PH502: Scientific Programming Concepts

Irish Centre for High End Computing (ICHEC)

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Overview

- In the previous lecture we found that variables with the same name but in different program blocks were in different memory locations.
- Some variables are created and destroyed when calling a function.
- This brings up the question, when are variables defined?
- This is called the scope of a variable.
- The examples we will use are C code. FORTRAN also has scoping rules, which are different, but the considerations are the same.

Variable Scope

Scope: A region of the program where a defined variable can have its existence and beyond that variable can not be accessed.

- The variable name must be unique within its scope.
- Local Variables: Variables declared within a code unit are local to that unit. That is to say that they do not exist outside the code unit. Local variables are created and destroyed along with the code unit usage.
- Global variables: Those that are declared outside any program unit. These variables are visible to all program units. They are created and destroyed at program start and termination.
- Arguments: Function Parameters. Special variables in that they provide an information conduit between program units. Space in memory is required for the variable in the calling routine and the dummy argument in the called routine, if passed by $r - value$. The dummy argument is destroyed when the routine terminates.
- FORTRAN has no global variables (modules are discussed later), argument properties are controlled with the INTENT qualifier.

C Example

```c
#include <stdio.h>
#include <math.h>
float pi;
float degtorad(float arg);

int main(void) {
   float degang, radang;
   pi = atanf(1.0)*4.0;
   degang = 10.0;
   radang = degtorad(degang);
   printf(" Deg %f, Rad %f\n",degang,radang);
   return 0;
}

float degtorad(float arg) {
   return( (pi * arg)/180.0 );
}
```

- This program is slightly more efficient in that the variable pi is not created and destroyed each time the function is called.

Question

- A program can have same name for local and global variables but value of local variable inside a function will take preference.

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#include <math.h>
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int main(void) {
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   float pi;
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float degtorad(float arg) {
   return( (pi * arg)/180.0 );
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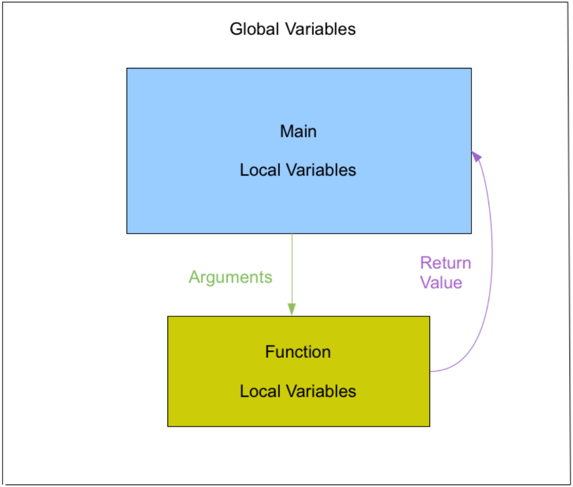
Schematic of Scope Rules


Global Variables
Main
Local Variables
Arguments
Return Value
Function
Local Variables