C Fundamentals

HoangND1

Objectives

- History of C
- Application Areas Of C
- About C & C Program Structure
- First C Program
- Discuss variables
- Differentiate between variables and constants
- List the different data types and make use of them in C programs
- Discuss arithmetic operators

History of C and 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;
         :
   }
```

First C Program
Source codes

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

```
Welcome to C++!
```

Single-line comments.

Function `main` returns an

Left brace `{` begins function body.

ive to

Function `main` appears exactly once in every C/C++ program..

Statements end with a semicolon `;`.

Corresponding right brace `}` ends function body.

Name `printf` belongs to namespace `stdio`

Keyword `return` is one of several means to exit function; value `0` indicates program terminated successfully.

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.

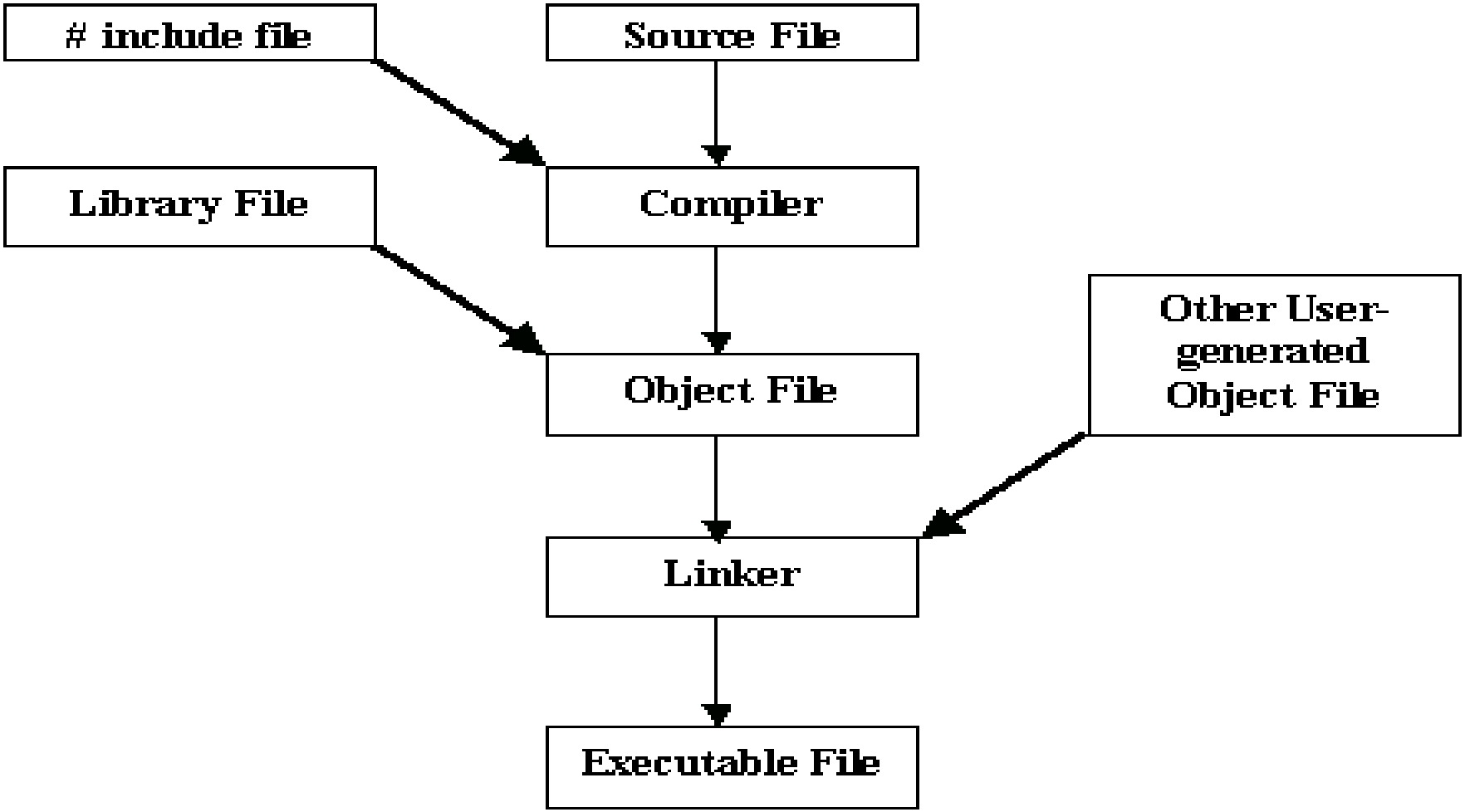
First C Program
Preprocessor Directives

- 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.

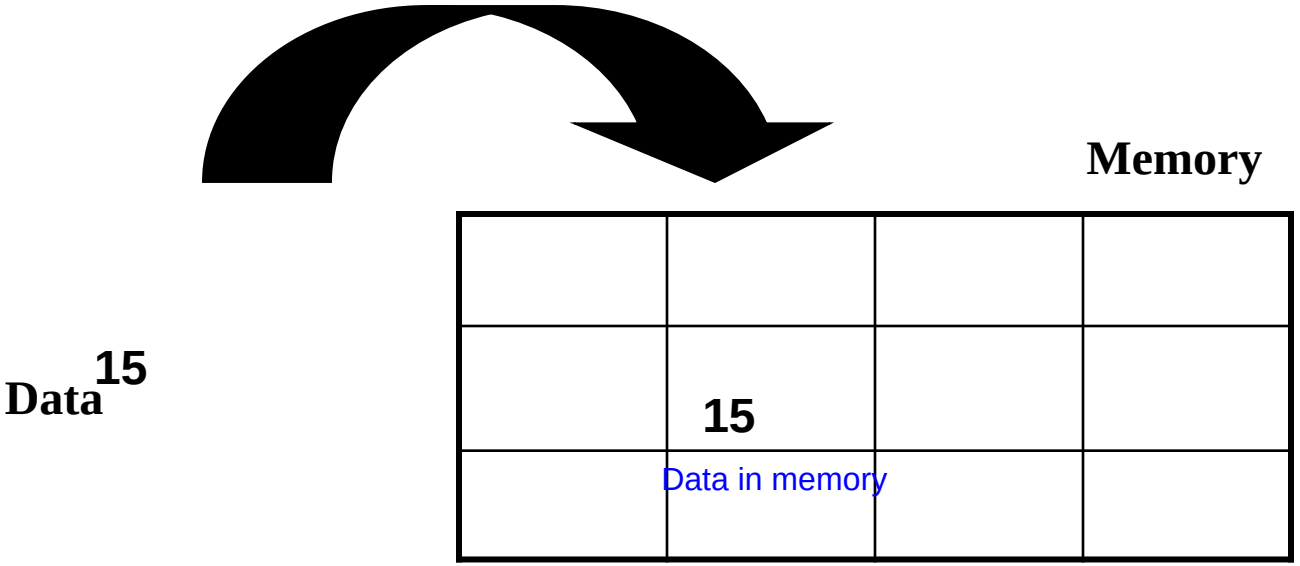
First C Program
Tool Preparation: Dev-C++

- 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
Compiling & Running



Variables



Each location in the memory is unique

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

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”

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

Guidelines for Naming Identifiers

- 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

Data Types-1

- 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-2

A data type describes the kind of data that will fit into a variable

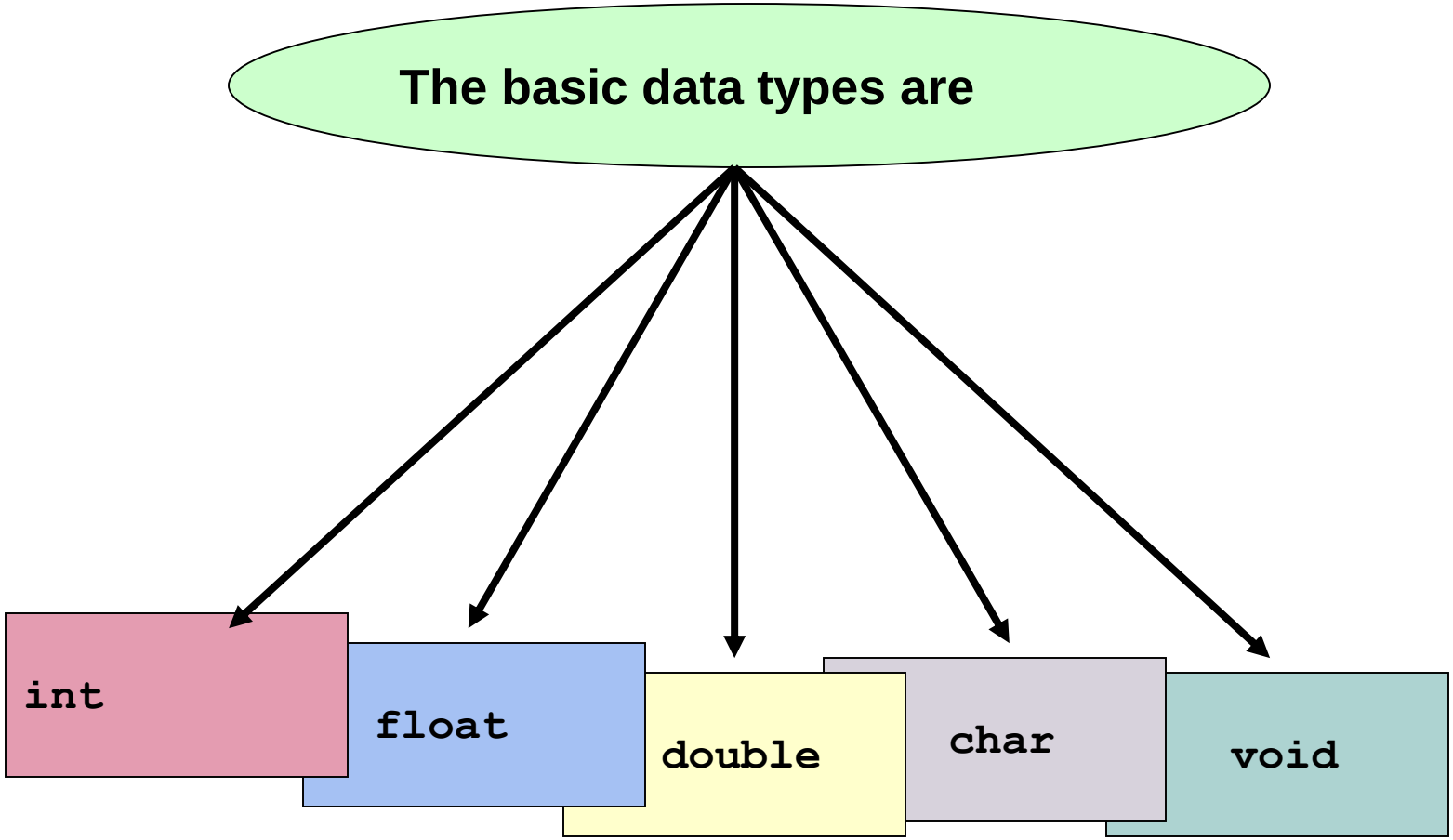
The name of the variable is preceded with the data type

For example, the data type int would precede the name varName

```
Datatype variableName
```

```
int varName
```

Basic Data Types



Type int

- 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, -232

Type float

- Stores values containing decimal places

```
float num;
```

- Precision of upto 6 digits
- 32 bits (4 bytes) of memory
- Examples: 23.05, 56.5, 32

Type double

- Stores values containing decimal places

```
double num;
```

- Precision of upto 10 digits
- 64 bits (8 bytes) of memory
- Examples: 2.0, 3.55, 100000

Type char

- Stores a single character of information

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

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

Type void

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

Derived Data Types

Data type Modifiers	+	Basic Data types	=	Derived data type
unsigned	+	int	=	unsigned int (Permits only positive numbers)
short	+	int	=	short int (Occupies less memory space than int)
long	+	int/double	=	Long int /longdouble (Occupies more space than int/double)

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 and their range-1

The size of data type depends Operating System

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

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

Data Types and their range-2

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

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*/
}
```

Q & A