

Computer Programming

Dr. Deepak B Phatak
Dr. Supratik Chakraborty
Department of Computer Science and Engineering
IIT Bombay

Session: Representing Characters, Strings, Booleans

Quick Recap of Relevant Topics



- Architecture of a simple computer
- Representing integers and floating point numbers

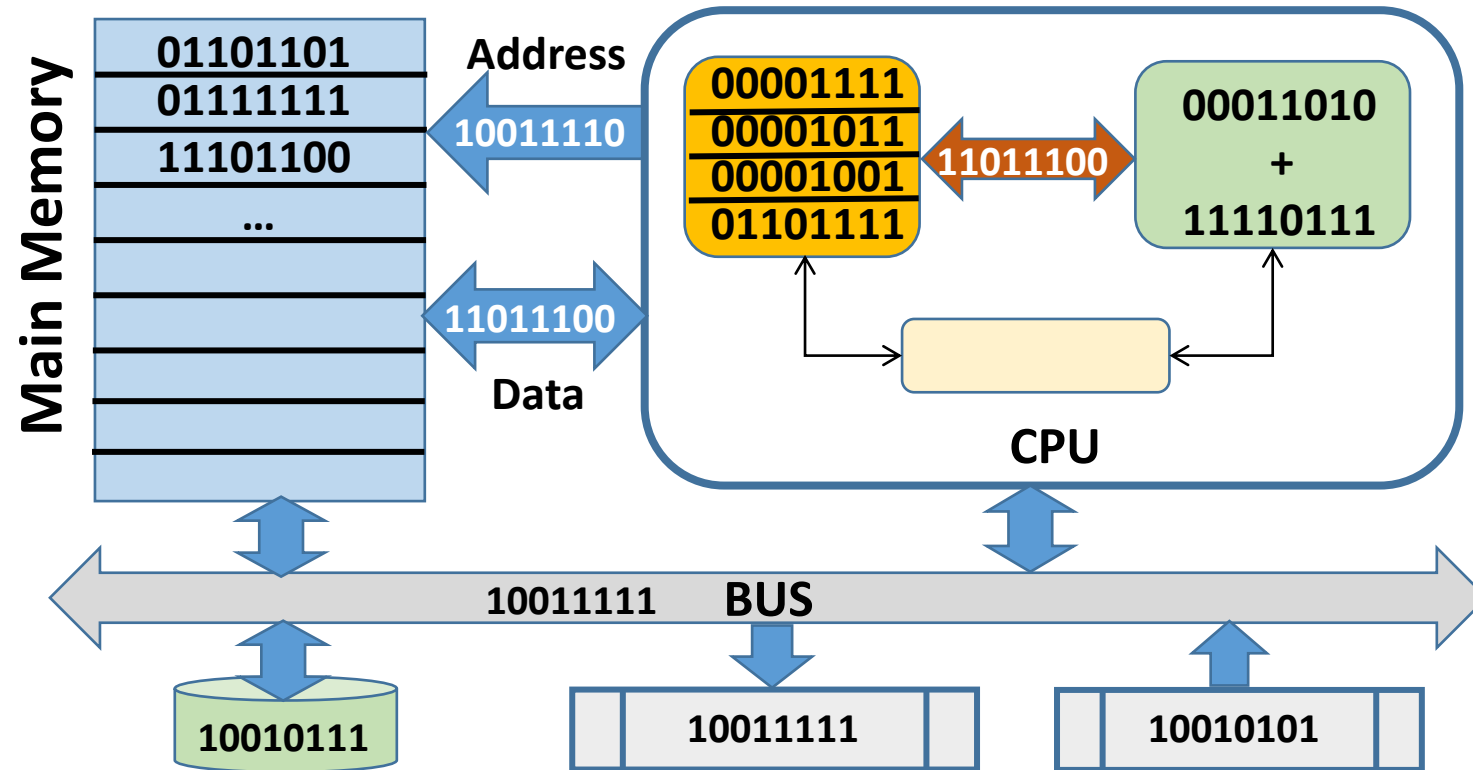
Overview of This Lecture



- A computer's internal representation of
 - Characters
 - Strings
 - Booleans
- C++ declarations of above data types
- Putting things together: Our first simple C++ program

Recap from Earlier Lecture

- Snapshot:



- How do we represent characters/strings using 0's and 1's?

Representing Characters



- Character

- For purposes of this course, a character is a byte

- 2^8 characters:

00000000 (decimal 0) through 11111111 (decimal 255)

- Each character (A, 0, p, ...) is an unsigned 8-bit integer

ASCII encoding: 'A' = 65, 'B' = 66, '0' = 48, '.' = 46, ' ' = 32

- Characters can be compared and sorted like integers

Blank space
character

Characters in C++

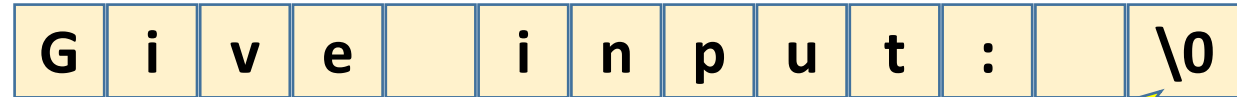


- `char` data type
- `unsigned char` is an unsigned 8-bit integer
- C++ declaration: `char userInput`, `unsigned char numChild`
- Constant characters
 - Can be specified as unsigned integers in 0 through 255
`const char userInput = 89`; `const char defaultOutput = 0x4e`;
 - Can be specified as character symbol within ' '
`const char userInput = 'Y'`; `const char defaultOutput = 'N'`;

Representing Strings

- A string is a sequence (array) of characters terminated by a special end-of-string character

- String “Give input: ” is



Special end-of-string
character
00000000 or '\0'

- Individual characters in string can be accessed
- string as a whole can also be used
 - Recall Dumbo's program: Output “Give input: ”;
 - C++ program: `cout << “Give input:”;`

Strings in C++

- Can be declared as an array of characters

```
char myString[12];
```

Name of array

Size of the array

Can we store “Give input: ” (12 characters) in `myString` ?

NO! We need space for ‘\0’ at the end

To store a 12 character string, the array size must be 13 or more

- Can be declared as `string` data type (**preferred choice**)

```
string myOtherString(“Give input: ”);
```

Not just an array of characters, has several attributes we’ll use later

Constant Strings in C++



- Sequence of characters enclosed in “ ”
“Give input: “, “The output is: “, “Hello world!!!”
- `const string myMessage(“Hello world!!!”)`
 - Value is “Hello world!!!”
 - Cannot be changed during program execution

Representing Booleans



- Like integers where only 0 or non-0 values are relevant
 - 0 means **false**, non-0 means **true**
 - 37 means **true**, 103 also means **true** !!!
- Earlier versions of C++ used **int** to store booleans
- A separate datatype **bool** exists in C++ (**preferred choice**)
 - Uses a form of **int** internally to store 0 and non-0 values
- C++ declaration: **bool** **flag**;
- Boolean constants in C++: **true**, **false**
 - **const bool** **trueValue** = **true**;

Putting It All Together

- C++ program:
 - Read two numbers from keyboard, add and display on console

```
int main() {  
    int A, B, C;  
    cout << "Give two numbers: ";  
    cin >> A >> B;  
    C = A + B;  
    cout << "Sum is: " << C;  
    return 0;  
}
```

Dumbo's program:

Use locations A, B, C;
Output "Give two numbers: ";
Input A; Input B;
C = A + B;
Output "Sum is: "; Output C;
Report job as done;

Summary



- Representation of characters and strings
 - Declaration in C++
- Representation of booleans
 - Declaration in C++
- From Dumbo's program to a C++ program