Lebanese University
Faculty of Science
Section I

BS - Computer Science
Semester 1
2022-2023

I3305
Graphical Interface and Application
Lab 2 (A) : Structural Patterns

Exercise 1:

Text editors (as notepad++, sublime,) have 26 distinct letters to write words. The editor has to instantiate all 26 letters repeatedly. For instance, when typing "Birthday baby", there are three occurrences of the letter 'b'. If instantiate three different characters 'b' object separately it is a complete waste of time, effort and memory because it is the same object base. That is one occurrence it is capital 'b' while the next it is simple 'b'.
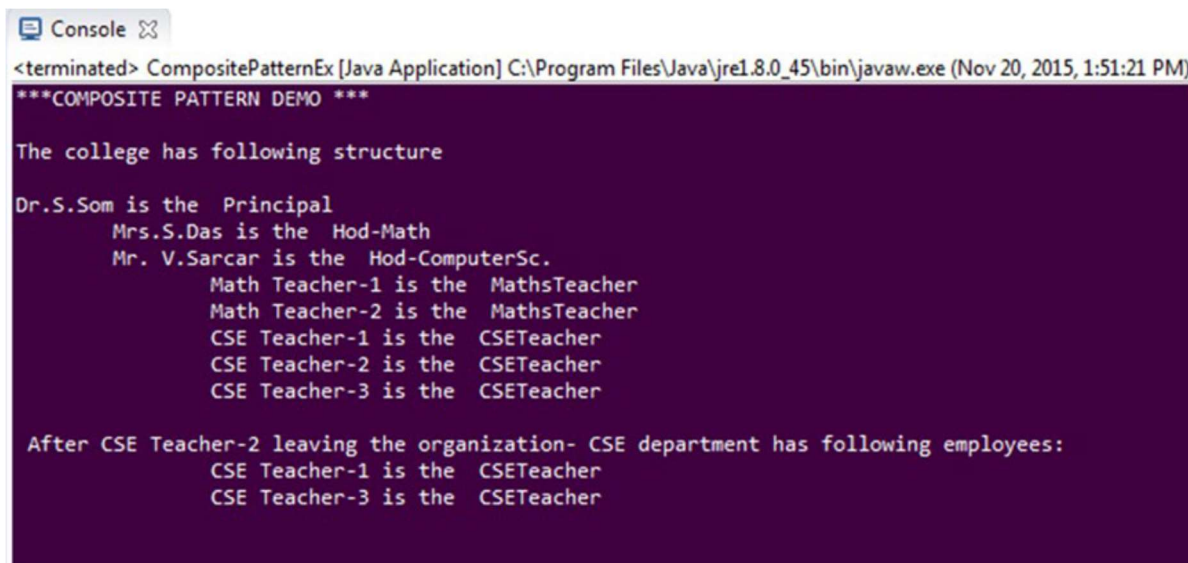
Use the flyweight pattern to overcome repeated heavy object creation.

Exercise 2:

In a small college organization, there are 8 teachers. At top position, there is 1 Principal. Under Principal, there are two Heads of Departments: one for computer science and one for mathematics. At present, in the mathematics department, we have two lecturers; in the computer science department we have three lecturers. At the end, one lecturer from the computer science department retires/leaves.

Use the composite pattern to represent the part-whole hierarchy.

The output results will be as the following:

```
Console ☒
<terminated> CompositePatternEx [Java Application] C:\Program Files\Java\jre1.8.0_45\bin\javaw.exe (Nov 20, 2015, 1:51:21 PM)
***COMPOSITE PATTERN DEMO ***

The college has following structure

Dr.S.Som is the  Principal
        Mrs.S.Das is the   Hod-Math
        Mr. V.Sarcar is the  Hod-ComputerSc.
                Math Teacher-1 is the  MathsTeacher
                Math Teacher-2 is the  MathsTeacher
                CSE Teacher-1 is the  CSETeacher
                CSE Teacher-2 is the  CSETeacher
                CSE Teacher-3 is the  CSETeacher

 After CSE Teacher-2 leaving the organization- CSE department has following employees:
                CSE Teacher-1 is the  CSETeacher
                CSE Teacher-3 is the  CSETeacher
```

Exercise 3:

XML (Extensible Markup language) is a markup language for documents containing structured information. XML tags identify the data and are used to store and organize the data, rather than specifying how to display it like HTML tags, which are used to display the data. An XML is hierarchical in nature, it starts from an <? xml> tag which is the parent or the root tag, and it contains other tags which can be a parent or a child tag. Each tag has Start, End and Body information. The Following example shows a correctly formed XML document:

```xml
<?xml version = "1.0"?>
<class>
    <student>
       <firstname>Ahmad</firstname>
       <lastname>Youssef</lastname>
       <ID>LB1234</ID>
       <marks>85</marks>
    </student>
    <student>
       <firstname>Mark</firstname>
       <lastname>Ghostina</lastname>
       <ID>LB1235</ID>
       <marks>95</marks>
    </student>
</class>
```

Write a JAVA program to illustrate your use of the composite pattern to solve the problem and display the above example.