MCA I Sem. (2017-20 Batch)
Sub: Programming and Object Oriented Concepts using C++
End-Term Exam

25th November, 2017

Duration: 3 Hrs
Max. Marks: 50

Note: Question Number 1 is compulsory. Answer any 3 questions out of the remaining 4 questions.

1.a) Students and staff often have to wait during the peak lunch and snacks time in college canteens. Two colleges, **Aryabhatta** and **Chanakya** participated in an experiment testing customers' satisfaction with waiting times in the queue. The experiment produced the following data :

Waiting times of college students at their respective canteens [in minutes] :

Aryabhatta : 5.5, 5.6, 4, 6.1, 6.3, 7, 5.3, 6, 6.5, 5
Chanakya :   4.5, 6, 3, 5.1, 5.3, 6, 4.3, 5, 5.5, 4

Write a program to analyze the waiting time situation for these two colleges based on the results in the table above, and :
i)   Design two classes **Aryabhatta** and **Chanakya** with functions to input the values.
ii)   Add functions to calculate **standard deviation** and **mean**.
iii) Write a main function to demonstrate the classes and show the results and **determine which college canteen is more efficient**.
iv)   You may add any other functions you deem fit.

[Note :] Standard deviation = square root of variance.
    variance = sum of ((each data value – mean of all the values)^2 divided by no. of data values

1.b) How does **function overloading** differ from **function overriding** ?   **[20 Marks]**

2.a) Create a **Multilevel inheritance hierarchy** for the Point – Circle - Cylinder classes. Class Point will have x and y as float coordinates, class Circle will have an int radius and class Cylinder will have int height as its private data member. class Circle will have an additional method called area() which returns the area of the circle. class Cylinder will have two additional methods, area() which returns the area of the cylinder, and volume() which returns the volume of the cylinder.

Have the necessary constructors and show functions in the entire hierarchy with *cascading calls for constructors*. Write your own client code demonstrating the entire hierarchy and invoking all the functions. **Hint :**

area of cylinder : (2 * (PI * r^2)) + (2 * PI *r * h)
volume of cylinder : (PI * r^2) * h

(Note : Do not create virtual functions. Plain Multilevel Inheritance)

2.b) Write a note on exception handling. **[10 Marks]**

3.a) Create a **class String** and demonstrate the following methods using the overloaded operators :
i)   Copying one string to another (overloading =)
ii)   Concatenating one string to another (overloading +=)
iii)   Comparing two strings for equality (overloading ==)

Also write a simple client code to demonstrate the class. You may take a fixed length string.

3.b) Explain **new** and **delete operators** with examples. [10 marks]

4.a) Write a program to demonstrate **container classes** (also known as **Embedded** or **composite** classes). Have three classes: **Date**, **Address** and **Student**. Class **Date** will have day, month and year; class **Address** will have street Name, city and state; and class **Student** will have regno, name, DOB, contact. DOB will be an object of the **Date** class and contact will be an object of the **Address** class. Write a driver program to demonstrate the container class **Student** where a *Student object is populated via cascading constructors*.

Note, that classes **Date** and **Address** will have only the constructors and print() functions.

4.b) Explain the need for a **copy constructor.** Also give with an example. **[10 marks]**

5.a) What are **virtual functions** ? How do they help in run-time polymorphism ? Give an example with a client code demonstrating the virtual calls.

5.b) How do **static** data members differ from non-static data members ? **[10 marks]**

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