CMSC 433 – Programming Language Technologies and Paradigms Spring 2007

Factory Pattern

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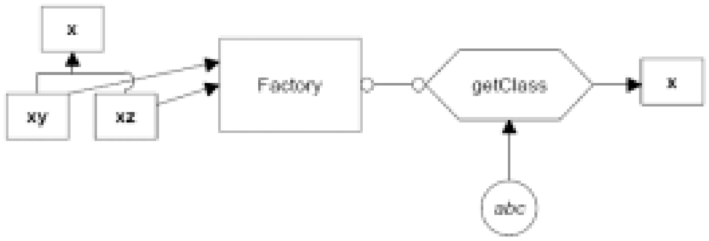
What is it?

- returns an instance of one of several possible classes depending on the data provided to it
  - Usually all of the classes it returns have a common parent class and common methods, but each of them performs a task differently and is optimized for different kinds of data

A Closer Look



- x is a base class and classes xy and xz are derived from it.
- Factory is a class that decides which of these subclasses to return depending on the arguments you give it.
- On the right, we define a getClass method to be one that passes in some value abc, and that returns some instance of the class x.

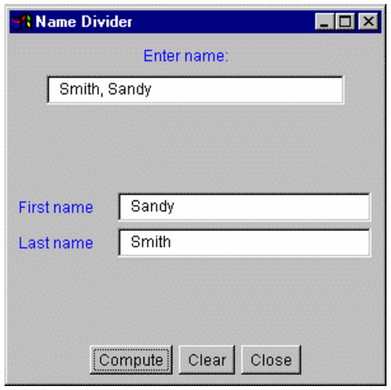
More…

- Which one it returns doesn't matter to the programmer since they all have “the same” methods, but different implementations.
- How it decides which one to return is entirely up to the factory.
  - It could be some very complex function but it is often quite simple.

An Example

- an entry form and we want to allow the user to enter name either
  - as “firstname lastname” or
  - as “lastname, firstname”
- decide the name order by whether there is a comma between the last and first name.

An Example



Lets look at some code

- start by defining a simple base class that takes a String and splits it (somehow) into two names:

```
class Namer {
//a simple class to take a string apart into two names
   protected String last;  //store last name here
   protected String first; //store first name here

   public String getFirst()      {
      return first;          //return first name
   }
   public String getLast()     {
      return last;           //return last name
   }
}
```

- store the split first and last names in the Strings first and last, and, since the derived classes will need access to these variables, we’ll make them protected.

A Derived Class “FirstFirst”

- In the FirstFirst class, we assume that everything before the last space is part of the first name

```
class FirstFirst extends Namer {          //split first last
   public FirstFirst(String s)     {
      int i = s.lastIndexOf(" ");         //find sep space
      if (i > 0)   {
         //left is first name
         first = s.substring(0, i).trim();
          //right is last name
          last =s.substring(i+1).trim();
         }
       else  {
          first = "";                  // put all in last name
         last = s;                     // if no space
         }
    }
}
```

Another Derived Class “LastFirst”

- LastFirst class, we assume that a comma delimits the last name.

```
class LastFirst extends Namer {          //split last, first
   public LastFirst(String s)    {
      int i = s.indexOf(",");                   //find comma
      if (i > 0)   {
         //left is last name
          last = s.substring(0, i).trim();
          //right is first name
          first = s.substring(i + 1).trim();
         }
      else         {
         last = s;         // put all in last name
         first = "";              // if no comma
         }
   }
}
```

Lets Build the Factory!

- test for the existence of a comma and then return an instance of one class or the other

```
class NameFactory {
//returns an instance of LastFirst or FirstFirst
//depending on whether a comma is found
   public Namer getNamer(String entry)     {
      int i = entry.indexOf(",");   //comma determines name
order
      if (i>0)
         return new LastFirst(entry);   //return one class
      else
         return new FirstFirst(entry);  //or the other
   }
}
```

Using the Factory

- initialize an instance of the factory class
  `NameFactory nfactory = new NameFactory();`
- call the computeName method, which calls the getNamer factory method and then calls the first and last name methods of the class instance it returns

```
private void computeName()   {
    //send the text to the factory and get a class back
     namer = nfactory.getNamer(entryField.getText());

    //compute the first and last names
    //using the returned class
     txFirstName.setText(namer.getFirst());
     txLastName.setText(namer.getLast());
  }
```

Fundamental Principle of Factory Patterns

- Create an abstraction which decides which of several possible classes to return, and
  - return one.
- Then you call the methods of that class instance without ever knowing which derived class you are actually using.

When to Use a Factory Pattern

- You should consider using a Factory pattern when
  - A class can't anticipate which kind of class of objects it must create.
  - A class uses its subclasses to specify which objects it creates.
  - You want to localize the knowledge of which class gets created.