Requires a different mode of thinking by the programmer.

Advantages of functional Lisp and ML are the roots of the two main trees.

A more complete list of necessary features for functional programming,

----------------------------------------

NB3: Recursion isn't enough by itself to create a

NB2: But there's no reason why we

In particular, F

NB: This tail recursive code exploits the associativity of addition;

Things to notice in this code:

Unfortunately, now we

Other tasks we're used to thinking of as naturally iterative:

We might write this in C as

Some tasks are "naturally" recursive. Consider for example the

Takes the place of iteration.

The key idea: do everything by composing functions.

are an attempt to realize Church's lambda calculus in practical form as

Functional language compilers will translate this as, roughly:

Note that the recursive call is the

expensive than the iterative solution.

But there's nothing sacred about this "natural" intuition.

Other tasks we're used to thinking of as naturally recursive. Consider for example the

- Lack of side effects and explicit evaluation order simplifies some

lack of side effects makes programs easier to understand

Haskell is an ML descendant (through Miranda); it's the leading

two most widely used dialects today are Common Lisp (big, full

inspired by the lambda calculus, Alonzo Church's mathematical

Many academics consider SML more elegant, but

originally developed by Robin Milner, who received the Turning Award in 1991.

Microsoft's F# is an

popular in industry as well. Haskell is distinguished for being

functional (no imperative features at all) and for using lazy

The Haskell function to compute the greatest common divisor (gcd)

is a

very heavy use of references (space and time and locality problem)

Lots of copying of data through parameters

Some tasks are a natural fit for iterative algorithms:

- The summation function

- The factorial function

- The Fibonacci function

- The power function

- The length function

- Euclid's algorithm

- The sum of a sequence

Using regular languages, this is accomplished by

- nesting loops

- using goto statements

- using break statements

Some tasks are a natural fit for recursive algorithms:

- Fibonacci numbers

- Factorial numbers

- Trees

- The definition of primes

- space

- time

- complexity

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Let's rewrite the above expression to use

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