C Fundamentals

First C Program

Lesson Objectives

- History of C, About C
- First C Program
- Variables, Constants
- Identifier Names
- Data Types

Section 1

HISTORY OF C, ABOUT C

History of C

- History of C
  - ✓ Evolved from two other programming languages
    - BCPL and B
      - "Typeless" languages
  - ✓ Dennis Ritchie (Bell Laboratories)
    - Added data typing, other features
  - ✓ Development language of UNIX
  - ✓ Hardware independent
    - Portable programs
  - ✓ 1989: ANSI standard
  - ✓ 1990: ANSI and ISO standard published
    - ANSI/ISO 9899: 1990

Application Areas Of C

- C was initially used for systems programming
- A system program forms a portion of the operating system of the computer or its support utilities
- Operating Systems, Interpreters, Editors, Assembly programs are usually called system programs
- The UNIX operating system was developed using C
- There are C compilers available for almost all types of PC's

About C & C Program Structure

- C has 32 keywords
- These keywords combined with a formal syntax form a C programming language
- Rules to be followed for all programs written in C:

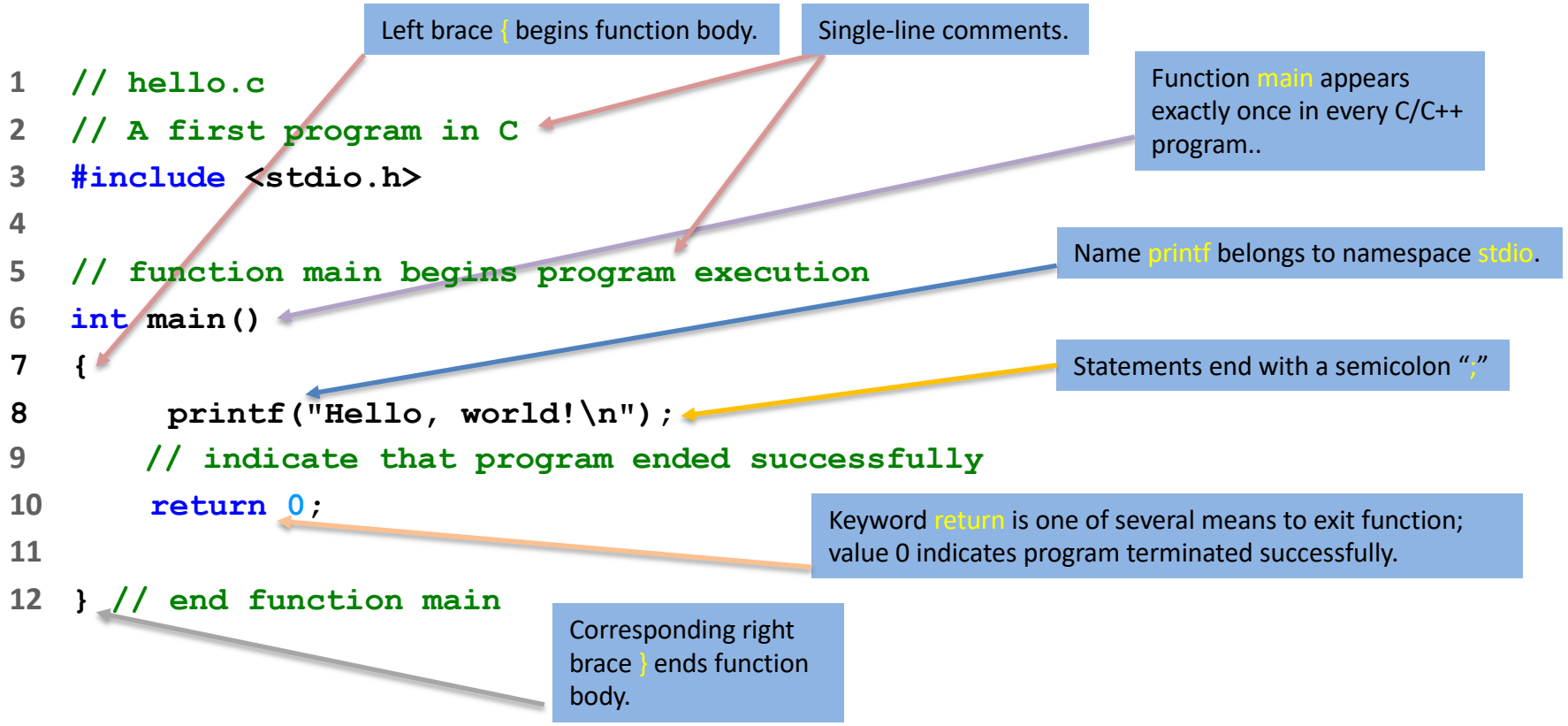
- All keywords are lowercased
- C is case sensitive, do while is different from DO WHILE
- Keywords cannot be used as a variable or function name

```
main()
{
/* This is a sample Program*/
      int i,j;
      i=100;
      j=200;
}
```

Section 2

FIRST C PROGRAM

First C Program: Source codes




```
1   // hello.c
2   // A first program in C
3   #include <stdio.h>
4
5   // function main begins program execution
6   int main()
7   {
8        printf("Hello, world!\n");
9       // indicate that program ended successfully
10      return 0;
11
12  } // end function main
```

First C Program: Anatomy of a C Program

program header comment

preprocessor directives (if any)

```
int main ( void )
{
    statement(s)
    return 0 ;
}
```

First C Program: Program Header Comment

- A **comment** is descriptive text used to help a reader of the program understand its content.
- All comments must begin with the characters /* and end with the characters */
- These are called **comment delimiters**
- The program header comment always comes first.
- Look at the class web page for the required contents of our header comment.

First C Program: Preprocessor Directives

- Lines that begin with a # in column 1 are called **preprocessor directives** (**commands**).
- Example: the **#include <stdio.h>** directive causes the preprocessor to include a copy of the standard input/output header file **stdio.h** at this point in the code.
- This header file was included because it contains information about the printf ( ) function that is used in this program.

First C Program: Tool Preparation: Dev-C++

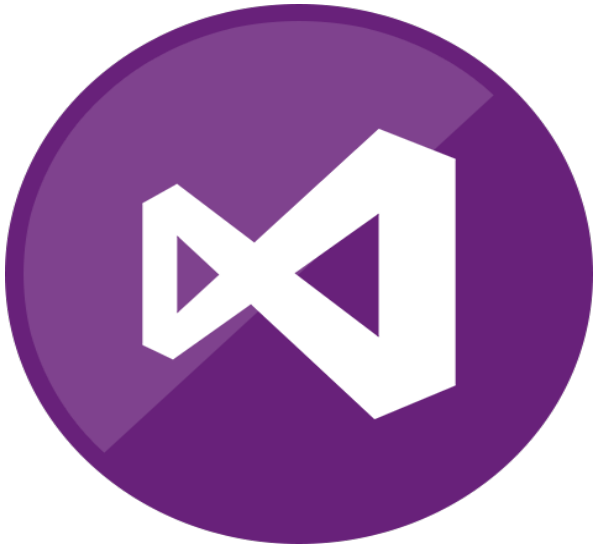
- Download & Install Dev-C++ from

http://www.bloodshed.net/dev/devcpp.html

- Run Dev-C++ and discover its features
- Creating a Program: Ctrl+N
- Compiling a Program: Ctrl+F9
- Running a Program: F9

First C Program: Tool Preparation Visual Studio

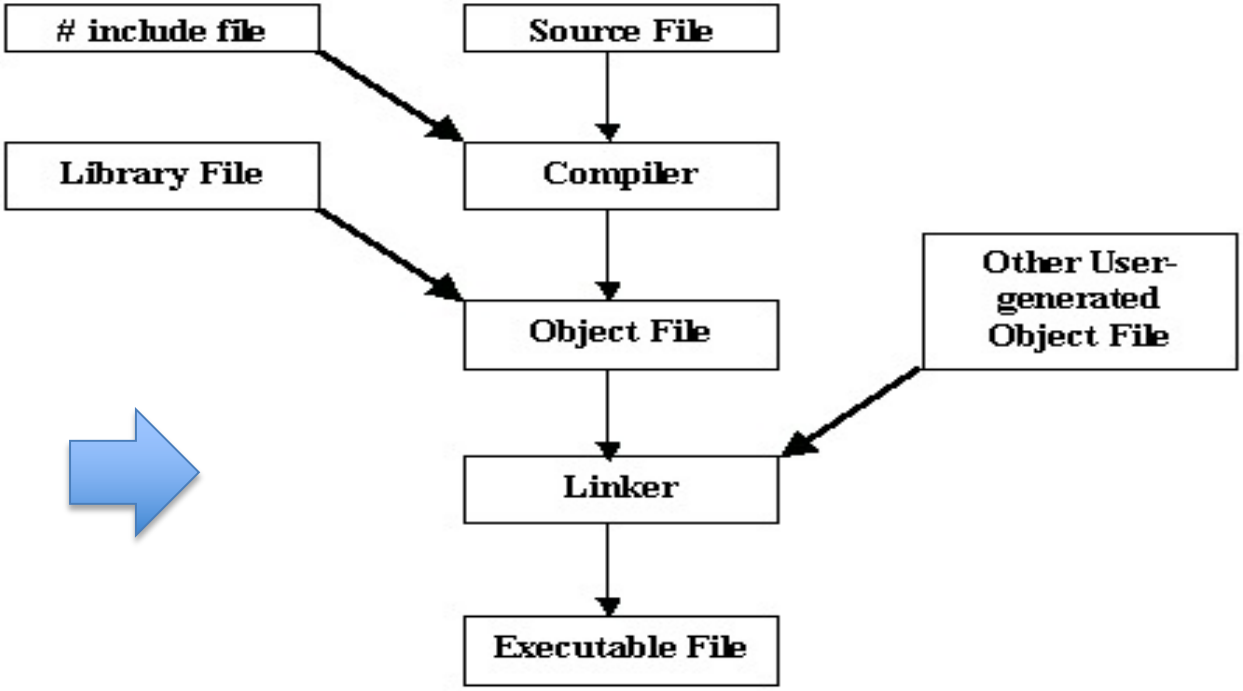
- Download & Install Visual Studio from https://visualstudio.microsoft.com/
- Run Visual Studio and discover its features
- Creating a new Project: Ctrl+N
- Compiling a Program: Ctrl+B
- Running a Program: F5



First C Program: Compiling & Running

Compiler converts a C program into an executable.
There are four phases for a C program to become an executable:

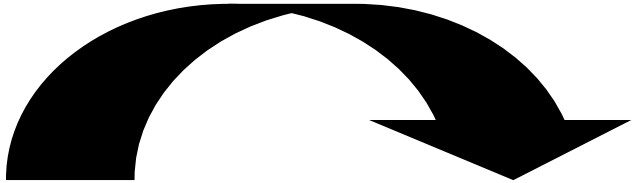
1- Pre-processing
2- Compilation
3- Assembly
4- Linking



Section 3

VARIABLES, CONSTANTS

Variables



Memory

Data 15

	15		
	Data in memory		

Variables allow to provide a meaningful name for the location in memory

Each location in the memory is unique

Constants

- A **constant** is a value whose worth never changes

- Examples
  - ✓ 5 **numeric / integer constant**
  - ✓ 5.3 **numeric / float constant**
  - ✓ 'Black' **string constant**
  - ✓ 'C' **Character constant**

- Variables hold constant values

Numeric Constants

- Numeric constants are an uninterrupted sequence of digits (and may contain a period). They never contain a comma.
- Examples:
  - ✓ 123
  - ✓ 98.6
  - ✓ 1000000

Character Constants

- Singular!
- One character defined character set.
- Surrounded on the single quotation mark.
- Examples:
  - ✓ ‘A’
  - ✓ ‘a’
  - ✓ ‘$’
  - ✓ ‘4’

String Constants

- A sequence characters surrounded by double quotation marks.
- Considered a single item.
- Examples:
  - ✓ “UMBC”
  - ✓ “I like ice cream.”
  - ✓ “123”
  - ✓ “CAR”
  - ✓ “car”

Section 4

IDENTIFIER NAMES

Identifier Names

- Some correct identifier names
  - ✓ arena
  - ✓ s_count
  - ✓ marks40
  - ✓ class_one
- Examples of erroneous identifiers
  - ✓ 1sttest
  - ✓ oh!god
  - ✓ start... End
- Identifiers in C are case sensitive

Identifier Names: Guidelines

- Variable names should begin with an alphabet
- The first character can be followed by alphanumeric characters
- Proper names should be avoided while naming variables
- A variable name should be meaningful and descriptive
- Confusing letters should be avoided
- Some standard variable naming convention should be followed while programming

Section 5

DATA TYPES

Data Types

- Different types of data are stored in variables. Some examples are:
  - ✓ **Numbers**
    - Whole numbers. For example, 10 or 178993455
    - Real numbers. For example, 15.22 or 15463452.25
    - Positive numbers
    - Negative numbers
  - ✓ **Names**. For example, John
  - ✓ **Logical values**. For example, Y or N

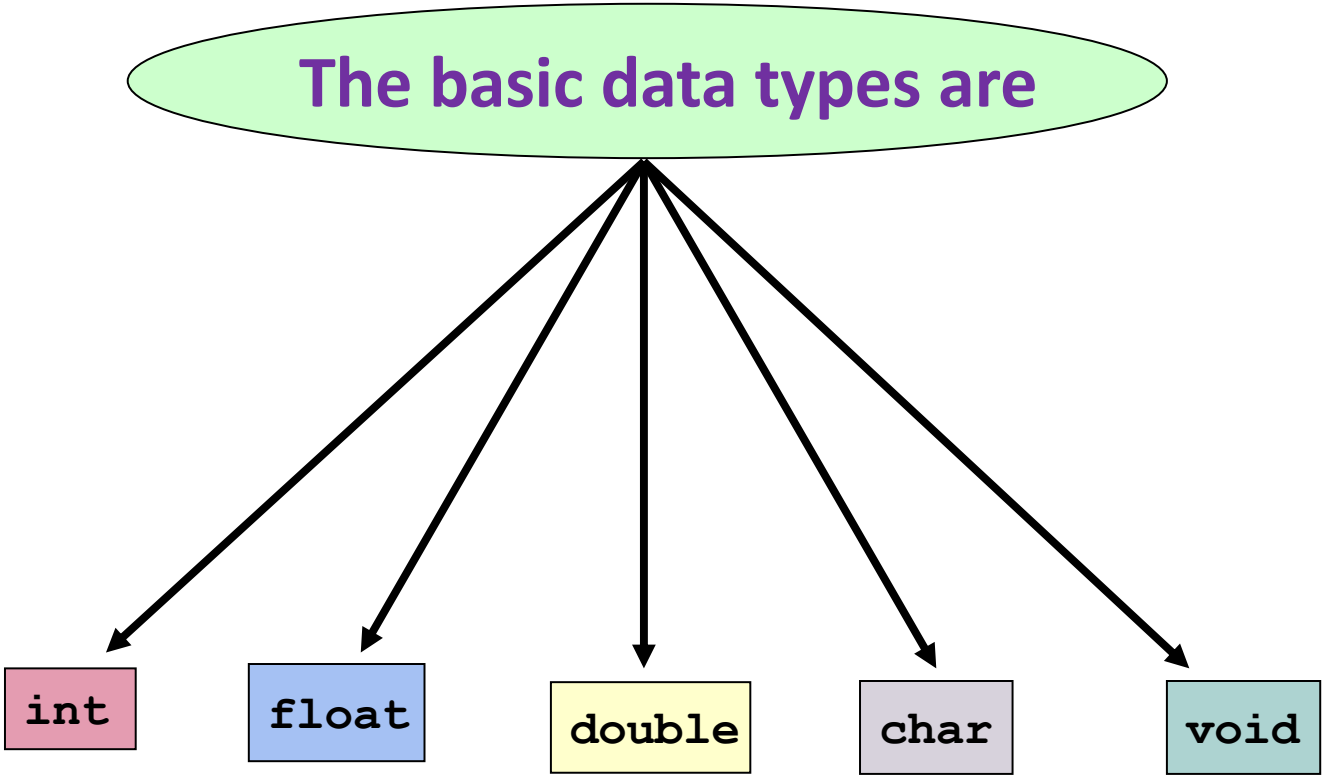
Data Types (1)

- A data type describes the kind of data that will fit into a variable.
- The name of the variable is preceded with the data type.
- For example, the data type int would precede the name varName

```
Datatype variableName
```

```
int varName
```

Data Types: Basic Types



Data Types: integer

- Stores numeric data

```
int num;
```

- Cannot then store any other type of data like "Alan" or "abc"
- 16 bits (2 bytes)
- Integers in the range -32768 to 32767
- Examples: 12322, 0, -1991

Data Types: float

- Stores values containing decimal places

```
float num;
```

- Precision of upto 6 digits
- 32 bits (4 bytes) of memory
- Examples: 69.96, 28.07, 2020

Data Types: char

- Stores a single character of information

```
char gender;
gender='M';
```

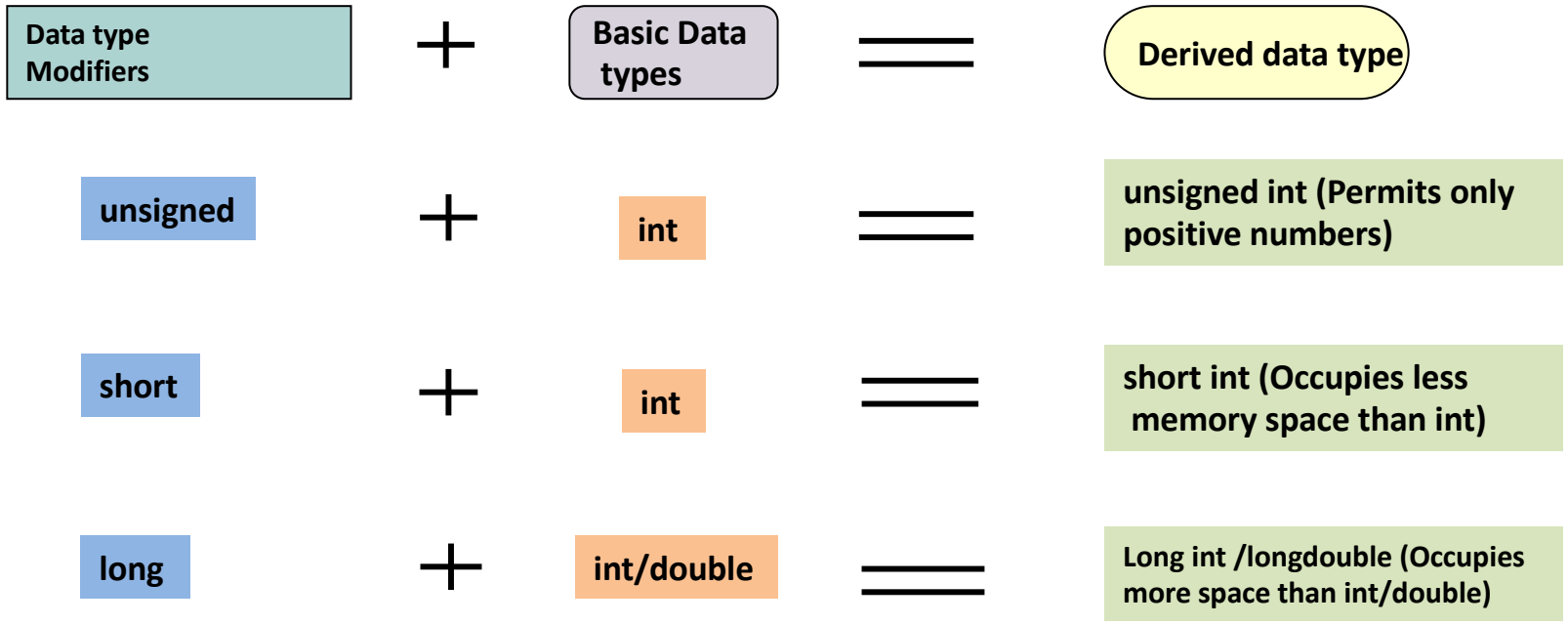
- 8 bits (1 byte) of memory
- Examples: ‘a’, ‘m’, ‘$’, ‘%’, ‘1’, ‘5’

Data Types: void

- Stores nothing
- Indicates the compiler that there is nothing to expect

```
void func()
{
// do something
    return;
}
```

Derived Data Types



signed and unsigned Types

- **unsigned** type specifies that a variable can take only positive values

```
unsigned int varNum;
varNum = 23123;
```

- varNum is allocated 2 bytes
- modifier may be used with the **int** and **float** data types
- **unsigned int** supports range from 0 to 65535

long and short Types

- **short int** occupies 8 bits (1 byte)
  - ✓ allows numbers in the range -128 to 127
- **long int** occupies 32 bits (4 bytes)
  - ✓ -2,147,483,647 and 2,147,483,647
- **long double** occupies 128 bits (16 bytes)

Data Types: Range (1)

Type	Approximate Size in Bits	Minimal Range
char	8	-128 to 127
unsigned	8	0 to 255
signed char	8	-128 to 127
int	16	-32,768 to 32,767
unsigned int	16	0 to 65,535
signed int	16	Same as int
short int	16	Same as int
unsigned short int	8	0 to 65, 535

The size of data type depends Operating System

Sizeof (data type) function return the size of data type

Data Types: Range (2Data Types: Range (1))

Type	Approximate Size in Bits	Minimal Range
signed short int	8	Same as short int
long int	32	-2,147,483,647 to 2,147,483,647
signed long int	32	0 to 4,294,967,295
unsigned long int	32	0 to 4,294,967,295
float	32	Six digits of precision
double	64	Ten digits of precision
long double	128	Ten digits of precision

Data Types: Sample Declaration

```
main ()
   {
      char abc;  /*abc of type character */
      int xyz;             /*xyz of type integer */
      float length;  /*length of type float */
      double area;       /*area of type double */
      long liteyrs;  /*liteyrs of type long int */
      short arm;           /*arm of type short integer*/
   }
```

Thank you

Q&A