University of Central Punjab

**Faculty of Information Technology**

# Object Oriented Programming

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| **Lab 13** | |  |
| **Topic** | Pure Virtual functions, Abstract Classes, Diamond Problem & Polymorphism |
| **Objective** | The basic purpose of this lab is to implement the concept of virtual functions and function overloading and Polymorphism. |
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**Instructions:**

* Indent your code.
* Comment your code.
* Use meaningful variable names.
* Plan your code carefully on a piece of paper before you implement it.
* Name of the program should be same as the task name. i.e. the first program should be Task\_1.cpp

**Students are required to work in multiple files i.e .h and .cpp**

**Task 1 (CP):**

Your task is to think of 3 hierarchies in which you will be facing the diamond problem. Design a diagram (like shown in task 2) and submit a word file.

**Task 2:**

Create an abstract class **Shape** and two additional classes (each derived from Shape) named **Rectangle** and **Triangle**. The member attributes and functions for each class are given below:

**Shape:**

private:

int width;

int height;

public:

virtual int Area() = 0;

void setHeight(int h);

void setWidth (int w);

**Rectangle:**

public:

int Area(); //width\*height

**Triangle:**

public:

int Area(); //(width\*height)/2

**Task 3:**

Create the following hierarchy of classes

Person

Faculty

Student

TA

Person class has the following attributes:

* Name
* Age

Student class has the following attributes:

* Degree
* CGPA

Faculty class has the following attributes:

* Department\_Id

TA

* Course\_id

Think and decide the data type of each object yourself. Create appropriate parameterized constructors and destructors for each class. In each Constructor display the statement

“class\_name constructor called”

Example:

For Person class’s constructor display   
Person constructor called.

Do the same for all the destructors.

1. In your main function only create an object of TA and pass the course\_id in the parameterized constructor. All the constructors called due to the creation of TA should also be called.

**Note: Ideally each class’s constructor should only be called once, in case your program calls the person constructor twice, you are facing the diamond problem.**

1. Once you resolve the diamond problem create appropriate setters and getters for each attribute and finally create display function in TA which should display all the information of the TA.