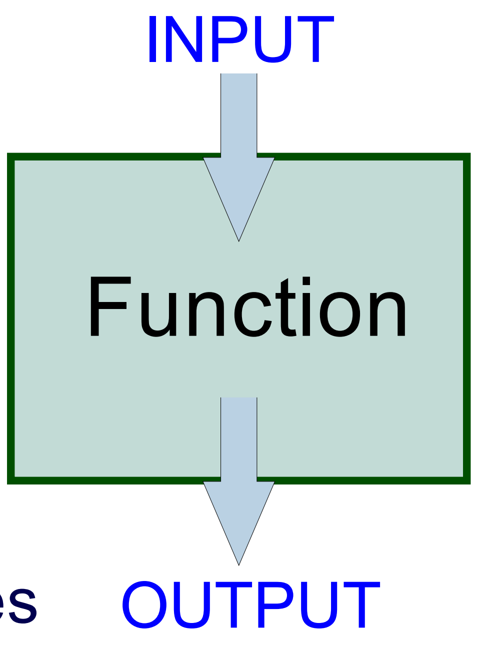
Creating and Using MATLAB Functions

Increasing Readability and Usability of Codes

What is a function, and when should I create one?

- Examples of functions:
  - sin, exp, plot, find, +, ./, /
- Functions Simplify a Program
  - Move code from one level to another
  - Hide ugly details from the programmer
- Use Functions when:
  - A series of steps are repeated multiple times
  - A complicated procedure must be performed
    - eg. Solving a linear system



Properties of Functions

Function Workspace vs. MATLAB Workspace

- Scope
  - Variables used within the function are *different* than those used elsewhere
  - Function variables are only defined while the function is executing!!!
- Types of variables
  - Local Variables (default)
    - Variables used within a function. These are completely separate from any variables defined elsewhere (other functions, main program, etc)
  - Global Variables
    - These can be seen by all routines (functions) within a program
    - Use these cautiously!
  - Persistent Variables
    - Retain their value after the function is exited

Argument Lists

Getting Variables in and out of Functions

- Order of arguments in function declaration and function call
  - Order is important, names are not
- Number of arguments
  - Using “nargin” and “nargout” in programs

Creating User-Defined Functions

The Syntax

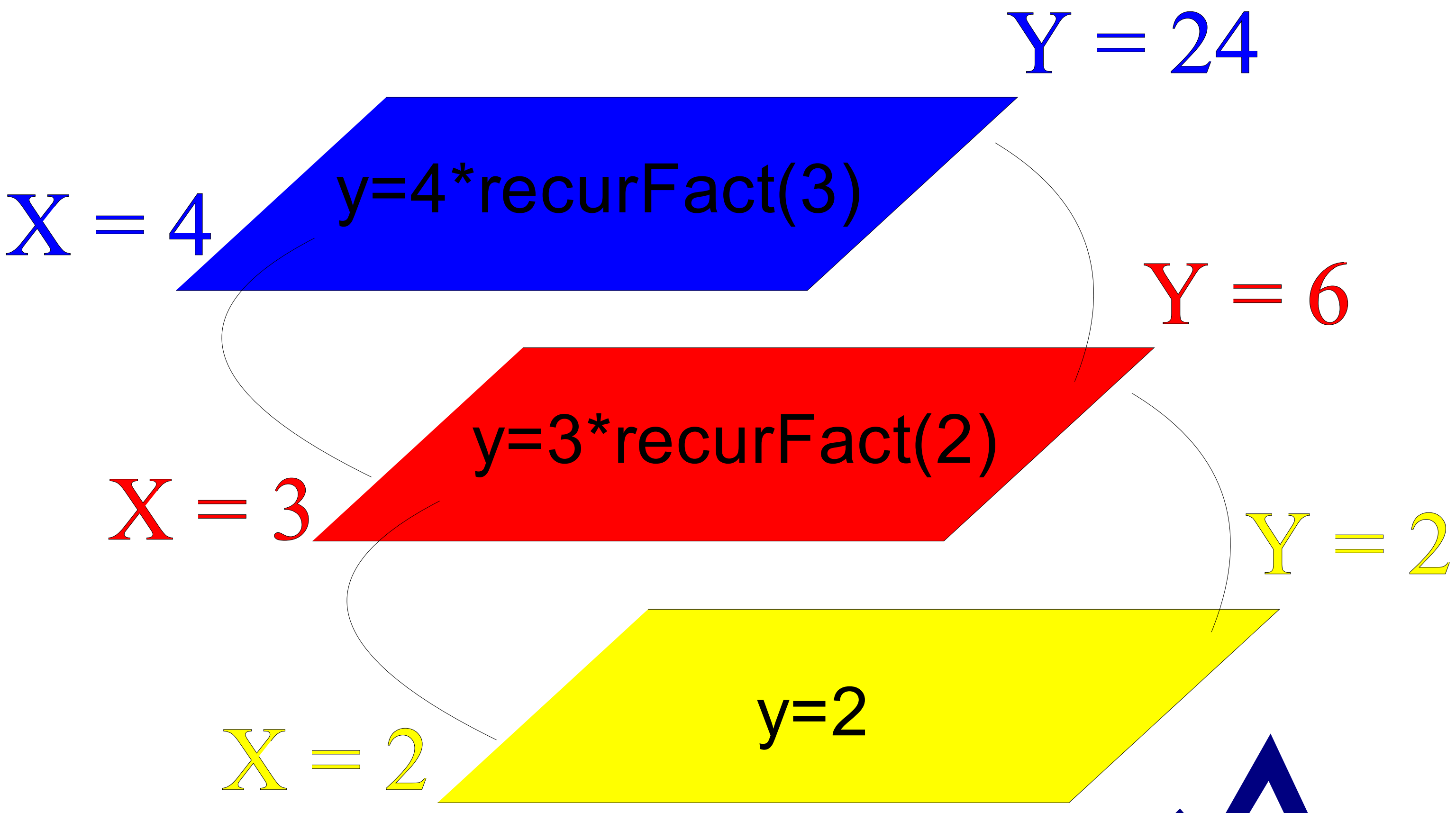
- function [result]=fun_name(arg$_1$, arg$_2$, ... arg$_n$)
  - Function declaration
  - result ☞ output from the function
    - Could be several variables, i.e. [a,b,c] = fun_name(...)
  - fun_name ☞ name of the function
    - Should be the same as the file name
      - MATLAB doesn’t actually use the function name
  - arg$_1$, arg$_2$, ... arg$_n$ ☞ input parameters for the function
- EXAMPLE: Create a function to compute the factorial of a number.

Recursive Functions

- What is a recursive function?
  - A function that calls itself
    - If some condition holds, then the function calls itself.
    - f(f(f(f(x))))
- EXAMPLE: revisit the factorial function.
  - Could we write this as a recursive function?
    - $f(x) = x * f(x-1)$, for $x>2$ $\Rightarrow$ $y = f(f(f(f(\ldots f(x))))\ldots)$
  - Algorithm:
    - Input: number to compute factorial of (x)
    - If x is larger than 2, then
      - Save the result as x * factorial(x-1)
    - Otherwise, the result is equal to x!
    - Output: result

```
function y = recurFact(x)

if (x > 2)
   y = x * recurFact(x-1);
else
   y = x;
end
```



Inline Functions

A Fast Way to Create Simple Functions

- fun = inline(‘function’, ‘arg_1’, ‘arg_2’, ...);
  - Defines a function
  - arg1...argn are variables passed into this function
- Example:

```
f=inline('a*x^2+b*x+c', 'a', 'b', 'c', 'x');
myNum = f(1,0,0,2);
```

- More later...