Computer Programming

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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

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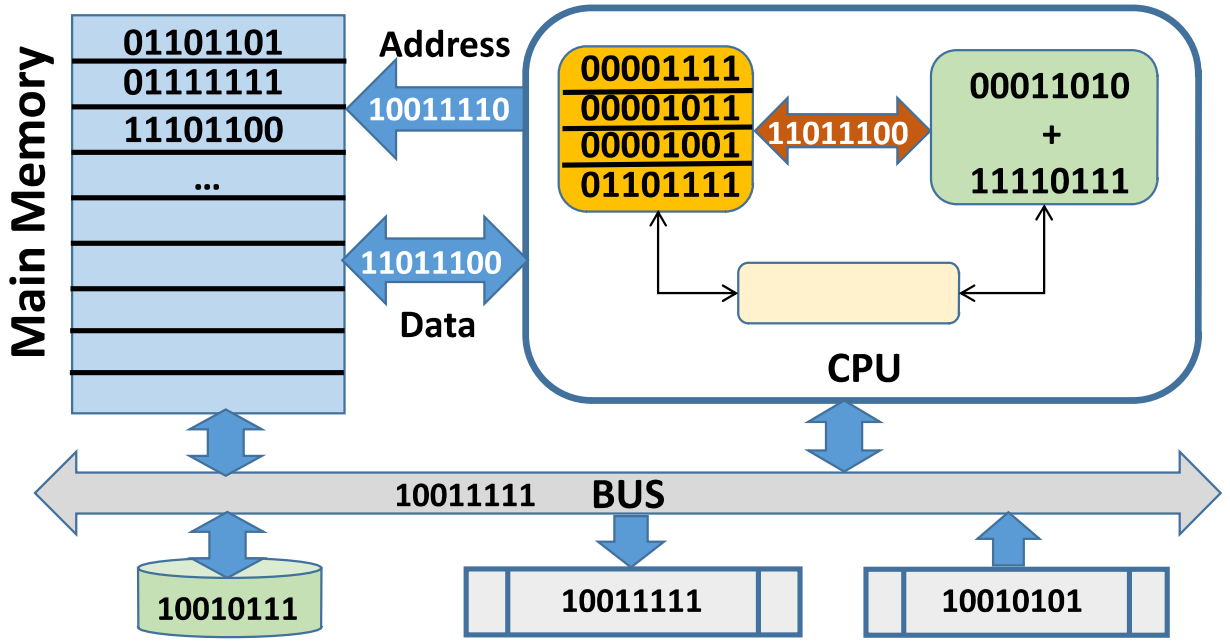
- Snapshot:



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

Representing Characters

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- 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++

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- 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

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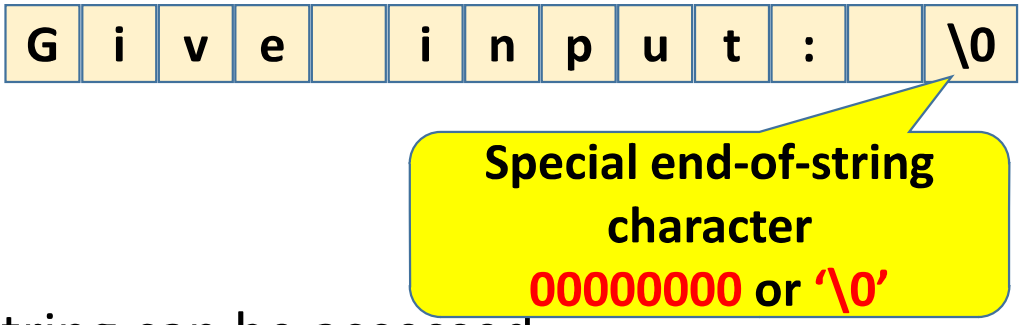
- A string is a sequence (array) of characters terminated by a special end-of-string character
  - String "Give input: " is



- 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++

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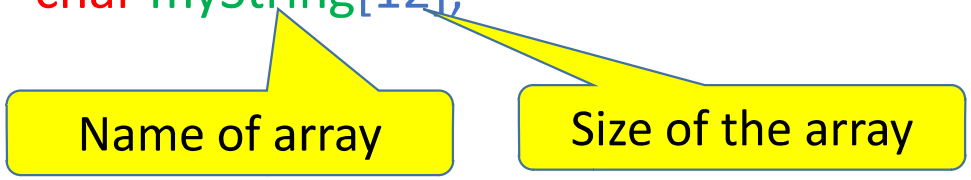
- Can be declared as an array of characters

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



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++

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- 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

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- 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