**CS-224: Object Oriented Programming & Design Methodologies**

**Midterm Exam II– A- Fall 2017**

**Instructor: Ms. Asma Sanam Larik**

**Dated: 1st Nov** 2017 **Time:** **80** mins

**Note:**

* **Please read the question paper thoroughly**
* **I expect you invest 40 minutes on each question**
* **Maximum OOP techniques should be utilized**

**Q1)** University lecturer may obtain from a library a loan of textbooks. A library has a collection of books containing name and ISBN number. Every lecturer has a name and a list of books borrowed. Books can be reference that is issued only for 7 days or text books that can be issued for the entire semester. Construct a UML diagram of this system and write complete C++ code showing how a lecturer could ask for display of books in the library, borrow a book and return a book (checking if some fine needs to be implemented in case of late returns). Lecturers should also be able to display the books they have out on loan. Use polymorphic references wherever you can.

**Marks Distribution: Classes Identification + Implementation : 4 marks**

**UML diagram on paper complete: 3 marks**

**Working code with driver class : 3 marks**

**Q2)** Suppose you have a linked list of integers, implement the following functions: **[5]**

* **void InsertSort():** Inserts a single elements in its correct sorted position (Note: It can be ascending or descending)
* **int CountList() :** It returns the number of elements in the list
* **void DeleteList():** It deletes the entire list and makes head pointer null
* **void Reverse():** A recursive code that reverses the entire list
* **void RemoveDuplicates():** It removes any duplicates found

---------------------------------------------- Good Luck ☺-----------------------------------------

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**Note:**

* **Please read the question paper thoroughly**
* **I expect you invest 40 minutes on each question**
* **Maximum OOP techniques should be utilized**

**Q1)** A rental car company has several cars. Each car has a unique registration number, model name and year of registration. Cars may be hired out to a customer registered in the company. The customer can be a business class or economy class. Business class customers hire cars that are expensive and also request a driver while economy class customers rent less costly cars. Each customer has a name and a unique number associated with him or her. You are required to construct a UML diagram for the above scenario and write complete C++ code with all the classes and driver program to execute it. Use polymorphic references wherever you can.

**Marks Distribution: Classes Identification + Implementation : 4 marks**

**UML diagram on paper complete: 3 marks**

**Working code with driver class : 3 marks**

**Q2)** Suppose you have a linked list of characters that acts as a postfix expression. A simple example is the postﬁx expression **[5]**

1 2 3 \* +

You need to implement the following functions in your linklist class:

* Take postfix expression as input validate that all symbols come after digits
* Valid Symbols would only be (+,-,\*,/) and digits (0-9)
* Evaluate the expression using stack class as follows:

When a digit is seen, it is pushed onto a stack. When an operator is seen, two numbers are popped from the stack, the operator is evaluated, and the result is pushed back onto the stack.

* Display the result obtained after evaluation and that would be the answer on the top of the stack

-------------------------------------------- Good Luck ☺-------------------------------------------