Expressions

Expressions have many uses – not just evaluation. Not all expressions can be evaluated.

A list has 1 or more elements (members) which are written between parentheses, separated by spaces. We store many kinds of information in lists. Examples of lists:

- (A) a list with the symbol A as its only element
- (A B C 49) a list of 3 symbols and a number
- (A (B C) D) a 3-element list whose 2nd element is another list
- ((GEORGIA ATHENS) (FLORIDA TALLAHASSEE)) a 2-element list of 2-element lists

Operations on lists

- (FIRST e) where \( e \) is a list, extracts the first element
  Example: (FIRST '(A B C)) \( \Rightarrow \) A

- (REST e) where \( e \) is a list, gives the list of all elements except the first
  Example: (REST '(A B C)) \( \Rightarrow \) (B C)

- (CONS x y) where \( y \) is a list, makes the list whose FIRST is \( x \) and whose REST is \( y \)
  Example: (CONS 'A '(B C)) \( \Rightarrow \) (A B C)

Special forms

A special form is like a function except that its arguments are not evaluated. So we have to revise our rule for how to evaluate a list:

To evaluate a list:
Look up the first element. It must be the name of a function or of a special form.
If it's a function, then:
  Evaluate all the remaining elements, in order.
  Pass those values to the function and perform the function.
If it's a special form, then:
  Pass the rest of the elements to the special form, unevaluated.
  The special form will decide whether to evaluate them.

Example of a special form: SETF

- (SETF A 23) when evaluated, gives the symbol A the value 23.
  (Do you see why SETF has to be a special form, not a function?)
And because (SETF A 23) is an expression, it has a value, namely 23.

Once given a value with SETF, a symbol retains that value until changed.

Example:

- (SETF A 23) \( \Rightarrow \) 23 Now the value of A is 23
- (SETF B 'A) \( \Rightarrow \) A Now the value of B is the symbol A
- (SETF C 'B) \( \Rightarrow \) B Now the value of C is the symbol B
- (SETF D A) \( \Rightarrow \) 23 But the value of D is the number 23.
- A \( \Rightarrow \) 23
- B \( \Rightarrow \) A
- (EVAL B) \( \Rightarrow \) 23
- (EVAL (EVAL C)) \( \Rightarrow \) 23