Object-Oriented Analysis and Design
Final Exam, Spring 2016

Date: May 24, 2016 **Marks: 90** **Time: 180 mins.**

Section _____ Roll No. _____ Name_____

Note for Invigilators: Students are allowed to use a double-sided, hand-written, A-4 size help sheet.
Note for Students: Solve the exam on this question paper. Do **not** submit answer sheets.

Question 1 (Max. Marks = 15)

For each of the questions given in the table below, provide a short (i.e. no more than three words) answer.

S#	Question	Answer
1	Which type of an event in a state diagram is caused by the satisfaction of a boolean expression?	
2	Which UML diagram depicts the behavior of an object?	
3	Which type of use case (UC) cannot be used directly by an actor in a UC diagram?	
4	Which type of UC relationship adds incremental behavior to a UC?	
5	Which of the three models (i.e. class, state, and interaction) describes the static structure of a system?	
6	Which of the three compartments of a class in a class diagram is not included while drawing objects in an object diagram?	
7	Which characteristic distinguishes an object from the other even though two may have identical state?	
8	Which type of feature visibility (access specifier) in a class diagram allows methods of the descendants of the containing class to access those features?	
9	What is an association between two objects of the same type called?	
10	Which type of class cannot contain abstract operations?	
11	Which UML 2 element lets you organize and partition large models so that the readers can more readily understand them?	
12	Which type of patterns are concerned with algorithms and assignment of responsibility between objects?	
13	Which type of patterns use inheritance to describe algorithms and flow of control?	
14	Which type of design patterns describe ways to assemble objects?	
15	Which two major elements of the object-oriented paradigm are used by almost all design patterns?	

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Question 2 (Max. Marks = 10 + 20 = 30)

Consider the dispense feed use case of an automatic bird feed dispensing system (ABFDS) that automatically dispenses the right bird feed (food and water) upon the press of a button. When the user presses the button, a message is sent to the bird feed controller to dispense feed. The type of feed dispensed depends on three factors i.e. time, temperature, and feed plan. The bird feed controller sequentially retrieves time from the time controller, temperature from the temperature controller, and feed plan from the feed plan controller. During hours of darkness (i.e. between 7 pm and 5 am), only water is dispensed using the water dispenser. Similarly, during day time (i.e. when it is not dark), if temperature is extremely hot (i.e. more than 40 °C) only water is dispensed using the water dispenser. If temperature is not extremely hot during the day time then, first, water is dispensed using the water dispenser. Once the water has been dispensed, the food is dispensed using the food dispenser. The type of food dispensed by the food dispenser depends on the feed plan. If the feed plan is set to "frugal", seeds are dispensed by the food dispenser after retrieving them from the seed tray. Otherwise, the food dispenser sequentially dispenses one fruit retrieved from each fruit tray.

Without making any assumptions, use only the information provided above to answer the following two parts of this question.

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a. Model the dispense feed use case using a UML 2 **swimlane activity diagram**.

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b. Model the dispense feed use case using a single detailed design-level UML 2 **sequence diagram**.

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Question 3 (Max. Marks = 20 + 10 + 10 + 5 = 45)

Consider FASTGift - a web application used to send gifts to your contacts on occasions like birthdays, etc. Application provides a list of gift items that can be sent, such as flowers, cakes, etc. Each gift item has a price. Some gift items are bundle items that combine multiple items into a single item and are offered at a discounted price (e.g. both flowers and cake in a single bundle). Price of a bundle item is the sum of price of all the constituent items, less the discount (specified in percentage). A customer places an order and includes as many items as desired. For each item ordered, quantity needs to be specified. Before the order is placed, application calculates the total order price, taking into account each gift item and its ordered quantity. After the order is placed, both the customer and order fulfillment staff are notified. Customer is notified through email. Order fulfillment staff is notified through a special GUI that lists all pending orders in a First-In-First-Out queue.

a.. Using only the information provided above, develop a complete design-level class diagram of FASTGift by using the following abstractions: Bundle, Customer, Email, GiftItem, Order, OrderItem, and OrderQueue. Your design class diagram must show all relevant attributes, operations, and relationships. It is compulsory to use and explicitly mention all relevant design patterns in your design class diagram (you may add additional classes for this purpose).

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b. Write complete C++ code for the Bundle class (assume there is no separate header file).

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c. Write complete C++ code for the Order class (assume there is no separate header file).

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d. Write complete C++ code for the OrderQueue class (assume there is no separate header file).