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المرحلة : الثانية
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عنوان المحاضرة : oop



Ministry of Higher Education and Scientific Research

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C/C++ programming language

Lecture (9+10)

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Introduction to Object Oriented Programming in C++

Introduction:

تعتبر **Object Oriented Programming** تقنية مكنت المطورين على انشاء البرامج بشكل هيكلية Modeling شبيهه الى حدما من الاشياء الموجودة في حياتنا اليومية، ومكنت كذلك شركات البرمجة على توفير الوقت والجهد في عدم تكرير الاكواد.

البرمجة الكائنية OOP

عبارة عن نمط برمجة متقدم، يمكن من تقسيم البرامج الى وحدات تسمى الكائنات Objects ، بحيث يعتبر كل كائن عبارة عن حزمة من البيانات. ويتم البرمجة بواسطة استخدام الكائنات وربطها مع بعضها البعض وواجهة البرنامج الخارجية باستخدام هيكلية البرنامج وواجهات الاستخدام الخاصة بكل كائن.

There are two weaknesses related with structured programming. *Firstly*, functions have unrestricted access to global data. This causes a program's structure difficult to conceptualize. In addition, it makes the program difficult to modify. Any change made in a global data item may necessitate rewriting all the functions that access that item. *Secondly*, the arrangement of separate data and functions does a poor job of modeling things in the real world. In the real world we deal with objects such as people and cars. Such objects aren't like data and they aren't like functions. Complex real-world objects have both data and functions. Therefore



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there was a need for a new programming approach which is called Object-Oriented Programming.

OOP features

OPP is built on three main concepts

التجريد Abstraction

وهي عبارة عن تحديد وصف برمجي خاص بصنف معين وهي نوعان Data Abstraction وهي المسئولة عن التعرف على الخصائص لكائن معين و Methods Abstraction وهي تحديد العمليات والاجراءات.

التغليق Encapsulation

وهو عبارة عن تغليف البرنامج عن المستخدم. بحيث المستخدم لا يعنى حقا بتفاصيل بناء البرنامج مايمهه هو سهولة ونمفيد البرنامج للمطلوب منه كذلك يستعمل لحماية بعض الدوال من العبث بهم من خارج class.

الوراثة Inheritance

يستطيع الكائن ان يرث خصائص اي كائن اخر دون ان تتأثر خصائص الموروث منه على سبيل المثال نجد ان الطائرة تترت خصائص من الطائر وان يضيف إليه بعض الخائص الاخرى دون ان يتأثر كائن الطائر في حد ذاته.

تعدد الواجه Polymorphism

يستطيع الكائن Object ان ياخذ عدة اشكال بحيث يمكن ان يُستخدم صف أب parent class للإشارة إلى صف يرث منه child class لذلك يمكن اعتبار أي غرض يمكنه اجتياز أكثر من اختبار علاقة IS-A يعتبر غرض متعدد الأشكال.

- Class: is like a blueprint (general form) used to create objects. A class also is an abstract data type that can be treated like any other built-in data type. A



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class defines the attributes of its objects and the methods that can be applied to its objects.

- Object: is the basic run-time entity in an object-oriented system. It may represent a person, a place, a bank account, etc. An object is also called an instance of a class.
- Encapsulation: is the mechanism that binds together data and functions into a single unit (called class). The data is not accessible to the outside world, and only the functions which are wrapped in the class can access it. This insulation of data from direct access is called data hiding or information hiding.
- Inheritance: is the process by which objects of one class acquire the properties of objects of another class. It supports the concept of hierarchical classification. It also provides the idea of reusability. This means that we can add additional features to an existing class without modifying it.
- Polymorphism: is the ability for objects of different classes related by inheritance to respond differently to the same message. The same message sent to many different types of objects takes on “many forms”--hence the term polymorphism.

من اللغات التي تعمل بالكائنية

- لغة سي++
- لغة جافا
- لغة بايثون
- لغة دلفي (لغة برمجة)
- لغة سي شارب
- لغة الجافا سكربت
- لغة php
- لغة Dart



Classes

The general form of a class declaration in C++ is:

```
class class_name
{
private:
variable declarations;
function declarations;

public:
variable declarations;
function declarations;
};
```

- The keyword *class* indicates that an abstract data type called `class_name` will be specified.
- The class body is enclosed within braces and terminated by a semicolon.
- The variables declared inside the class are known as data members and the functions are known as member functions.
- These functions and variables are usually grouped under two sections: namely, `private` and `public`.
- Only the member functions can have access to the private data members and private functions. However, the public members can be accessed from outside the class.



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- Note that declaring data variables as public defeat the idea of data hiding and therefore should be avoided.

A Simple Class Example

```
#include <iostream>
using namespace std;
class item
{
private:
int number;
float cost;

public:
void getdata(int a, float b);
void putdata();
};

void main() {
}
```

Here, we have defined a class called **item**. This name is used to declare objects of that class. The data members (**number** and **cost**) are declared as private, while the member functions (**getdata()** and **putdata()**) are declared as public. As mentioned earlier, these two functions provide the only access to the two data members from outside the class. Note that, at this stage class definition does not allocate any memory space.



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Objects:

داخل البرنامج الرئيسي تكون الصيغة العامة

CLASS NAME object name;

Once a class has been defined, we can create objects of that type as follows:

```
item x;
```

This statement creates an object **x** of type **item**. At this stage, memory space is allocated to the object **x**. We may also declare more than one object in one statement, for example:

```
item x, y, z;
```

Another way to create objects is by placing their names immediately after the closing brace in the class definition, for example:

```
class item  
{  
.....  
.....  
} x, y, z;
```

Accessing Class Members

As previously mentioned, the public member functions can be accessed only from outside the class. This can be done using the dot operator, for example:

```
اسم x.getdata(100, 75.5);
```



This function call statement is valid and assigns the value 100 to **number** and 75.5 to **cost** of the object **x** by implementing the **getdata()** function. Similarly, the statement

```
x.putdata ();
```

would display the values of **number** and **cost**.

While the statement

```
x.number =100;
```

is **illegal** because **number** is a private member and cannot be accessed from outside the class.

When a variable is declared as public, it can be accessed by the objects directly, for example:

```
class xyz
{
private:
    int x;
    int y;
public:
    int z;
};
.....
.....
xyz p; // create object p
p.x = 0; // error, x is private
p.z = 10; // OK, z is public
.....
.....
```




However, the public declaration of data conflicts with the OOP concept *data hiding* and therefore should be avoided.

Definition of Member Functions:

Class member functions can be defined in two places:

Outside the Class Definition

Example:

```
void item :: getdata(int a, float b)
{
    number = a;
    cost = b;
}
```

Here, the membership label **item ::** tells the compiler that the function *getdata()* belongs to the class **item**. That is, the scope of the function *getdata()* is restricted to the class **item** specified in the header line. The symbol **::** is called the *scope resolution operator*. Note the statements

```
number = a; cost = b;
```

show that the member functions can have direct access to private data items.

Similarly, the function **putdata()** is defined outside the class **item** as follows

```
void item :: putdata()
{
    cout << " Number :" << number << "\n" ;
    cout << " Cost :" << cost << "\n" ;
}
```



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Inside the Class Definition

Example:

```
class item
{
private:
    int number;
    float cost;
public:
    void getdata(int a, float b);
    void putdata()
    {
        cout << " Number :" << number << "\n" ;
        cout << " Cost :" << cost << "\n" ;
    }
};
```

Note: Normally, only small functions are defined inside the class definition.

A Complete C++ Program with Class

The following program includes all the details discussed so far:

Example: write a program in C++, to create a class for input the number and cost for several items and display them.



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```
#include <iostream>
using namespace std;
class item
{
private:
    int number;
    float cost;
public:
    void getdata(int a, float b);
    void putdata()
    {
        cout << "number :" << number << "\n";
        cout << "cost :" << cost << "\n";
    }
};
void item :: getdata(int a, float b)
{
    number = a;
    cost = b;
}
void main()
{
    item x; //create object x
    cout << "\n Object x " << "\n";
    x.getdata(100, 299.95);
    x.putdata();
    item y; //create another object y
    cout << "\n Object y " << "\n";
    y .getdata(200, 175.50);
    y .putdata();
}
```



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The output of the above program is:

Object x

number :100

cost :299.95

Object y

number :200

cost :175.5