



McGill

December 2015
Final Examination

Software Development

COMP-303

December 9, 2015 at 9:00 – 12:00

Examiner: Joseph Vybihal

Assoc Examiner:

Student Name:		McGill ID:											
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INSTRUCTIONS:

- This is a **CLOSED BOOK** examination.
- You are permitted **TRANSLATION** dictionaries **ONLY**.
- **STANDARD CALCULATOR** permitted **ONLY**.
- This examination is **PRINTED ON BOTH SIDES** of the paper
- This examination paper **MUST BE RETURNED**
- You are permitted to write your answers in either **English or French**
- Write your answers in the **exam booklet** providedd
- Attempt all questions, **part marks** will be assigned, show your work.

NOTE: THIS SAMPLE EXAM IS FROM A WHILE BACK AND THE COURSE IS A LITTLE DIFFERENT FROM THAT TIME. I EDITED THE PROBLEMS TO MAKE THEM MORE RELATED TO HOW WE DID THE COURSE THIS TERM.

Question 1: Threads and Locks

Class Count contains three private integer variables named: one, two and three. There is a public void method called void action(int programID). The variable programID either has the value 1 or 2 or 3. If the value is 1, then private variable one is incremented. If the value is 2, then private variable two is incremented, etc. The method action(int programID) performs no action when the sum of the three private variables is greater than or equal to 30.

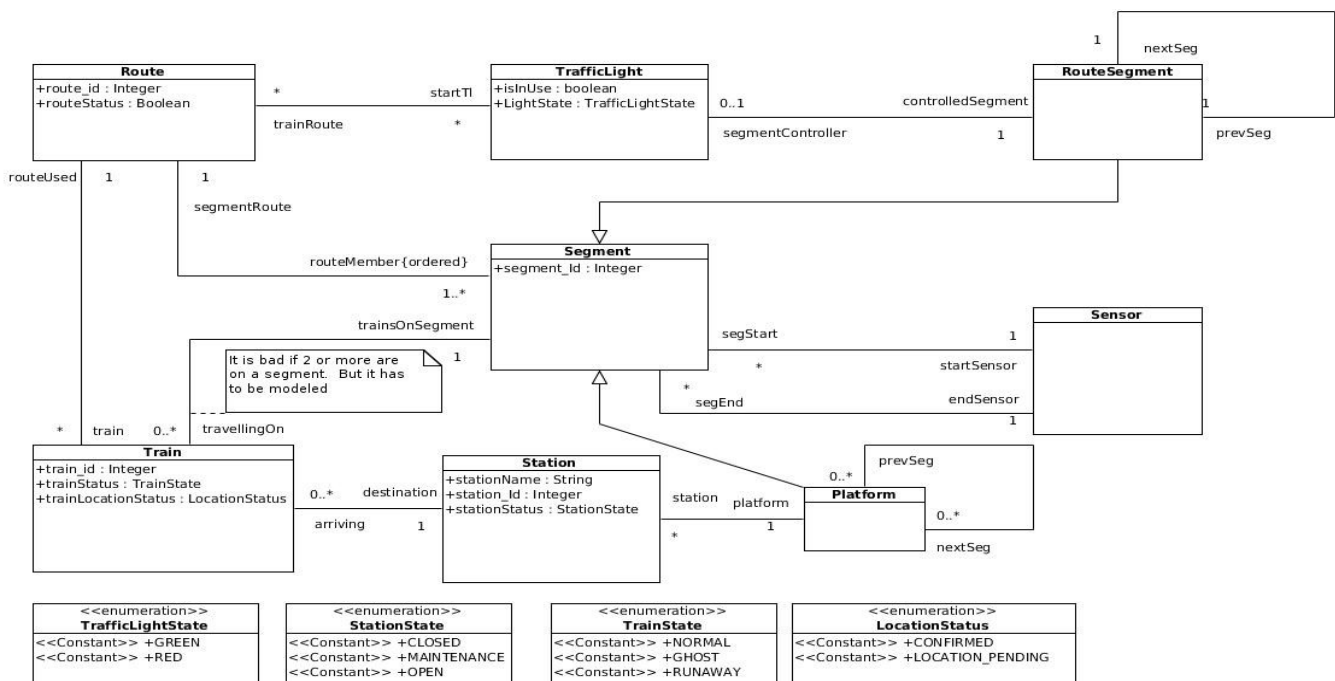
Class Count has a second public method called String results() that returns a String formatted as follows: "One=###, Two=###, Three=###"; where ### is the value stored in the respective variable.

Write a main method that launches three threads that each call action(). The first threads called action(1), the second thread calls action(2) and the last thread calls action(3). This will be a race to see who gets the highest count.

The main method ends when the sum of the three variables is greater than or equal to 30. The threads will need to terminate themselves. The last thing main() does is to call the results() method, displaying the result to the console.

Question 2: Class Diagram

- (1) Provide a detailed interpretation for this class diagram
- (2) Provide an interpretation for the nature of the line-arcs: aggregation or composition, or something else? You can write over top the arcs in the exam paper.



Question 3: Sequence Diagram

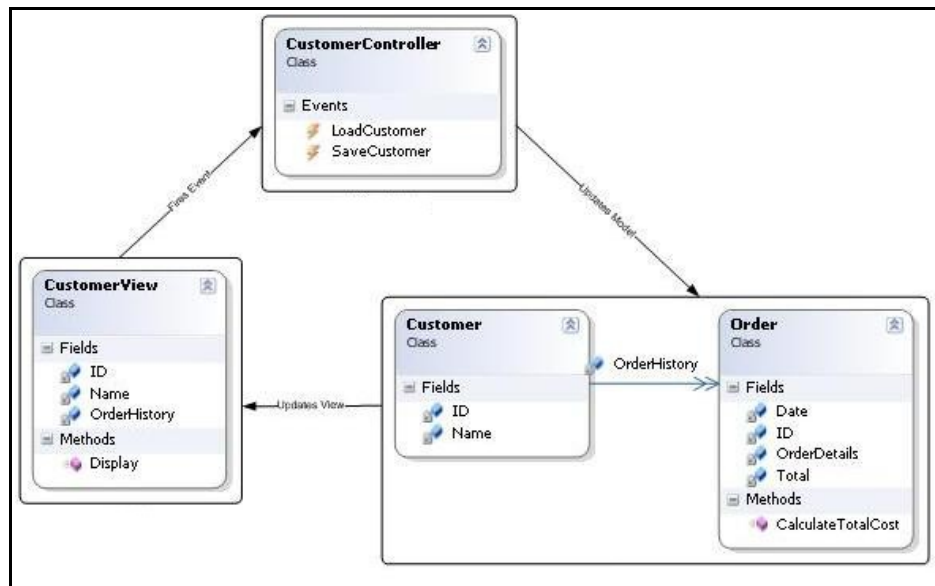
Draw a use Sequence diagram for this problem:

Company ABC wants a program that tracks their employee hours. Their employees are not on a fixed salary but are instead paid by the hour using a computerized punch card system. These are the rules of the punch card system: when employees arrive to work they punch in and the date and time are recorded in a database; when an employee leaves work they punch out and the date and time they punched out is recorded in the database. To punch in or out the employee enters their employee ID number and then presses a single on screen button labeled PUNCH. The system automatically figures out if it needs to punch IN or punch OUT the employee. Employees are supposed to punch out during lunch time. If an employee forgets to do this, at the next punch out the system will automatically assume a 30 minute lunch and adjust the time accordingly. Employees do not work past 5 pm, the latest. They normally finish work at 4:30. If an employee forgets to punch out at the end of the day then at the next punch out the system automatically adjusts the time and punches them out at 4:30 pm, for the previous event. Employees would like to see their hours for the day. There is a second button on the UI called Show My Time. It asks for the employee ID and then displays the hours they worked for that day.

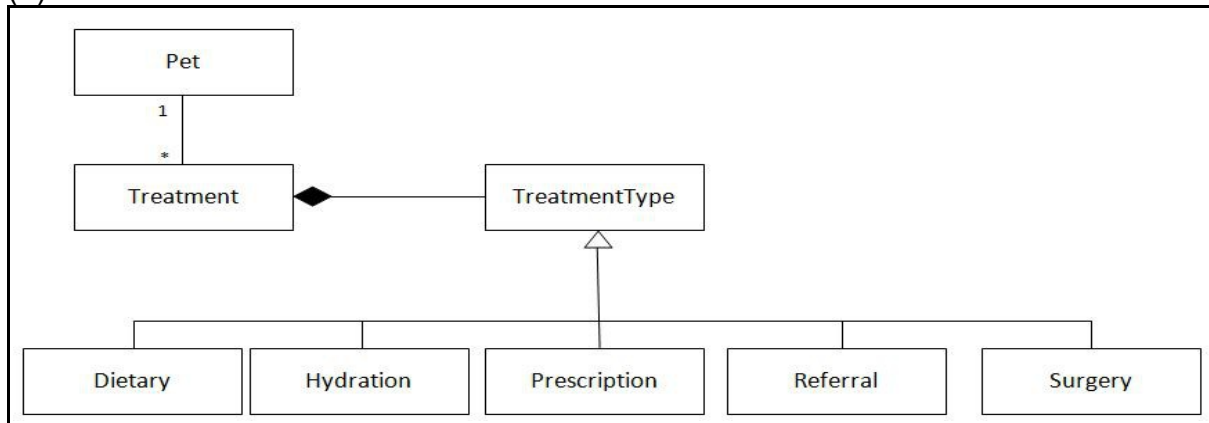
Question 4: Design Patterns

Identify each of the following design patterns:

(1)



(2)



(3) Draw a domain model for the Proxy design pattern.

Question 5: Well-formed Objects

Draw a class diagram for the following problem. Make sure it implements well designed principals and at least two design pattern.

Students in school Royal Blue come in two forms: full time and part time. Generally these two types of students are identical except for the maximum number of courses they are permitted to take. Full time students must take between 4 to 6 courses per semester. Part time students must take between 1 to 3 courses per semester. These enrollment limits are strictly monitored. The following information is kept per student: name, student ID, history of courses taken (as references to course objects), and history of course grades (as an array of course number and final grade pairs).

In your answer identify all major class variables and method signatures.

Question 6: Generic Types

Redo question 5 using Generic Types.

Note: We can generalize this problem, for example: School could be replaced by Club, Event membership, etc. Students could be different membership types, different users, etc. Courses could be seminars, events, tasks, etc. A grades could be awards, points, collection sizes, etc..

First find a general name for each class (replacing the existing names but maintaining the analogy) and then provide a generic type expression (where needed) to create a strong contract.

Instead of redrawing the diagram (you may if you want), write the generic type expressions and indicate where they should be placed.

Question 7: The Object Type

Write a method `dumpClass` that prints out the name of a class (including its package name), its superclass, and all of its constructors, methods, and fields, including parameter and field types and modifiers (such as `static` and `final`). Format the output to look as much as possible like a class definition. The input to the method should be either the `Class` object that describes the class or an object of the class.