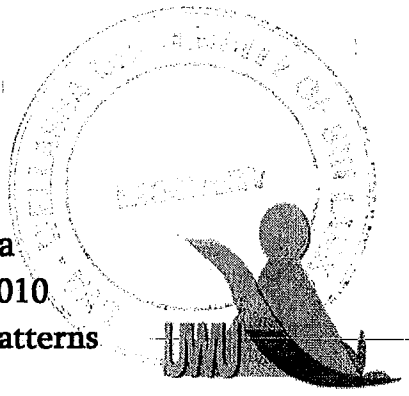

Uva Wellassa University, Sri Lanka
End Semester Examination – Dec/Jan 2010
CST463-3 Software Design Using Design Patterns
Time: Three (03) hours

Total 06 Questions from PART A and 01 Question from PART B. Answer **All** questions.
This is an Open Book Examination.

PART A

Follow each case study given below in question 01 to 06 and identify the design patterns you should use when implementing them. Justify your answers logically.

01) A company has planned to build a two-story office building and to equip it with the latest elevator technology. You are required to develop a simulator for the functions given below.

The elevator, which has capacity of one person, is designed to conserve energy, so it only moves when necessary. The elevator starts the day by waiting with its door shut on first floor of the building. The elevator, of course, alternates directions, first up and then down. Your simulator includes a clock that begins the day set to time 0 and that ticks once per second. The scheduler component of the simulator randomly schedules the arrival of the first person on each floor.

When the clock's time equals to the time of the first arrival, the simulator creates a new person for the specified floor, and places the person on that floor. The person then presses the button on that floor to summon the elevator. The person's destination floor is never equal to the floor on which that person arrives. If the first person of the day arrives at floor one, the person can immediately get on the elevator (after pressing the button and waiting for the elevator's door to open). If the first person arrives at floor two, the elevator proceeds to floor two to pick up that person. The elevator requires five ticks of the clock to travel between floors.

The elevator signals its arrival at a floor by turning on light above the elevator door on that floor and by sounding a bell inside the elevator. The button on the floor and the button in the elevator for that floor are reset, the elevator opens its door, the passenger (if there is one whose destination is that floor) gets out of the elevator, another passenger (if there is another waiting

on that floor) gets into the elevator and presses a destination button, and the elevator closes i door. If the elevator needs to begin moving, it determines in which direction it should go, a begins moving to the next floor.

Assume that all of the events that happen once the elevator reaches a floor, and until t elevator closed its door on that floor, take zero time. The elevator always knows what floor it on and what floor it is going to. At most, one person can be waiting on each floor at any tim so if a floor is occupied when a new person is due to arrive at that floor; the new arrival rescheduled for one second later. Assume that people arrive at random on each floor every 5 20 seconds.

(15 marks)

02) Diabetes is a medical condition where the body does not manufacture its own insulin. Insulin used to metabolize sugar and, if it is not available, the person suffering from diabetes wi eventually be poisoned by the build-up of sugar. It is important to maintain blood sugar level within a safe range as high levels of blood sugar have long-term complications such as kidne damage and eye damage. These are not however, normally dangerous in the short-term. Ve low levels of blood sugar (hypoglaecemia) are potentially very dangerous in the short-ter They result in a shortage of sugar to the brain which causes confusion and ultimately a diabet coma and death. In such circumstances, it is important for the diabetic to eat something increase their blood sugar level.

Most diabetics are currently treated by injections of insulin 2 or 3 times a day but this leads peaks and troughs in their level of insulin. A portable insulin pump measures the level of bloo sugar at regular intervals and delivers doses of insulin depending on the actual level of sugar i the blood. This will lead to a situation where the sufferer's blood sugar levels are much clos to those of people without diabetes. The complications and long-term effects of diabetes ca therefore be reduced.

The system measures the level of blood sugar every 10 minutes and if this level is above certain value and is increasing then the dose of insulin to counteract the increase is compute and injected into the diabetic. The system can also detect abnormally low levels of blood sug and, if these occur, an alarm is sounded to warn the diabetic that they should take some action

This case study focuses on the control software for the insulin pump which is concerned with reading the blood sugar (glucose) sensor, computing the insulin requirements and controlling the micro pump which causes the insulin to be delivered. As it is impractical to build such a device in a course, students are asked to develop a simulator for it which allows the control software to be tested.

(15 marks)

03) An automated ticket-issuing system sells rail tickets. Users select their destination and input a credit card and a personal identification number. The rail ticket is issued and their credit card account charged. When the user presses the start button, a menu display of potential destinations is activated, along with a message to the user to select a destination. Once a destination has been selected, users are requested to input their credit card. Its validity is checked and the user is then requested to input a personal identifier. When the credit transaction has been validated, the ticket is issued.

(05 marks)

04) Consider a retail bank which collects money from customers and in return gives them an interest at pre determined rate. Our objective is to automate this process of interest calculation.

The system developed should calculate interest daily for each account having balance more than zero at the correct interest rate. This interest calculated will be cumulatively stored in a table which will be updated every day. Remember that the balance on which interest is calculated daily will change because the customer may deposit or withdraw money.

Every month the cumulative interest calculated will be credited to the customer. After this point of time the cumulative interest stored should be set to zero because the customer has benefited for the period specified.

Before interest is credited to the customer's account tax should be debited from the interest according to prevalent government laws.

(05 marks)

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05) Miles Acquisition System (MAS) is a Web based application for a particular Airlines company. This application facilitates registering, updating, and utilization of miles for a Frequent Flier of its flights. The frequent flier should be able to login and key in all the details of his travel in their airlines. The application is accessible for the frequent fliers from the existing website of the airlines

(05 marks)

06) Medication Packaging Systems Australia (MPS) provides a specialized service to Pharmacy and Aged Care Facilities. Through advanced technologies and manufacturing systems they produce multiple Dose Administration Aids and medication for the aged. Their product vastly improves drug compliance and streamlines efficiencies within the Pharmacy and Aged Care Facility. Through their network of clients they are the largest supplier of medication and packaging to the aged in Australia. They pack over 3,000,000 medications per month, supplying tens of thousands of patients around Australia their essential daily medicines.

MPS required the development of an online software application and eHealth portal fulfilling the following requirements:

- Maintain the entire up-to-date database of PBS medicines, with photographic image and drug description.
- Maintain an interactive administration module.
- Incorporate a full billing system.
- Communicate with various technologies, including automated manufacturing machines, pharmacy point of sale systems, doctor prescribing software, and inventory systems.
- Have permission based authentications to allow all health professionals – doctors, nurses, pharmacists, and MPS personnel – to work in real time on a patients file.
- Full batch tracking and audit facilities.

The resulting product, Health stream, is the flagship product in the industry.

(10 marks)

PART B

01. Select one of the case studies given in question number 01 or 02 from PART B and implement it using the design pattern(s) you have identified. Comment your java files to show the places you are using design patterns.

(45 marks)