Name: ________________________________    Student Number: ________________

1. What are the stereotype types in the analysis model? Give the UML notation for each of these [6 pts]

2. Give at least two examples of stereotype types in the design model and the UML notation for these [3 pts]

3. (a) Given the following code, draw the UML class diagram [1 pts]:
   // Car belongs to the Automobile package/namespace; Engine to Parts.
package Automobile;
import Parts.*;
class Car {
    private Engine theEngine;
    public Car(Engine anEngine) {...}
    ...
};

class Engine {
    private int power;
    public int getPower()...
    ...
};

(b) Derive (show how you get these values) the value of I (the Instability value), the value of A (the Abstraction value) and the value of D’ (normalized distance from main sequence = |A + I - 1|) for each package. Plot these values for the two packages on the graph of A vs. I (I on x-axis). What is the average D’ value of the code above [4 pts].

Please answer only in the space provided under each question for each question.      1 of 5
(c) Now, draw a UML diagram showing your redesign. Feel free to add other packages, classes and interfaces/abstract classes, if necessary [4 pts]

(d) Derive the value of I, A and D’ for each package in your design. What is the average D’ value of your code [4 pts]?

(e) Apart from reduced D’ value, is there any benefit to your design? What principle was used in your redesign? Explain the principle used [4 pts]?

4. If you find that two packages have a cyclic dependency between them, what are the options you would consider to break their cyclic dependencies [3 pts]?
5. Give a partial code example, in Java or C++, where using RTTI will be a violation of OCP and an example where using it will not be considered to be a violation of the same principle [6 pts].

6. Given the class
   class PoorConditions extends Exception {}
   class FlatTire extends Exception {}
   class Vehicle {
       public void drive() throws PoorConditions {...}
   }
   class Car extends Vehicle {
       public void drive() throws PoorConditions, FlatTire {...}
   }

   If a Java compiler would compile this code without error (it does not, but assume it does), what would be the problem. Explain with an example of situation where this would be a problem, and mention the principle that would be violated [5 pts].
7. A program will display the current time of the system in digital format (numbers). The clock will let the user set an alarm that will simply pop up a message box at the set time. The alarm may be set for a specific time instant or a repeat each day at that set time. When an alarm pops up, it stays on the window until the user clicks OK on the message box. Draw a use case diagram, write the flow of events, draw the collaboration diagrams and the class diagrams for your System State any assumptions you make. [10 pts]