Functions

Example

- int max(int a, int b);

```
int main(){
    int x;
    x = max(5,8);
    x = max(x,7);
}
```

```
int max(int a, int b){
        return a>b?a:b;
}
```

What is a C Function?

- A function receives zero or more parameters, performs a specific task, and returns zero or one value.
- A function is invoked by its name and parameters.
  - No two functions have the same name AND parameter types in your program.
  - The communication between the function and invoker is through the parameters and the return value.
- A function is independent:
  - It is “completely” self-contained.
  - It can be called at any places of your code and can be ported to another program.
- Functions make programs reusable and readable.

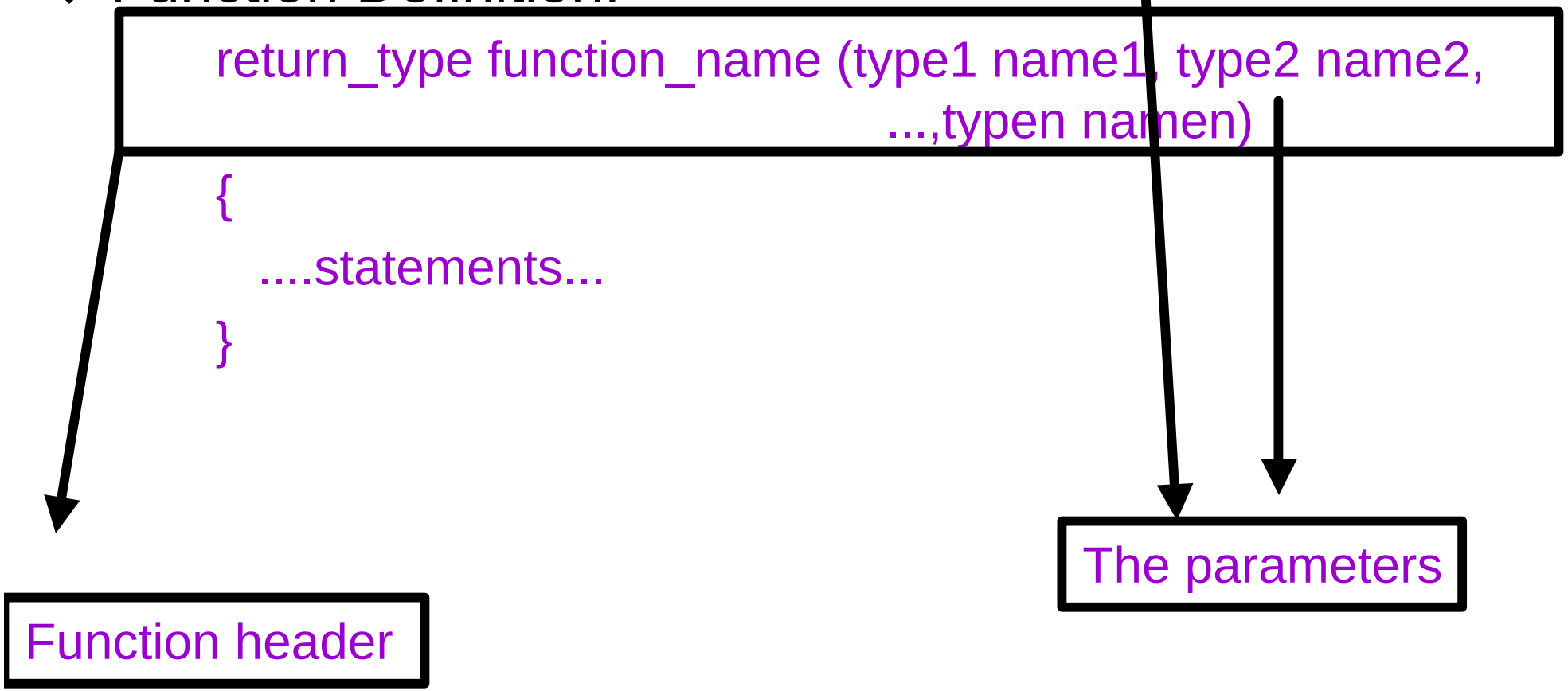
Syntax

- Function Prototype:

```
return_type  function_name (type1  name1, type2  name2,
                            ..., typen  namen);
```

- Function Definition:

```
return_type function_name (type1 name1, type2 name2,
                           ...,typen namen)
{
   ....statements...
}
```



Some Examples

- Function Prototype Examples

```
double squared (double number);
void print_report (int);
int get_menu_choice (void);
```

- Function Definition Examples

```
double squared (double number)
{
   return (number * number);
}

void print_report (int report_number)
{
   if (report_nmber == 1)
         printf("Printer Report 1");
     else
         printf("Not printing Report 1");
 }
```

void parameter list means it takes no parameters

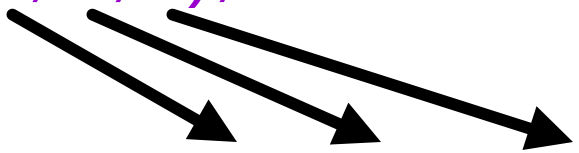
return type void means it returns nothing

Passing Arguments

- Arguments are passed as in Java and Pascal
- Function call:

```
func1 (a, b, c);
```

- Function header



```
int func1 (int x, int y, int z)
```

  - Each argument can be any valid C expression that has a value:
  - For example:

```
x = func1(x+1,func1(2,3,4),5);
```

- Parameters x y z are initialized by the value of a b c
- Type conversions may occur if types do not match.

Parameters are Passed by Value

- **All parameters are passed by value!!**
  - This means they are basically local variables initialized to the values that the function is called with.
  - They can be modified as you wish but these modifications will not be seen in the calling routine!

```
#include<stdio.h>
int twice(int x)
{
   x=x+x;
   return x;
}
int main()
{
   int x=10,y;
   y=twice(x);
   printf("%d,%d\n",x,y);
}
```

Returning a Value

- To return a value from a C function you must explicitly return it with a return statement.
- Syntax:

```
return <expression>;
```

  - The expression can be any valid C expression that resolves to the type defined in the function header.
  - Type conversion may occur if type does not match.
  - Multiple return statements can be used within a single function (eg: inside an “if-then-else” statement…)

Local Variables

- Local Variables

```
int func1 (int y)
{
    int a, b = 10;
    float rate;
    double cost = 12.55;
    .......
}
```

- Those variables declared “within” the function are considered “local variables”.
- They can only be used inside the function they were declared in, and not elsewhere.

A Simple Example

```
#include <stdio.h>
int x=1;   /* global variable - bad! */
void demo(void);
int main() {
  int y=2;  /* local variable to main */
  printf ("\nBefore calling demo(), x = %d and y = %d.",x,y);
  demo();
  printf ("\nAfter calling demo(), x = %d and y = %d.\n",x,y);
  return 0;
}
void demo () {
  int x = 88, y =99;  /* local variables to demo */
  printf ("\nWithin demo(), x = %d and y = %d.",x,y);
}
```

Placement of Functions

- For large programs
  - Manage related functions in a .c file
  - Write a .h file containing all the prototypes of the functions
  - #include the header file in the files that uses the functions.
- For small programs, use the following order in the only one file:
  - All prototypes
  - main() function
  - Other functions

- mymath.h

```
int min(int x,int y);
int max(int x,int y);
```

- mymath.c

```
int min(int x,int y)
{
    return x>y?y:x;
}
int max(int x,int y)
{
    return x>y?x:y;
}
```

Recursion - An Example

```
unsigned int factorial(unsigned
    int a);


int main () {
  unsigned int f,x;
  printf("Enter value between 1
    & 8: ");
  scanf("%d", &x);
  if (x > 8 || x < 1)
    printf (”Illegal input!\n");
  else {
    f = factorial(x);
    printf ("%u factorial equals
    %u\n", x,f);
  }
}
```

```
unsigned int factorial (unsigned
    int a) {
  if (a==1)
    return 1;
  else {
    a *= factorial(a-1);
    return a;
  }
}
```