5$ is in this language.

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ข้อสังเกต

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Languages can be defined by

- $L_1 = \{ x^n \text{ for } n = 1 2 3 \dots \}$
- $L_2 = \{ x^n \text{ for } n = 1 3 5 7 \dots \}$
- $L_3 = \{ x^n \text{ for } n = 1 4 9 16 \dots \}$
- $L_4 = \{ x^n \text{ for } n = 3 4 8 22 \dots \}$.

More precision and less guesswork are required.