



Data-Types

(CS 1002)

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Constants (named)

- **Named constants** are declared and referenced by identifiers:

```
const int MAX_MARKS = 100;
```

```
const string UNIVERSITY = "FAST";
```

```
const double PI = 3.141592654;
```

```
const char TAB = '\t';
```

- Constants must be initialized in their declaration
- No further assignment possible within program



C++ Standard Constants

#include <climits>

INT_MIN INT_MAX
LONG_MIN LONG_MAX

//integer constants defined here

Lower and upper bounds for
Integer types.

#include <float>

FLT_MIN FLT_MAX
DBL_MIN DBL_MAX

// float constants defined here

Lower and upper bounds for
Decimal types.



Types

- C++ provides a set of types
 - E.g. **bool**, **char**, **int**, **double** called “**built-in types**”
- C++ **programmers** can **define new types**
 - Called “*user-defined types*”
- The **C++ standard library** provides a **set of types**
 - E.g. **string**, **vector**, ..
 - (for vector type → `#include<vector>`)



Data Types

Three basic PRE-DEFINED data types:

1. To store whole numbers

– **int, long int, short int, unsigned int**

2. To store real numbers

– **float, double**

3. Characters

– **char**



Types and Literals

- Built-in types

- Boolean type
 - **bool**
- Character types
 - **char**
- Integer types
 - **int**
 - and **short** and **long**
- Floating-point types
 - **double**
 - and **float**

- Standard-library types

- **string**

- Literals

- Boolean: **true**, **false**
- Character literals
 - **'a', 'x', '4', '\n', '\$'**
- Integer literals
 - **0, 1, 123, -6,**
- Floating point literals
 - **1.2, 13.345, 0.3, -0.54,**
- String literals
 - **"asdf", "Hello", "Pakistan"**



Declaration and initialization

`int a = 7;` → 7

`int b = 9;` → 9

`char c = 'a';` → a

`double x = 1.2;` → 1.2

`string s1 = "Hello, world";` → Hello, world

`string s2 = "1.2";` → 1.2



char type

- Reserves **8 bits** or **1 byte** of memory
- A char variable may represent:
 - **ASCII** character 'A', 'a', '1', '4', '*'
 - signed integers **127** to **-128** (Default)
 - unsigned integer in range **255** to **0**

Examples:

- char grade;
- unsigned char WeekNumber= 200;
- char cGradeA = 65;
- char cGradeAA = 'A';



char type

- Example program...



Special characters

- Text string special characters (Escape Sequences)

- \n = newline
- \r = carriage return
- \t = tab
- \" = double quote
- \? = question
- \\ = backslash
- \' = single quote

- Examples:

```
cout << "Hello\t" << "I\'m Ali\n";
```

```
cout << "123\nabc ";
```



Escape Sequence

- Example Program:



int type

32 bits (4 bytes) on Win32 /Linux 32-bit system

– int -2,147,483,648 to 2,147,483,647

– unsigned int 0 to 4,294,967,295

- **Examples:**

```
int earth_diameter;
```

```
int seconds_in_week= 604800;
```

```
unsigned int Height = 100;
```

```
unsigned int Width = 50000;
```



int type (long and short)

- **long int**

- reserves 64 bits (8 bytes) of memory
- signed long -2,147,483,648 to 2,147,483,647
- unsigned long int 0 to 4,294,967,295

- **short int**

- reserves 16 bits (2 bytes) of memory
- signed short int -32,768 to 32,767
- unsigned short int 0 to 65,535



int (long and short)

- Examples:

long int light_speed=186000;

unsigned long int seconds= 604800;

short int Height = 30432;

unsigned short int Width = 50000;



Check Bytes in Memory – Whole Numbers

- Check how many bytes following types occupy in memory:
 - **int**
 - **short**
 - **long int**
 - **short int**
 - **char**
- Use (**cout << sizeof(intVar);**) operator to get this information, Example:...



Real Values

- **float**

- Reserves **32 bits** (4 bytes) of memory
- **$\pm 1.180000 \times 10^{\pm 38}$** , 7-digit precision
- *Example:* float radius= 33.4221;

- **double**

- Reserves **64 bits** (8 bytes) of memory
- **$\pm 1.7900000000000000 \times 10^{\pm 308}$** , 15-digit precision
- *Example:* double Distance = 257.5434342;

- **long double**

- Reserves **128 bits** (16 bytes) of memory , 18-digit precision
- *Example:* long double EarthMass = 25343427.53434233;



Check Bytes in Memory – Real Numbers

- get information for following data types:
 - float
 - double
 - long double
- Use (`cout << sizeof(floatVar);`) operator to get this information, Example:...



bool Type

- Only **1 bit of memory required**
 - Generally, **1 byte** is reserved
- **Literal values:**
 - **true**
 - **false**
- Can be used in **logical conditions:**
 - Examples:

```
bool RainToday=false;  
bool passed;  
passed = GetResult(80);
```



string type

- **Special data type** supports working with “*strings*”
#include <string>

string <variable_name> = “string literal”;

- string type variables in programs:

string firstName, lastName;

- Using with assignment operator:

firstName = “Umer”;

lastName = “Arshad”;

- Display using **cout**

cout << firstName << " " << lastName;



Working with Characters and String Objects

- **char**: holds a single character
- **string**: holds a sequence of characters
- Both can be used in assignment statements
- Both can be displayed with **cout** and **<<**



Other Input Functions

- **>> operator DOES NOT read WHITESPACE**
 - **Skips** or **stops** on space, tab, end-of-line,
 - **Skips** over leading white space;
 - **Stops** on trailing white space.
- **To read any single char V (*incl. whitespace*)**
 - **cin.get(V)**



Character Input

- **To skip input characters:**
 - `cin.ignore();` // **one character.**
 - `cin.ignore(n);` // ***n* characters.**

Reading in a character

```
char ch;
```

```
cin >> ch;    // Reads in any non-blank char
```

```
cin.get(ch);  // Reads in any char
```

```
cin.ignore(); // Skips over next char in  
             // the input buffer
```



Any Questions!