Introduction to Computing

MCS1101B

Lecture 4

Recap

- Control Statements
  - Branching
  - Looping

- Branching
  - if
  - if else
  - if else if else if …
  - ? :
  - Nested if else
  - switch

- Looping
  - while
  - for
  - do while
  - break, continue

Nested Loops: Printing a 2-D Figure

- How would you print the following diagram?

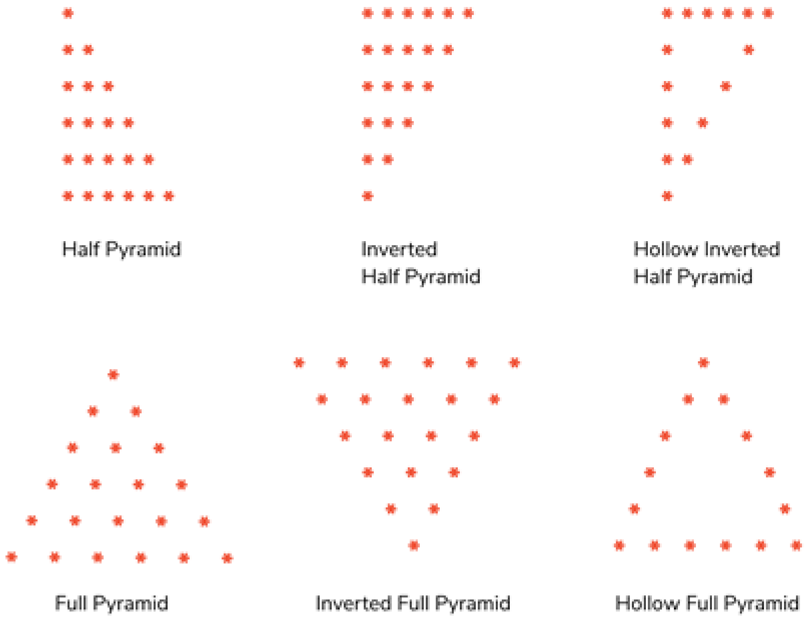
```
* * * * * *

* * * * * *

* * * * * *

* * * * * *
```

- Nested Loops
  - **break** and **continue** with nested loops



Nested Loops: Printing a 2-D Figure

```
printf ("*); →
```

```
*
```

```
for (i=0; i<5;i++)
   printf ("*");          →
```

```
*****
```

```
for (j=0; j<5;j++)
{
   for (i=0; i<5;i++)
          printf ("*");          →
   printf("\n");
}
```

```
*****
*****
*****
*****
*****
```

```
for (j=0; j<5;j++)
{
   for (i=0; i<j; i++)
          printf ("*"); → ?
   printf("\n")
}
```

```
for (j=0; j<5;j++)
{
   for (i=0; i<=j; i++)
          printf ("*"); → ?
   printf("\n")
}
```

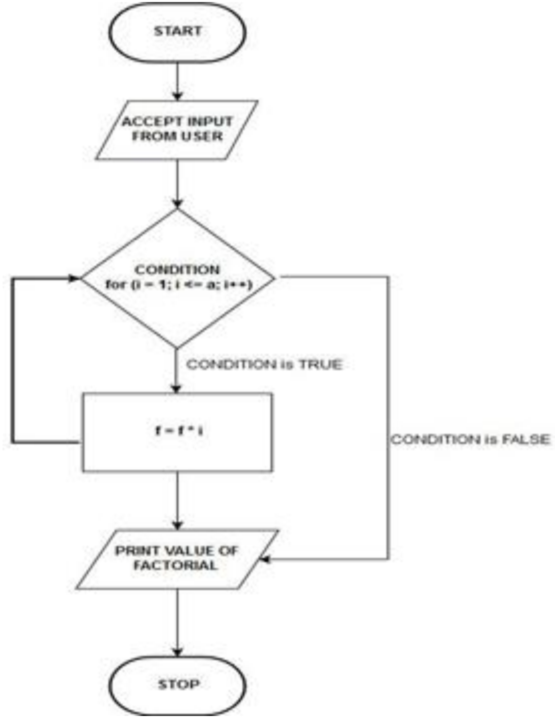
```
for (j=0; j<5;j++)
{
   for (i=j; i<5; i++)
          printf ("*"); → ?
   printf("\n")
}
```

```
for (j=0; j<5;j++)
{
   for (i=0; i<5; i++)
     If(i<j) printf(" ")
     else printf ("*"); → ?
   printf("\n")
}
```

Sequence of Execution

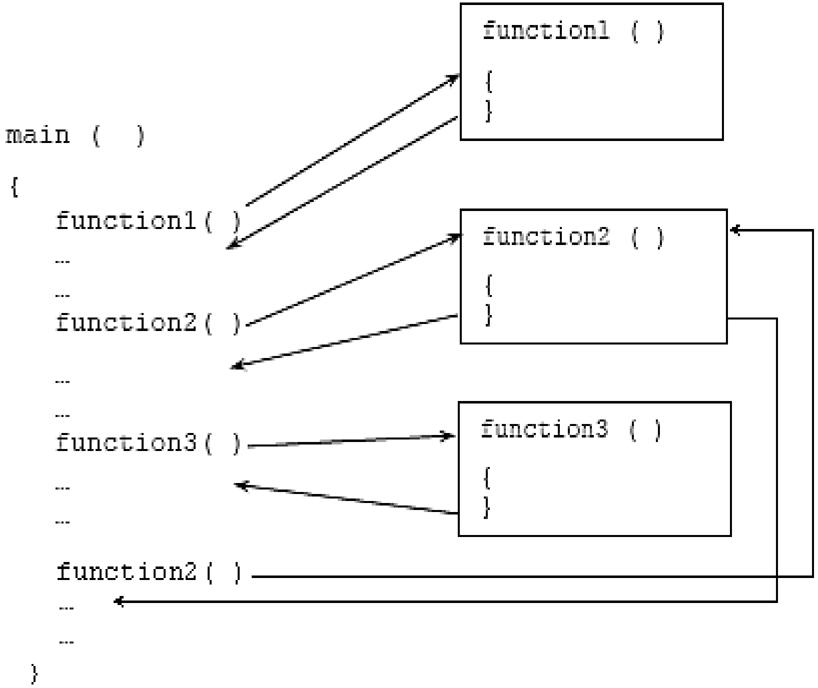
- *The flow of a program*
    - the steps and branches can be represented in graphically

- Represented using Flow chart
    - Example: a for loop ⇒



Functions

- *A program segment that carries out some specific, well-defined task*
- Examples:
  - A function to add two numbers
  - A function to find the largest of n numbers
- A function will carry out its intended task whenever it is **called** or **invoked**
  - A function can be **called** multiple times



```
main (   )
{
    function1( )
    ...
    ...
    function2( )

    ...
    ...
    function3( )
    ...
    ...

    function2( )
    ...
    ...
 }
```

```
function1 ( )
{
}
```

```
function2 ( )
{
}
```

```
function3 ( )
{
}
```

Function Definition

- Examples:
  - Print a banner
  - Factorial computation
  - GCD computation

- A function definition has two parts:
  - The first line, called header
  - The body of the function
  - May or may not have a return value

```
return-value-type  function-name  ( parameter-list )
{
            declarations and statements
}
```

Example

➢ Function prototype	int gcd (int, int);
➢ Function Header	int gcd (int A, int B)
➢ Start of function body	{
➢ Local variables	int temp;
➢ A while loop	while ((B % A) != 0)
➢ Start of the loop block	{
➢ Statement	temp = B % A;
➢ Statement	B = A;
➢ Statement	A = temp;
➢ End of loop block	}
➢ Return statement	return (A);
➢ End of function body	}

Function Prototypes

- Compiler needs to know some details of a function(see list below) before it is being used (called) in a program
  1. Name of the function
  2. Return type of the function
  3. The sequence of the parameters-types (*parameter names are optional*) of that function
  4. The definition/body of the function **is optional**
- The collection of these minimum requirements is known as *function prototype*

Function Prototypes (contd.)

- void print_msg ();
- int get_hour (void);
- void print_num (int);
- int increment (int x);
- int sum (int a, int b, int c);
- float add (float, float);

```
double power (double, int);

int main ()
{... printf ("%lf", power(2, 10)); ...}

double power (double base, int expo)
{
    int i; double result=1;
    for(i=0; i<expo; i++)
        result *= base;
    return result;
}
```

Functions (Two ways of writing)

```
#include<stdio.h>
void print_msg ()
{
  printf ("inside print_msg function\n");
}
int main ()
{
  printf ("inside main function\n");
  print_msg ();
  printf ("inside main function again\n");
  return 0;
}
```

```
#include<stdio.h>
void print_msg ();
int main ()
{
  printf ("inside main function\n");
  print_msg ();
  printf ("inside main function again\n");
  return 0;
}
void print_msg ()
{
  printf ("inside print_msg function\n");
}
```

For both the above styles
The **output** will be the same >>>

```
inside main function
inside print_msg function
inside main function again
```

Functions (Two more examples)

```
#include<stdio.h>
int get_result ()
{
  printf ("inside get_result\n");
  return 1000;
}
int main ()
{
  int result = get_result();
  printf ("value returned = %d\n", result);
  // printf ("value returned = %d\n", get_result());
  // you can also directly call here  ^^^^^^^^^^
  return 0;
}
```

Output>>>

```
inside get_result
value returned = 1000
```

```
#include<stdio.h>
float add_num (float a, float b)
{
  float result = a + b;
  return result;
}
int main ()
{
  float x=100, y=200;
  printf ("sum of x and y = %f\n", add_num (x, y));
  return 0;
}
```

Output>>>

```
sum of x and y = 300.0
```

Functions - *Passing of variables*

- Variables values are copied when then are passed (by calling) to a function
- The actual variables are not passed
- So, a change made to a variable within a function will not reflect in the variable at the end of the caller

The return statement

- Return statement is optional
- But, the return type in the function prototype must be present
- Return statement causes the sequence of execution to return to the caller

Functions (Another example)

```
void swap (int a, int b)
{
    printf ("a=%d  b=%d\n",  a, b); //a=10 b=20

    int tmp = a; // copies 10 into tmp
    a = b;       // copies 20 into a
    b = tmp;     // copies 10 into b

    printf ("a=%d  b=%d\n",  a, b); //a=20 b=10
}
```

```
#include<stdio.h>
void swap (int, int);
int main ()
{
   int a=10, b=20;

   printf ("a=%d  b=%d\n",  a, b); //a=10 b=20
   swap (a, b);
   printf ("a=%d  b=%d\n",  a, b); //a=? b=?
   return 0;
}
```

Scope of Variables

- Part of the program from which the value of the variable can be used (seen)
- *Scope of a variable* - Within the **block** in which the variable is defined
  - **Block** = group of statements enclosed within { }
- **Local variable** – scope is usually the function in which it is defined
  - So two local variables of two functions can have the same name, but they are different variables
- **Global variables** – declared outside all functions (even main)
  - scope is entire program by default, but can be hidden in a block if local variable of same name defined

In The Next Class…

- You will learn about array and pointers
- You will learn more about functions