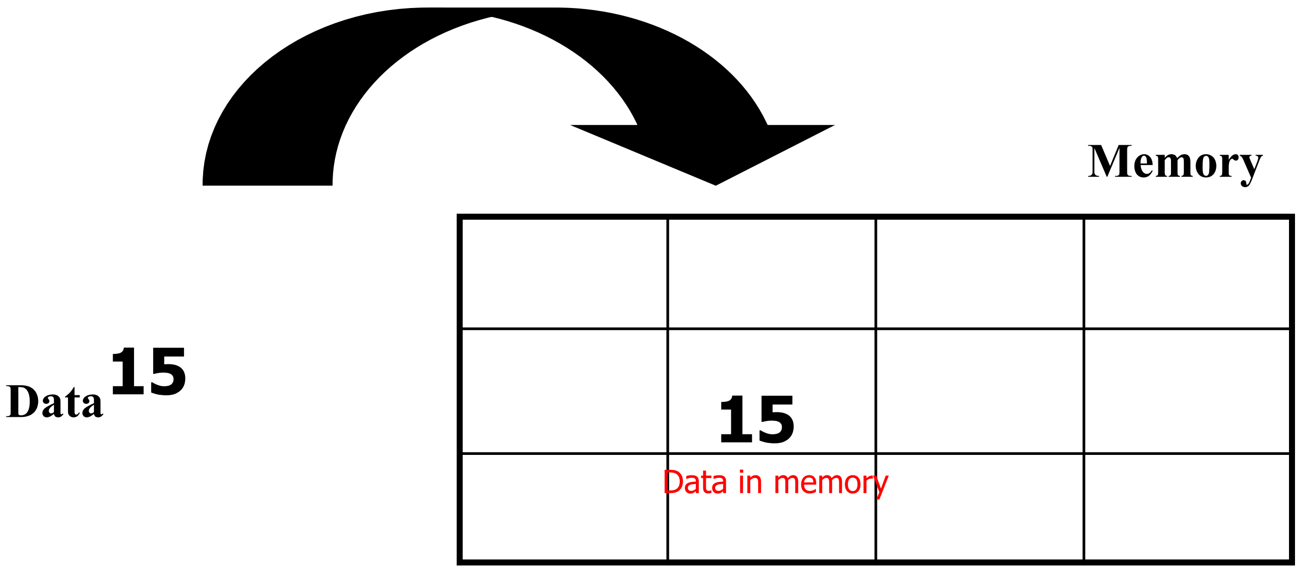
Variables and Data Types

Session 2

Objectives

- Discuss variables
- Differentiate between variables and constants
- List the different data types and make use of them in C programs
- Discuss arithmetic operators

Variables



Each location in the memory is unique

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

Example

```
BEGIN
 DISPlAY 'Enter 2  numbers'
INPUT A, B
C = A + B
DISPLAY  C
END
```

A, B and C are   variables in the pseudocode

Variable names takes away the need for a programmer to access memory locations using their address

The operating system takes care of allocating space for the variables

To refer to the value in the memory space, we need to only use the variable name

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

Identifier Names

- The names of variables, functions, labels, and various other user defined objects are called identifiers
- Some correct identifier names
  - arena
  - s_count
  - marks40
  - class_one
- Examples of erroneous identifiers
  - 1sttest
  - oh!god ! is invalid
  - start... end
- Identifiers can be of any convenient length, but the number of characters in a variable that are recognized by a compiler varies from compiler to compiler
- 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

Keywords

- Keywords : All languages reserve certain words for their internal use

- Keywords hold a special meaning within the context of the particular language

- No problem of conflict as long as the keyword and the variable name can be distinguished. For example, having *integer* as a variable name is perfectly valid even though it contains the keyword int

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

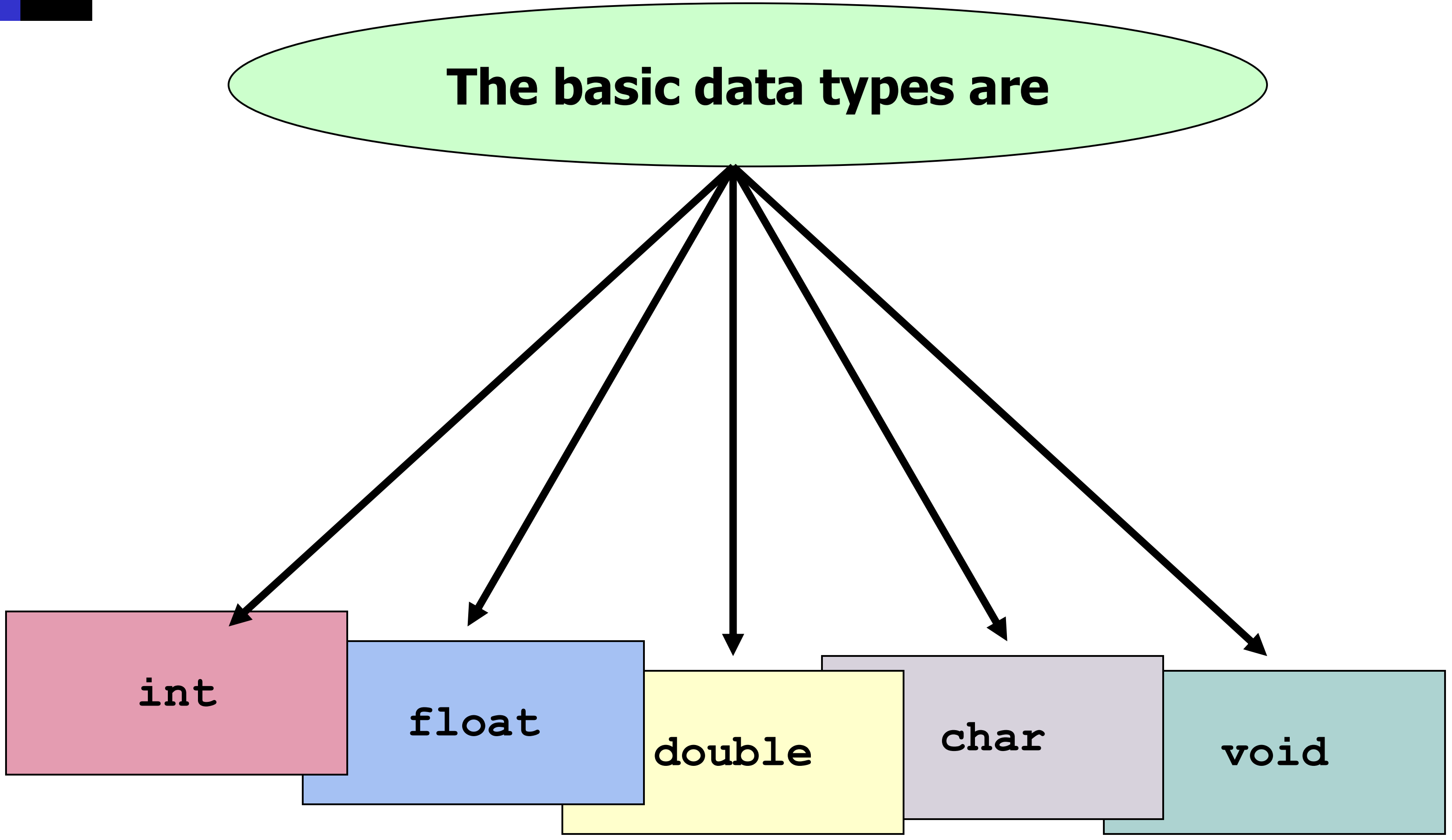
The name of the variable is preceded with the data type

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: ‘a’, ‘m’, ‘$’ ‘%’ , ‘1’, ’5’

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

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
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*/
}
```