Personal SE

Functions & Arrays

Functions in C

- Syntax like Java methods but w/o public, abstract, etc.
- As in Java, all arguments are passed by *value (a copy), EXCEPT pointers*.
- Example:

```
void try_swap( int x, int y ) {
    int t = x ;
    x = y ;
    y = t ;
}
```

- Doesn't work:
  - `x` and `y` are copies of the arguments in the caller.
  - Changing the copy has *no effect* in the caller.

Functions in C

- Functions must be declared before use:
  - *Declare* means specify name, return value, and argument types.
  - Technically functions can default to an implicit declaration. Never rely on implicit declaration!
- Indeed, in C *everything* must be declared before use!

Functions in C

- Functions must be declared before use:
  - *Declare* means specify name, return value, and argument types (but not argument name)
- Indeed, in C *everything* must be declared before use!

```
extern int min(int x, int y) ;  // Declaration of min
static int max(int x, int y) ;  // Declaration of max

int max_div_min(int x, int y) {
   return max(x, y) / min(x, y) ;
}

int min(int x, int y) {        // Definition of min
    return (x <= y) ? x : y ;
}

static int max(int x, int y) {  // Definition of max
    return (x >= y) ? x : y ;
}
```

Functions in C

extern: defined elsewhere (possibly this file).

- Functions must be declared before use:
  - *Declare* means specify name, return value, and argument types.
- Indeed, in C *everything* must be declared before use!

```
extern int min(int x, int y) ;  // Declaration of min
static int max(int x, int y) ;  // Declaration of max

int max_div_min(int x, int y) {
   return max(x, y) / min(x, y) ;
}

int min(int x, int y) {        // Definition of min
    return (x <= y) ? x : y ;
}

static int max(int x, int y) {  // Definition of max
    return (x >= y) ? x : y ;
}
```

Functions in C

static: defined and known only in this C source file.

- Functions must be declared before use:
  - *Declare* means specify name, return value, and argument types.
- Indeed, in C *everything* must be declared before use!

```
extern int min(int x, int y) ;  // Declaration of min
static int max(int x, int y) ;  // Declaration of max

int max_div_min(int x, int y) {
   return max(x, y) / min(x, y) ;
}

int min(int x, int y) {         // Definition of min
    return (x <= y) ? x : y ;
}

static int max(int x, int y) {  // Definition of max
    return (x >= y) ? x : y ;
}
```

Functions in C - Scope

- Functions can declare their own variables:
  - *int myVariable;*
- HOWEVER – these are local (aka local scope)
  - *No other function can see/ user them*

```
extern int min(int x, int y) ;  // Declaration of min

int main()
{
   int min = 0;
   int val1 = 9; int val2 = 20;
   min = min(val1, val2);
   return 0;
}


int min(int x, int y) {        // Definition of min
   int val1 = 10; int val2 = 20; //Totally different variables!
    return (x <= y) ? x : y ;
}
```

Arrays in C

- Generic form: *type name*[*size*] ;
- Examples:

```
#define MAX_SAMPLES (100)
int samples[MAX_SAMPLES] ;
```

Arrays in C

- Generic form: *type name*[*size*] ;
- Examples:

```
#define MAX_SAMPLES (100)
int samples[MAX_SAMPLES] ;
```

Array of 100 integers.
Indices run 0 .. 99

NO SUBSCRIPT CHECKS!

NOTE THE USE OF SYMBOLIC CONSTANT!

Arrays in C

- Generic form: *type name*[*size*] ;
- Examples:

```
#define MAX_SAMPLES (100)
int samples[MAX_SAMPLES] ;
```

Simple summation of array values.

```
int sum = 0 ;
int i ;

for ( i = 0 ; i < MAXSAMPLES ; ++i ) {
    sum += samples[ i ] ;
}
```

Arrays in C

```
#define DIMENSION (50) ;
double m1[DIMENSION][DIMENSION] ;
```

Arrays in C

A matrix or a 2 dimensional array

Access by `m1[ i ][ j ]`

```
#define DIMENSION (50) ;
double m1[DIMENSION][DIMENSION] ;
```

Arrays in C

Matrix multiplication to show use of double indices.

```
#define DIMENSION (50) ;
double m1[DIMENSION][DIMENSION] ;
double m2[DIMENSION][DIMENSION] ;
double product[DIMENSION][DIMENSION] ;
```

```
int i, j, k ;

for ( i = 0 ; i < DIMENSION ; ++i ) {
    for ( j = 0 ; j < DIMENSION ; ++j ) {
        product[ i ][ j ] = 0.0 ;
        for ( k = 0 ; k < DIMENSION ; ++k ) {
            product[i][j] += m1[i][k] * m2[k][j] ;
        }
     }
}
```

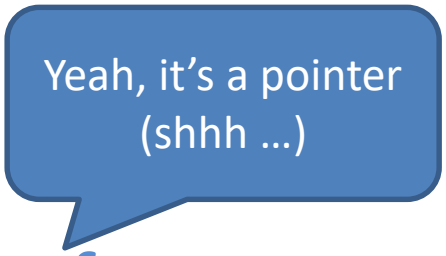
Arrays in C

- Arrays are passed to functions by *reference*.

Arrays in C

- Arrays are passed to functions by *reference*.
- Changes to the array contents in the function will be visible to the caller, e.g., array copy.

Arrays in C



- Arrays are passed to functions by *reference*.
- Changes to the array contents in the function will be visible to the caller, e.g., array copy.

```
void acopy( int to[], int from[], int size ) {
    int i ;

    for( i = 0 ; i < size ; i++ ) {
        to[ i ] = from[ i ] ;
    }
}
```

Arrays in C

- Arrays are passed to functions by *reference*.
- Changes to the array contents in the function will be visible to the caller, e.g., array copy.

```
void acopy(int to[], int from[], int size) {
    int i ;

    for( i = 0 ; i < size ; i++ ) {
        to[ i ] = from[ i ] ;
    }
}
```

Need not, but may, give the array size.

Arrays in C - Review

- Array size fixed at definition time.
- Good practice (that is, ***OUR*** practice) is to use symbolic constants to define array sizes.
- Array indices are integers.
- Legal indices run from 0 to ***arraysize*** - 1
- C will *not* prevent you from indexing outside the bounds of the array (no subscript checks).
- Arrays are passed by reference.