

# IMPLEMENTING C++ CLASSES

## ACCESS SPECIFIERS

## CONSTRUCTORS

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Problem Solving with Computers-II



Read the syllabus. Know what's required. Know how to get help.

CLICKERS OUT – FREQUENCY AB

## From last lecture...

- Last time we defined a class `DayOfYear` and wrote a main function that created objects of this class
  - We did not implement the member functions of the class.
  - When the code was compiled with `g++`, it resulted in a linker error but when we compiled with the `-c` option, compilation was successful. Why?
- A. The `-c` option suppresses linker errors and produces an executable
- B. The `-c` option does not attempt to link code and no executable is produced
- C. None of the above

In Java:

```
public class DayOfYear {  
    public void setDate(int mon, int day){  
        dd = day;  
        mm = mon  
    }  
    private int dd;  
    private int mm;  
  
}
```

C++, attempt 1:

```
class DayOfYear {  
    public void setDate(int mon, int day);  
    private int dd;  
    private int mm;  
};
```

Which of the following is a problem with the C++ implementation above?

- A. The implementation of the member function setDate should be included in the class
- B. The class DayOfYear should be declared public
- C. The semicolon at the end of the class will cause a compile error
- D. In C++ you specify public and private in regions, not on each variable or function

Which of the following is NOT a problem with the C++ implementation?

- A. Error in definition of **setDate**: member variables mm and dd should be accessed via objects
- B. Error in definition of **setDate**: missing scope operator in definition
- C. Objects declared outside the class cannot access the private member variables
- D. None of the above

C++, attempt 2:

```
class DayOfYear {

    public:
        void setDate(int mon, int day);
    private:
        int dd;
        int mm;
};

void setDate(int mon, int day) {
    mm = mon;
    dd = day;
}
```

```
int main() {
    DayOfYear today;
    today.setDate(1, 9);
    cout<<"Today's date is: ";
    cout<< today.mm <<"/"<< today.dd;
    return 0;
}
```

What will be printed by this code?

- A. 1/9
- B. 1/1
- C. 12/1
- D. Compiler error
- E. None of the above

```
int main() {
    DayOfYear today;
    today.setDate(1, 9);
    cout<<"Today's date is: ";
    cout<< today.getMonth() <<"/"
        << today.getDay();
    return 0;
}
```

```
class DayOfYear {
public:
    void setDate(int mon, int day);
    int getMonth();
    int getDay();
private:
    int dd;
    int mm;
};

void DayOfYear::setDate(int mon, int day) {
    mm = mon;
    dd = day;
}

int DayOfYear::getMonth() {
    dd = 1;
    return mm;
}

int DayOfYear::getDay() {
    mm = 12;
    return dd;
}
```

How can we make sure that a function doesn't inadvertently change the member variables of the class?

- A. Declare the variables const (as shown)
- B. Declare the function as a const

```
int main() {  
    DayOfYear today;  
    today.setDate(1, 9);  
    cout<<"Today's date is: ";  
    cout<< today.getMonth() <<"/"  
        << today.getDay();  
}
```

```
class DayOfYear {  
  
    public:  
        void setDate(int mon, int day);  
        int getMonth();  
        int getDay();  
    private:  
        const int dd;  
        const int mm;  
};  
void DayOfYear::setDate(int mon, int day)  
    mm = mon;  
    dd = day;  
}  
int DayOfYear::getMonth() {  
    dd = 1;  
    return mm;  
}  
int DayOfYear::getDay() {  
    mm = 12;  
    return dd;  
}
```

How can we make sure that a function doesn't inadvertently change the member variables of the class?

***Declare the function as a const***

***Introduce new terms:***

- ***Accessors (getters)***
- ***Mutators (setters)***
- ***Abstract data type (ADT)***

```
int main() {
    DayOfYear today;
    today.setDate(1, 9);
    cout<<"Today's date is: ";
    cout<< today.getMonth() <<"/"
        << today.getDay();
}
```

```
class DayOfYear {

    public:
        void setDate(int mon, int day);
        int getMonth() const;
        int getDay() const;
    private:
        int dd;
        int mm;
};

void DayOfYear::setDate(int mon, int day)
{
    mm = mon;
    dd = day;
}

int DayOfYear::getMonth() const{
    return mm;
}

int DayOfYear::getDay() const{
    return dd;
}
```

- *What is the output of this code?*

```
int main() {  
    DayOfYear today;  
    // today.setDate(1, 9);  
    cout<<"Today's date is: ";  
    cout<< today.getMonth() <<"/"  
        << today.getDay();  
}
```

```
class DayOfYear {  
  
    public:  
        void setDate(int mon, int day);  
        int getMonth() const;  
        int getDay() const;  
    private:  
        int dd;  
        int mm;  
};  
void DayOfYear::setDate(int mon, int day)  
{  
    mm = mon;  
    dd = day;  
}  
int DayOfYear::getMonth() const {  
    return mm;  
}  
int DayOfYear::getDay() const {  
    return dd;  
}
```



# Constructor

**Constructor:** An “initialization” function that is guaranteed to be called when an object of the class is created

- \* If you don't explicitly write a constructor, C++ will generate a default one for you
- \* Member variables are initialized to junk values

```
int main() {
    DayOfYear today;
    today.setDate(1, 9);
    cout<<"Today's date is: ";
    cout<< today.getMonth() <<"/"
        << today.getDay();
}
```

C++, attempt 5: We'll now try to improve this `class DayOfYear` {

```
public:
    void setDate(int mon, int day);
    void getMonth() const;
    void getDay() const;
private:
    int dd;
    int mm;
};

void DayOfYear::setDate(int mon, int day)
{
    mm = mon;
    dd = day;
}

void DayOfYear::getMonth() const{
    return mm;
}

void DayOfYear::getDay() const{
    return dd;
}
```

# Constructor:

## Writing your own

- Constructors must have the same name as the class
- Constructors don't have a return type
- Different types of constructors
  1. Constructor with no parameters (default)
  2. Constructor with parameters (parameterized constructor)
  3. Constructor with parameters that have default values

```
int main() {
    DayOfYear today;
    //today.setDate(1, 9);
    cout<<"Today's date is: ";
    cout<< today.getMonth() <<"/"
        << today.getDay();
}
```

C++, attempt 6:

```
class DayOfYear {

    public:
        void setDate(int mon, int day);
        void getMonth() const;
        void getDay() const;

    private:
        int dd;
        int mm;

};
```

//Function definitions omitted

# Parametrized Constructor

C++, attempt 7:

```
class DayOfYear {

    public:
        void setDate(int mon, int day);
        void getMonth() const;
        void getDay() const;

    private:
        int dd;
        int mm;

};
```

```
int main() {
    DayOfYear today;
    //today.setDate(1, 9);
    cout<<"Today's date is: ";
    cout<< today.getMonth() <<"/"
        << today.getDay();
}
```

//Function definitions omitted

# Parametrized Constructor

What is the output of this code?

- A. Compiler error
- B. Junk values (default constructor is called)

```
int main() {
    DayOfYear today;
    cout<<"Today's date is: ";
    cout<< today.getMonth() <<"/"
        << today.getDay();
}
```

C++, attempt 7:

```
class DayOfYear {

    public:
        void setDate(int mon, int day);
        void getMonth() const;
        void getDay() const;
        DayOfYear(int mon, int day);

    private:
        int dd;
        int mm;

};

DayOfYear()::DayOfYear(int mon, int day)
{
    mm = mon;
    dd = day;
}

//Function definitions omitted
```

# Parametrized Constructor with default parameters

In the declaration of the parameterized constructor, specify default values for the parameters

Objects can be created in all the following ways:

```
DayOfYear today;
DayOfYear today(1,8);
DayOfYear today(2);
```

```
int main() {
    DayOfYear today;
    cout<<"Today's date is: ";
    cout<< today.getMonth() <<"/"
    << today.getDay();
}
```

C++, attempt 8:

```
class DayOfYear {

    public:
        void setDate(int mon, int day);
        void getMonth() const;
        void getDay() const;
        DayOfYear(int mon=1, int day=1);

    private:
        int dd;
        int mm;

};

DayOfYear()::DayOfYear(int mon, int day)
{
    mm = mon;
    dd = day;
}

//Function definitions omitted
```

# Summary

- Classes have member variables and member functions (method). An object is a variable where the data type is a class.
- You should know how to declare a new class type, how to implement its member functions, how to use the class type.
- Frequently, the member functions of an class type place information in the member variables, or use information that's already in the member variables.
- Constructors are used to initialized objects
- In the future we will see more features of OOP.

# Next time

- The Big four: constructor, destructor, copy-constructor, copy-assignment