****

Chapter 6 - Storage Classes

****

C uses 4 storage classes: auto, register, extern, static
– Class determines the variable's *duration*, *scope* and *linkage*
duration - some variables last the life of the program, others shorter
scope - where is it visible and can therefore be used
linkage - only the current file or also by other source files

e.g.,
```
static int x;
```

2 ***durations***:

automatic storage duration (auto and register)
lives on the stack or in a register
created on entering a block, destroyed when leaving
normal function variables (local) are like this
keyword auto is rarely used - it is the default
"register" suggests to the compiler to place it in a register - may ignore
today's compilers are pretty good at figuring what to do

e.g.,
```
int countcalls() {
    static int count = 0;
    return ++count;
}
```

static storage duration (extern and static)
these variables exist for the life of the program
storage is allocated and initialized once
(scope of variable can be local or global)
global variables and function names are extern by default
global variables declared outside any function
scope is from the point of declaration to the end of the file
* local variables can be declared as static - value persists between calls
* static variables are initialized to zero if you don't initialize

more on extern and static later

local variable x:
```
int x;       // not initialized
```

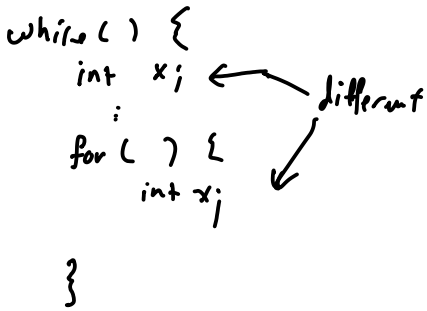
```
static int x;  // initialized to 0
```

Scope: where can we reference and use the variable
four scopes are:

function scope
labels (identifier followed by colon) e.g., start: (e.g., inside switch)
- only identifiers with function scope
can't be referenced outside the funciton

file scope
identifier declared outside any function
visible from that point to the end of the file
(global variables and function definitions and function prototypes)

block scope
identifiers inside a block (surrounded by {})
- we've seen this where block is a function
scope ends at end of block
variables must be declared at the beginning of the block
blocks can be nested
variables can have the same name - inner one hides the outer one



function-prototype scope
names used in the function prototype
these are actually ignored as the scope is only within the prototype

```
fct( float principle, float interest, int periods);
fct( float, float, int);
```

Static int x;

extern

volatile Variable can change at any moment

const Variable will not change

```
const int x = 42;        x can never change
```

```
const int x;
x = 42;      Error
```

```
#define  x  42
```

define macro

```
#define  square(x)     ((x) * (x))
#define  doubleit(x)   ((x) + (x))
```

```
square(3)
square(2+3)                    ((2+3)*(2+3))
doubleit(4) * doubleit(2)      ((4)+(4)) * ((2)+(2))
```

User-defined type

```
enum (red, green, blue);
      0    1     2

x = red
 ⋮
if (y == blue) do something

enum color (red, green, blue);

enum color mycolor = red
     ↑ new type        ↑ variable name
```

```
enum {jack = 11, queen, king};
```

12 13

```
enum {x = 12, y, z = 75};
```

12 13 75