ESc101 : Fundamental of Computing

I Semester 2008-09

Lecture 20

Object Oriented programming

Classes and Objects

What kind of problems did we solve till now

- 1. Computing Factorial of a number
- 2. Computing highest permutation
- 3. Checking if a number is palindrome
- 4. Computing prime numbers less than an integer n.

mathematical problems involving primitive (especially numeric) types only

Which methodology we used

Structured programming : A program is a group of methods which compute solution of the problem when executed on a given input data.

The methods are designed in total isolation from ...

Which methodology we used

Structured programming : A program is a group of methods which compute solution of the problem when executed on a given input data.

The methods are designed in total isolation from the property of data to be processed

A fact of real life

Most of the computational problems we face are **NOT** on merely numbers.

Examples

1. Problem involving maintenance of student records

Roll numbers, name, CPI,...

2. Problem involving maintenance Bank accounts

account number, balance, interest,...

3. Problem involving computing some geometric structure of a set of points Examples : smallest enclosing circle, intersection of line segments.

x-coordinate, y-coordinate

Aim : first to model the problem and then solve it ?

Modeling the problem

- 1. For student records will you need the family history of the student ?
- 2. For Bank accounts will you need to know the **height** of the account holder?
- For points, will you need to know the source from where they were generated
 ?

NO

We just focus on those features which are relevant to the problem

Abstraction : Ist step in modeling the problem

Abstraction of the problem :

Focus only on those features which are relevant to the problem

You have been using it for long (without perhaps noticing it consciously)

Let us review the Examples again

1. Problem involving maintenance of student records

2. Problem involving maintenance of Bank accounts

3. Problem involving computing some geometric structure of a set of points

which words catch your eyes ?

Let us review the Examples again

1. Problem involving maintenance of student records

2. Problem involving maintenance of **Bank accounts**

3. Problem involving computing some geometric structure of a set of points

Maintaining student records

Each student record will have the following pieces of information.

• Name, Roll number, SPI, CPI ...

and methods for each record



Maintaining student records

Each student record will have the following pieces of information.

• Name, Roll number, SPI, CPI ...

and methods for each record

- Retrieve Roll number,
- Retrieve Name
- Update CPI
- ...

Maintaining student records

Each student record will have the following attributes

• Name, Roll number, SPI, CPI ...

and **methods** for each record :

- Retrieve Roll number,
- Retrieve Name
- Update CPI
- ...

Maintaining Bank accounts

Each account will have the following

attribute

• Account number, Name, Type of account, Balance,...

and methods for each account :



Maintaining Bank accounts

Each account will have the following

attribute

• Account number, Name, Type of account, Balance,...

and **methods** for each account :

- What is the balance ?
- What was the last transaction ?
- Deposit a given amount ?
- Withdraw a given amount ?
- ...

Computing some geomteric structure for a set of points

Each point will have the following attributes

• *x*_coordinate, *y*_coordinate

and methods for points



Computing some geomteric structure for a set of points

Each point will have the following attributes

• *x*_coordinate, *y*_coordinate

and methods for points

- get the x_coordinate
- get the y_coordinate
- get distance from origin
- translate the point by Δ_x, Δ_y
- ...

Crucial Observation

For a given real life problem :

whenever we think of the (attributes of the) data, ...

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So it is useful to think of (the attributes of) data in conjunction of the methods which work on them.

Objects

Objects are self contained entity which has its own collection of

- attributes
- methods to access them, manipulate them and compute some functions on them.

Encapsulation : one of the fundamental principle of OOP

The ability of an object to be a container (or capsule) for its attributes (i.e. data variables) and its related methods (i.e. functions).

Object-oriented programming may be seen as *a collection of cooperating objects*.

(it will become clear as we proceed)

What is a class ?

Definition : A class specifies the attributes (data) and methods (actions) that objects can work with.

It is just a template or prototype for each of many objects belonging to the class.

How to describe Class for Point

What will be the attributes or properties of point ?

•

Class for Point

attributes

- x-coordinate
- y-coordinate

The methods dealing with Point :

set x-coordinate or y-coordinate of a point get x-coordinate and y-coordinate of a point Square_of_distance from origin translation of a point

Class for Point

```
public class Point
{ // what are the attributes ?
  double x;
  double y;
  // what are the actions or methods ?
  public void setX(double x_value) {x = x_value;}
  public void setY(double y_value) { y = y_value; }
  public double getX() {return x;}
  public double getY() {return y;}
  public double Square_distance_from_origin()
    {return x*x+y*y}
```

How to create an object

Point P; //P is NOT a Point object.

//P is reference to an object of class Point

P = new Point(); //an object of class Point is created by this command //P stores the reference to it.