Object-oriented Analysis and Design
Sessional 1, Fall 2015

Date: September 16, 2015 **Marks: 60** **Time: 90 mins.**

Section _____ Roll No. _____ Name_____

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

Question 1 (Max. Marks = 20 = 10 + 10)

a. Use a UML 2 analysis class diagram to depict the relationship between the following concepts: association, binary association (between two entities), ternary association (among three entities), n-ary association (among n entities), inheritance, single inheritance, multiple inheritance, aggregation, and composition. Treat each concept as a class. Show only the class name compartment.

b. Use a UML 2 analysis class diagram to depict the relationship between the following concepts: feature, attribute, and operation. Both attributes and operations / functions are basically features. Treat each concept as a class. Show the first two compartments (i.e. class name and attribute) for each class. You have to specify appropriate attributes for each class.

Question 2 (Max. Marks = 20)

Consider a final year project (FYP) management system. A FYP is undertaken by a team, advised by a faculty member, and evaluated by a committee. A team must undertake exactly one FYP. Every team works, presents, and procrastinates. A faculty member has a name and rank and can advise up to 5 FYPs. All faculty members teach, grade, and do research. Every FYP has a title, domain, and start date. All committees attend presentations and assign grades. A committee evaluates many FYPs and is composed of exactly three faculty members. A faculty member must be a part of at least four committees. FYPs are of only two types i.e. development and research. For every development FYP, technology must be specified while, for every research FYP, research paper title must be provided. Each team has a unique registration number. A team consists of at most three and at least two students with one being the team leader. A student cannot belong to more than one team. Every student has a name and roll number and is enrolled in a program. Every program has a name and duration and it enrolls at least 50 and at most 100 students.

Without making any assumptions, use the space provided below to model just the information provided above about a FYP management system using a UML 2 analysis class diagram.

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Question 3 (Max. Marks = 20)

Consider a simple spreadsheet application that has following abstractions:

- **Cell:** Cell represents a location in spreadsheet. It has a 1 – 1 association with Value. It contains a function *evaluate* that results the final computed value of Cell as an integer.

- **Value:** Value represents a value assigned to a cell. It is an interface and has an abstract (pure virtual) function *result* that returns an integer. Value may be of several types as Literal, Function etc.

- **Literal:** Literal is a Value containing a simple integer

- **Function:** Function is a Value that represents the result of carrying out some operation on a list of integer type parameters. Function itself is an abstract class having no implementation for the abstract *result* function it inherits from Value.

- **Sum:** Sum is a Function that represents a summation operation. It is a concrete class.

You are given the following main function as an illustration

```
Cell* cell = new Cell();

Literal* literal = new Literal(10);
cell->setValue(literal);
cout << cell->evaluate() << endl;     // prints 10

Function* function = new Sum();
function->addParameter(10);
function->addParameter(20);
cell->setValue(function);
cout << cell->evaluate() << endl;     // prints 30
```

Provide C++ code for the abstractions given above that can help us write the above main function and get the desired results.