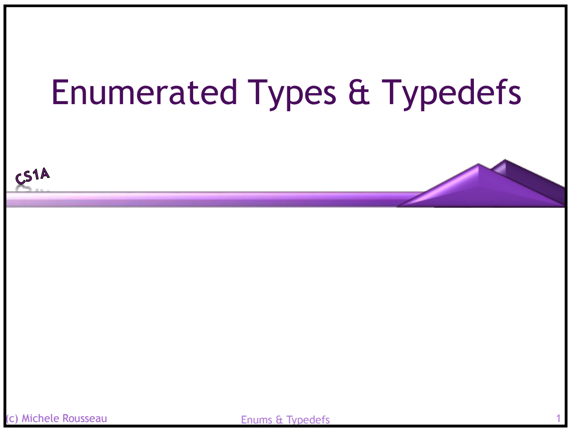

Enumerated Types & Typedefs

CS1A

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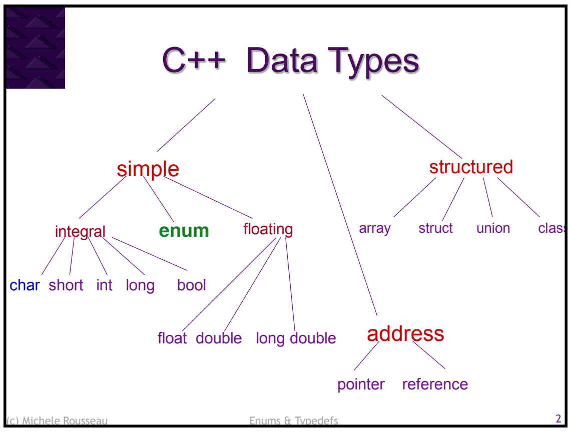

C++ Data Types

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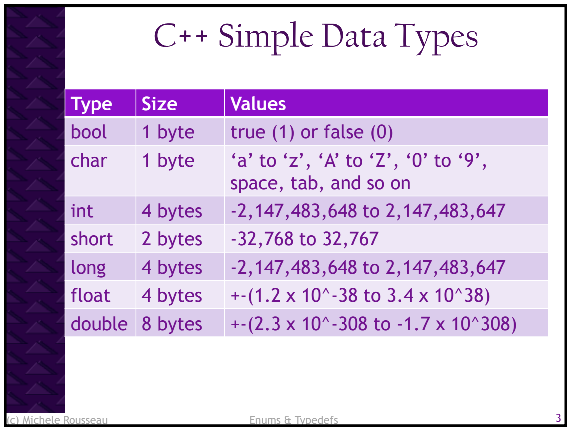

C++ Simple Data Types

Type	Size	Values
bool	1 byte	true (1) or false (0)
char	1 byte	‘a’ to ‘z’, ‘A’ to ‘Z’, ‘0’ to ‘9’, space, tab, and so on
int	4 bytes	-2,147,483,648 to 2,147,483,647
short	2 bytes	-32,768 to 32,767
long	4 bytes	-2,147,483,648 to 2,147,483,647
float	4 bytes	+-(1.2 x 10^-38 to 3.4 x 10^38)
double	8 bytes	+-(2.3 x 10^-308 to -1.7 x 10^308)

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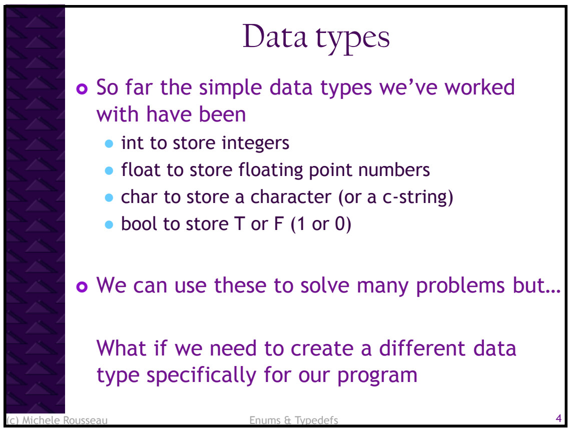

Data types

- So far the simple data types we've worked with have been
  - int to store integers
  - float to store floating point numbers
  - char to store a character (or a c-string)
  - bool to store T or F (1 or 0)
- We can use these to solve many problems but…

  What if we need to create a different data type specifically for our program

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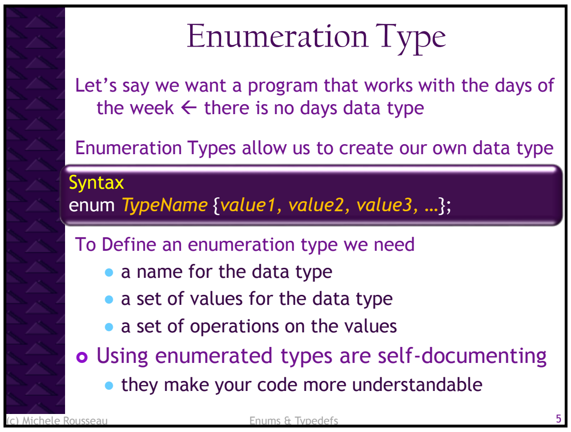

Enumeration Type

Let's say we want a program that works with the days of the week ← there is no days data type

Enumeration Types allow us to create our own data type

Syntax
```
enum TypeName {value1, value2, value3, …};
```

To Define an enumeration type we need
- a name for the data type
- a set of values for the data type
- a set of operations on the values

- Using enumerated types are self-documenting
  - they make your code more understandable

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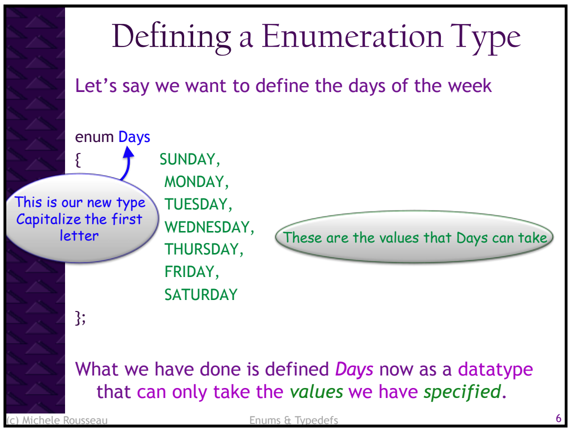

Defining a Enumeration Type

Let's say we want to define the days of the week

```
enum Days
{
        SUNDAY,
        MONDAY,
        TUESDAY,
        WEDNESDAY,
        THURSDAY,
        FRIDAY,
        SATURDAY
};
```

This is our new type Capitalize the first letter

These are the values that Days can take

What we have done is defined *Days* now as a datatype that can only take the *values* we have *specified*.

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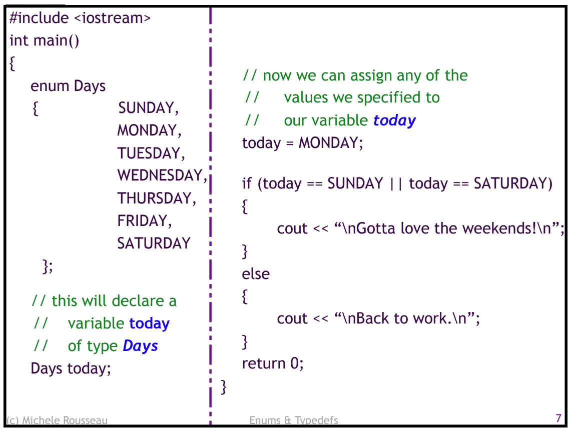

```
#include <iostream>
int main()
{
    enum Days
    {           SUNDAY,
                MONDAY,
                TUESDAY,
                WEDNESDAY,
                THURSDAY,
                FRIDAY,
                SATURDAY
      };

    // this will declare a
    //    variable today
    //    of type Days
    Days today;
```

```
    // now we can assign any of the
    //     values we specified to
    //     our variable today
    today = MONDAY;

    if (today == SUNDAY || today == SATURDAY)
    {
          cout << “\nGotta love the weekends!\n”;
    }
    else
    {
          cout << “\nBack to work.\n”;
    }
    return 0;
}
```

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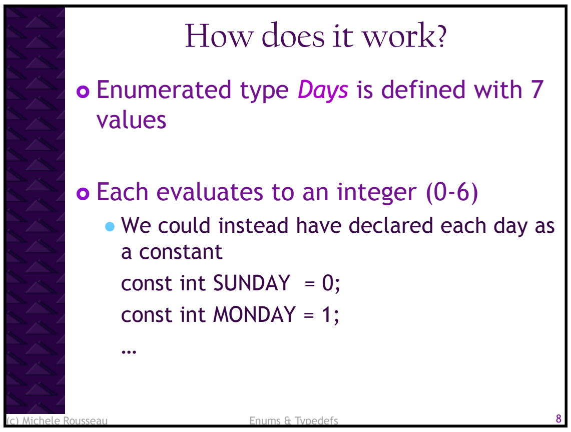

How does it work?

- Enumerated type *Days* is defined with 7 values
- Each evaluates to an integer (0-6)
  - We could instead have declared each day as a constant

    const int SUNDAY = 0;

    const int MONDAY = 1;

    …

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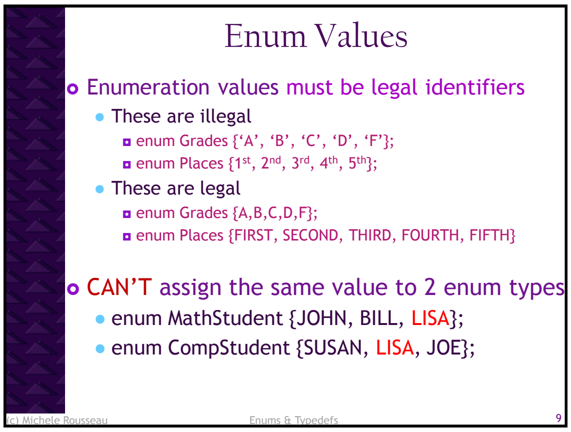

Enum Values

- Enumeration values must be legal identifiers
  - These are illegal
    - enum Grades {‘A’, ‘B’, ‘C’, ‘D’, ‘F’};
    - enum Places {1st, 2nd, 3rd, 4th, 5th};
  - These are legal
    - enum Grades {A,B,C,D,F};
    - enum Places {FIRST, SECOND, THIRD, FOURTH, FIFTH}
- CAN’T assign the same value to 2 enum types
  - enum MathStudent {JOHN, BILL, LISA};
  - enum CompStudent {SUSAN, LISA, JOE};

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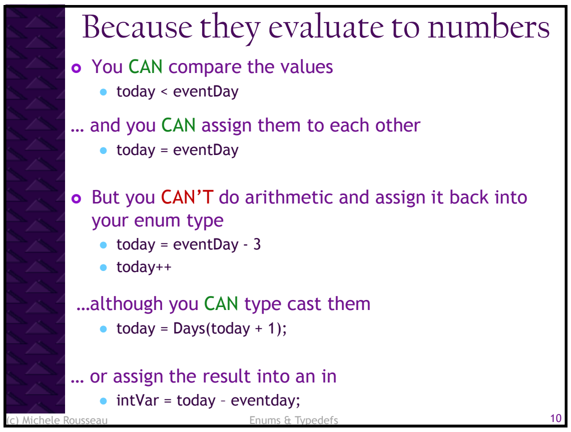


Because they evaluate to numbers

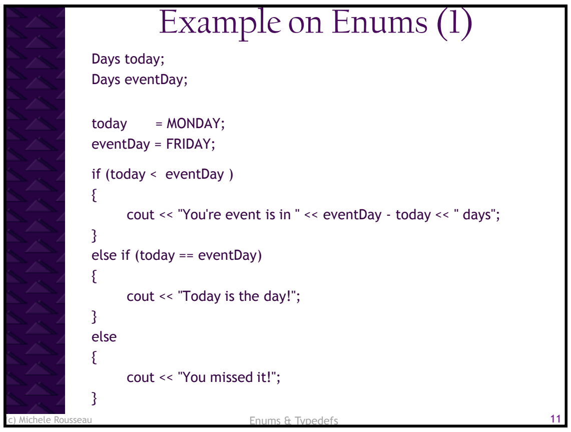
- You CAN compare the values
  - today < eventDay

... and you CAN assign them to each other
  - today = eventDay

- But you CAN'T do arithmetic and assign it back into your enum type
  - today = eventDay - 3
  - today++

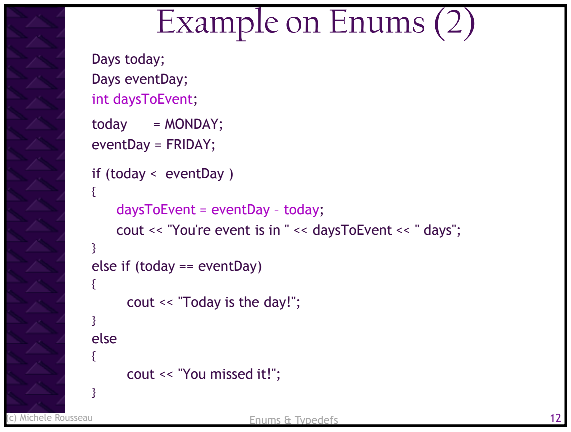
...although you CAN type cast them
  - today = Days(today + 1);

... or assign the result into an in
  - intVar = today - eventday;



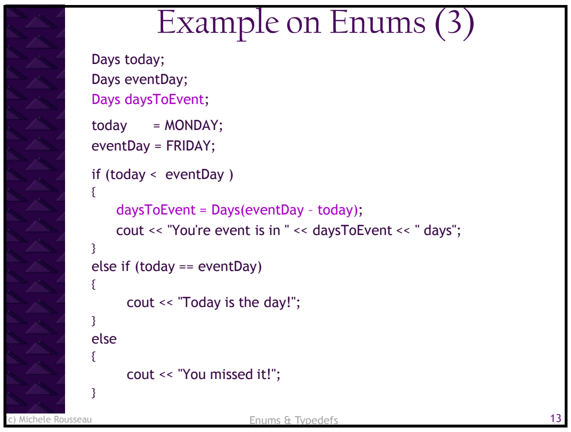
Example on Enums (1)

```
Days today;
Days eventDay;

today      = MONDAY;
eventDay = FRIDAY;

if (today <  eventDay )
{
       cout << "You're event is in " << eventDay - today << " days";
}
else if (today == eventDay)
{
       cout << "Today is the day!";
}
else
{
       cout << "You missed it!";
}
```



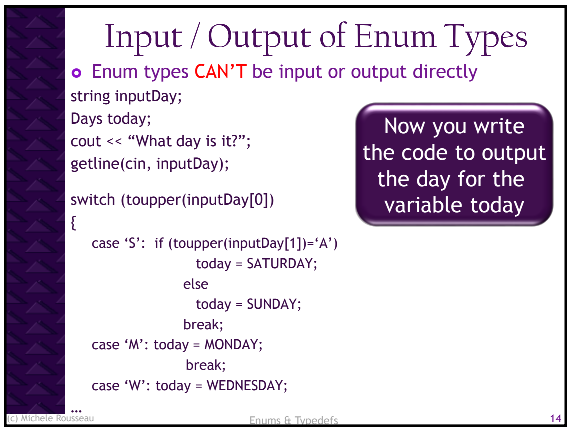
Example on Enums (2)

```
Days today;
Days eventDay;
int daysToEvent;
today      = MONDAY;
eventDay = FRIDAY;
if (today <  eventDay )
{
     daysToEvent = eventDay - today;
     cout << "You're event is in " << daysToEvent << " days";
}
else if (today == eventDay)
{
       cout << "Today is the day!";
}
else
{
       cout << "You missed it!";
}
```



Example on Enums (3)

```
Days today;
Days eventDay;
Days daysToEvent;
today      = MONDAY;
eventDay = FRIDAY;
if (today <  eventDay )
{
     daysToEvent = Days(eventDay - today);
     cout << "You're event is in " << daysToEvent << " days";
}
else if (today == eventDay)
{
       cout << "Today is the day!";
}
else
{
       cout << "You missed it!";
}
```

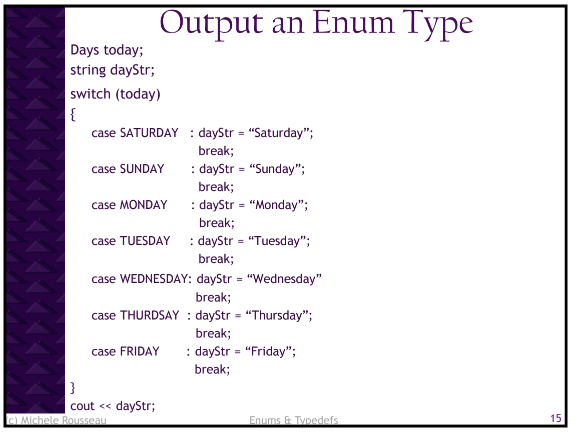


Input / Output of Enum Types

- Enum types CAN'T be input or output directly

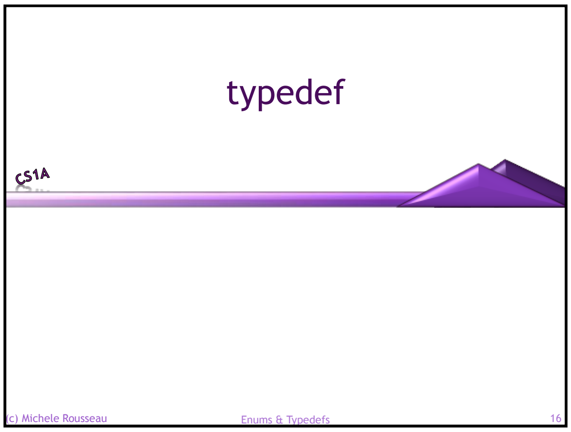
```
string inputDay;
Days today;
cout << "What day is it?";
getline(cin, inputDay);

switch (toupper(inputDay[0])
{
    case 'S':  if (toupper(inputDay[1])='A')
                       today = SATURDAY;
                    else
                       today = SUNDAY;
                    break;
    case 'M': today = MONDAY;
                    break;
    case 'W': today = WEDNESDAY;
…
```

Now you write the code to output the day for the variable today



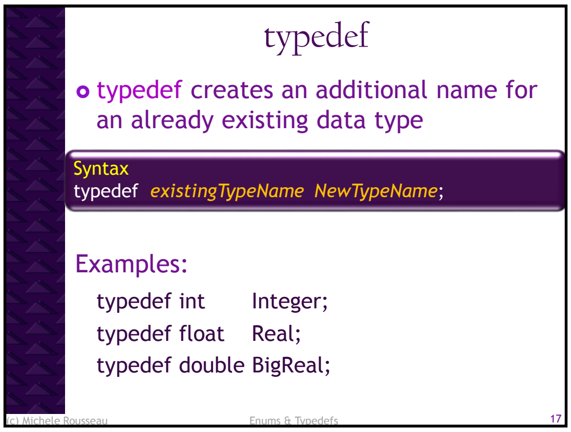
Output an Enum Type

```
Days today;
string dayStr;
switch (today)
{
    case SATURDAY   : dayStr = "Saturday";
                      break;
    case SUNDAY     : dayStr = "Sunday";
                      break;
    case MONDAY     : dayStr = "Monday";
                      break;
    case TUESDAY    : dayStr = "Tuesday";
                      break;
    case WEDNESDAY: dayStr = "Wednesday"
                      break;
    case THURDSAY  : dayStr = "Thursday";
                      break;
    case FRIDAY     : dayStr = "Friday";
                      break;
}
cout << dayStr;
```



typedef

CS1A



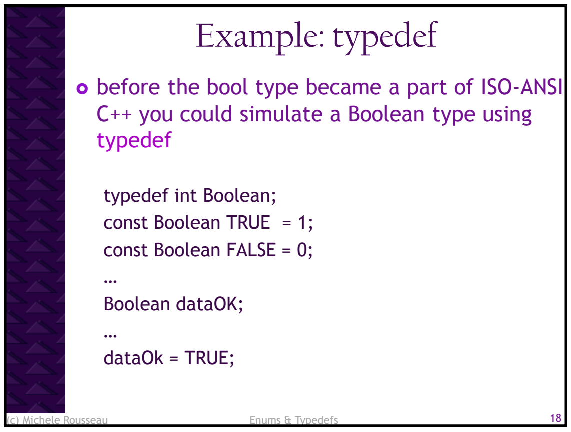
typedef

- typedef creates an additional name for an already existing data type

Syntax
typedef *existingTypeName* *NewTypeName*;

Examples:

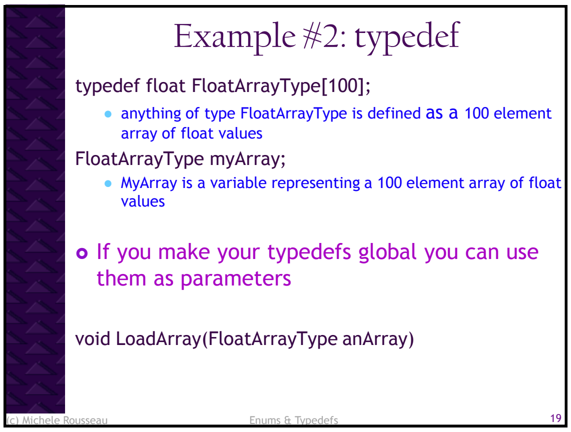
```
typedef int     Integer;
typedef float   Real;
typedef double BigReal;
```



Example: typedef

- before the bool type became a part of ISO-ANSI C++ you could simulate a Boolean type using typedef

```
typedef int Boolean;
const Boolean TRUE  = 1;
const Boolean FALSE = 0;
…
Boolean dataOK;
…
dataOk = TRUE;
```



Example #2: typedef

typedef float FloatArrayType[100];

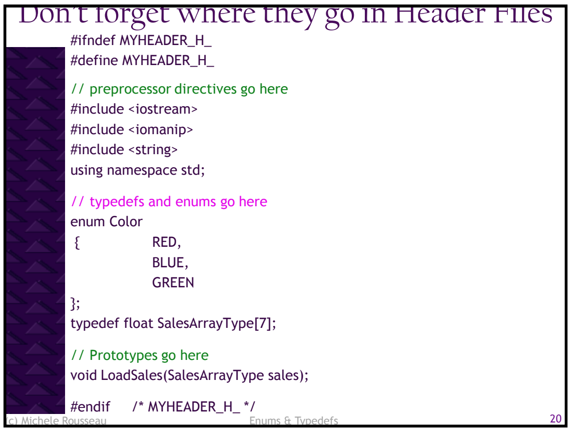
- anything of type FloatArrayType is defined as a 100 element array of float values

FloatArrayType myArray;

- MyArray is a variable representing a 100 element array of float values

- If you make your typedefs global you can use them as parameters

void LoadArray(FloatArrayType anArray)



Don't forget where they go in Header Files

```
#ifndef MYHEADER_H_
#define MYHEADER_H_
// preprocessor directives go here
#include <iostream>
#include <iomanip>
#include <string>
using namespace std;
// typedefs and enums go here
enum Color
{           RED,
            BLUE,
            GREEN
};
typedef float SalesArrayType[7];
// Prototypes go here
void LoadSales(SalesArrayType sales);
#endif    /* MYHEADER_H_ */
```