



**National University**  
of computer and emerging sciences

**CL-1004**

**Object Oriented Programming-**  
**LabSpring' 2023**

**BS-SE**

**Lab Manual 11**

## **Problem 1:**

Write a class Point that has the following data members.

- X\_Coordinate: x coordinate of type integer
- Y\_Coordinate: y coordinate of type integer

The Point class has following member functions.

1. A default constructor that initializes the data members to zero.

Point()

2. A parameterized constructor that accepts the parameters for each member variable.

Point(int , int)

3. A copy constructor that takes a previously constructed object as an argument.

Point(const Point &p)

4. Write accessors for each data member.

int getX\_Coordinate() const

int getY\_Coordinate() const

Write a class Line that represents a line segment between two Points hence it composes Point class. The Line class has the following data members.

Point\_1: a point P1 of type Point

Point\_2: a point P2 of type Point

The Line class has the following member functions.

Note\*: Use member initializer list for all constructors.

1. A default constructor that initializes the coordinates of 2 points to 4,6 and 2, 4.

Line()

2. A parameterized constructor.

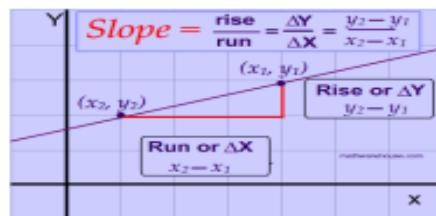
Line(int x1, int y1, int x2, int y2)

3. A copy constructor that takes two previously constructed Point objects as argument.

Line(const Point &p1, const Point &p2)

4. A member function findSlope that returns the slope of the length.

float findSlope()



5. A member function findLength that returns the length of the line segment using distance formula.

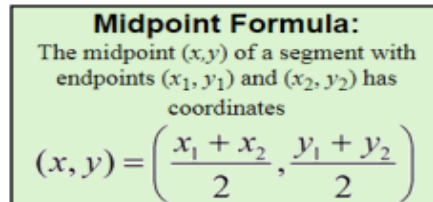
float findLength()

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

6. A member function findMidPoint that returns the midpoint of the line segment.

In this function you have to create a pointer of type Point, dynamically allocate memory to the pointer, set midpoints and return it.

Point\* findMidPoint()



**Midpoint Formula:**  
The midpoint  $(x, y)$  of a segment with endpoints  $(x_1, y_1)$  and  $(x_2, y_2)$  has coordinates

$$(x, y) = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

## **Problem 2:**

You are hired by a Garage owner to design a Garage Management System (GMS). To avoid the Traffic jams, your GMS will tell the new customers coming to the garage at the garage entrance that how many places are left in the Garage and whether there is place for their car in the Garage or not (Your GMS will also be conveying this information to Garage owner). To design this Garage Management System, you will write two classes:

Car and Garage class. Details of the functionalities desired by these classes shall be derived from the GMS requirements.

Write a class named Car having following data members.

- ☐ make of type string
- ☐ carModel of type string
- ☐ regNo of type string
- ☐ year of type int

Car Class will provide following interface.

1. Write a default constructor.

Car()

2. Write parametrized constructor to initialize the attributes of car.

Car(string m, string c, string r, string y)

3. Write getters and setters for car class.

Now write class Garage of your GMS having the following attributes

- name of type string

- index of type int that holds the value of occupied slots.
- capacity of type int
- Array of objects of Car class with maximum size equals to capacity.

Provide following functionality/interface for Garage class

1. Write a default constructor for class Garage to initialize its attributes. Initially consider that the Garage has capacity of 10 cars.

Garage()

2. Write a parametrized constructor for class Garage to initialize its attributes.

Garage(string n, int i, int c)

3. bool IsEmpty (): Returns true if garage is empty and false otherwise.

4. bool IsFull (): Returns true if garage is full and false otherwise.

5. bool Push (car c): Implement this function to park a new car c in garage, considering that the garage is not full.

6. bool Find (string reg): Function should return true if the car is parked in garage and false otherwise.

7. bool Remove (string reg): Function should remove the car object from garage having reg\_no equals to the one given in the parameter. Returns true if car is successfully removed and false otherwise and display messages accordingly.

8. void Display (): Displays all cars parked in garage currently.

### **Problem 3:**

A university owns various departments (e.g., CS, Electrical Engineering), and each department has number of professors. If the university closes, the departments will no longer exist, but the professors in those departments will continue to exist. Therefore, a University can be seen as a composition of departments, whereas departments have an aggregation of professors. In addition, a Professor could work in more than one department, but a department could not be part of more than one university.

Write a Class named Professor having following attributes:

- ☐ name of type string
- ☐ employeeID of type int
- ☐ designation of type string

Write a Class named Department having following attributes:

- ☐ name of type string
- ☐ deptID of type int

- ☐ Array profList of type Professor
- ☐ noOfProfessors of type int

Write a Class named University having following attributes:

- ☐ name of type string
- ☐ Array dept of type Department
- ☐ numberOfDepartments of type int

Write following functions.

1. Write appropriate getter setter of each data member for each Class.
2. Add/delete/update Department in University class
  - bool addDepartment(Department D)
  - bool deleteDepartment(string name)
  - bool updateDepartment(int id, string name) //Update name of department given department id.
  - void Display() function to display university information. Also display department information in this function.
3. Add/delete/update Professor in Department class
  - bool addProfessor(Professor p)
  - bool deleteProfessor (int id)
  - bool updateProfessor (int id, string newDesignation ) //Update designation of the professor given employee id
  - void Display() function to display department information. Also display professors information in this function.