Bangladesh University of Engineering and Technology
Department of Computer Science and Engineering
CSE308: Software Engineering Sessional
July 2022 Semester

Assignment-3 on Structural Design Patterns

Problem-1 [7 marks]

In a spaceship, roaming from one galaxy to another galaxy, there are two types of passengers onboard. Some of these passengers are called **Crewmates** and the other passengers are called **Imposters**. Crewmates are the individuals who are studying the interstellar objects and sometimes, do basic maintenance tasks of the spaceship. On the other hand, imposters are actually space monsters, in disguise, who are attempting to sabotage this voyage by poisoning the crewmates and damaging the spaceship. Recently, some of the crewmates have started to notice strange behavior from some of the other passengers (who are imposters actually) while doing the maintenance tasks together. To avoid suspicion, imposters have developed a device which helps them damage the spaceship without looking “sus”picious.

Now, implement the above scenario by writing necessary classes and using *appropriate* design pattern. You need not take inputs from the user in the solution of this problem. But, you have to show the above scenario in one of your implemented classes by creating objects and calling methods.

Problem-2 [8 marks]

There is a small but cozy coffee place, named কফির টং, in your locality. This coffee shop offers four different types of cups of coffee including **Americano**, **Espresso**, **Cappuccino**, and **Mocha**. Americano is a type of *black coffee* prepared by adding additional grinded coffee beans to regular black coffee. Espresso also is a type of black coffee prepared by adding dairy cream to regular black coffee. On the other hand, cappuccino is a type of *milk coffee* prepared by adding cinnamon powder to regular milk coffee. Mocha also is a type of milk coffee prepared by adding chocolate sauce to regular milk coffee. As you may know, black coffee is prepared with water and grinded coffee beans whereas milk coffee is prepared with milk and grinded coffee beans.

কফির টং serves the coffee in their handmade fancy coffee mugs, each of which costs 100 taka. The amounts of grinded coffee beans and milk, if required, added to each cup of coffee cost 30 taka and 50 taka, respectively. Besides, the amounts of dairy cream, cinnamon powder, and chocolate sauce added to different types of coffee cost 40 taka, 50 taka, and 60 taka, respectively.

Now, implement the above scenario by writing necessary classes and using *appropriate* design pattern. You need to take orders from the customers, using console, who can place multiple cups of coffee in an order. For each such order, you have to output in the console the ingredients used in each cup of coffee as well as the price of individual coffee along with the total price for the order.

Problem-3 [10 marks]

Suppose that there are two types of personnel in a **Software Company** including **Project Manager** and **Developer**. A project manager leads and manages a group of developers to complete a software project. On the other hand, a developer applies technical knowledge and skill to implement a software product.

At a certain time, a software company can run multiple projects. But, project managers as well as developers are obliged to take part in a single project at a time. A software company is characterized by its name and total number of running projects. On the other hand, both a project manager and a developer are characterized by their name, role (either project manager or developer), and name of the project they are currently working on. Besides, a project manager keeps a list of developers working under his/her supervision in a project. Likewise, the software company keeps a list of currently running projects and their managers.

Now, implement the above scenario by writing necessary classes and using *appropriate* design pattern. Each component class must contain a method to show the details about an instance of that class. Also, each composite class must contain a method to show the hierarchy under an instance of that composite class. You may consider the following examples.

`manager_component.details():`
 	
`Name: Alan Turing`
`Role: Project Manager`
`Current Project: CSE308`
`Number of Supervisees: 2`
	`company_composite.hierarchy():`
	
	`- Manhattan Company`
	`  - Alan Turing (CSE308)`
	`  - Robert Oppenheimer`
	`  - John von Neumann`
	`  - David Patterson (CSE307)`
	`  - Alfred Aho`

You need to take input from the user, using the console, as required. Also, you need to create and remove an instance of any component class by strictly following the hierarchy. For example, in order to create a developer, you need to create a software company followed by a project manager first. Likewise, in order to remove a software company, you need to remove all the developers followed by all the project managers working in that company first.

Submission Guidelines

- Create a folder which is named after your 7 digit student ID.
- Place all the essential files inside the folder and then, zip that folder.
- Submit the zipped file to the corresponding submission link in Moodle by **11:55 p.m. on February 12 (Sunday), 2023**.