

OBJECT ORIENTED PROGRAMMING I LABORATORY

Experiment # 6:

const Member Functions, const Data Members, Composition

QUESTIONS

We have examined const data members, const member functions and composition concepts in the course. Now, we will implement Triangle Class by using composition. The UML Class Diagram for Triangle Class is given in Figure 1. The Triangle Class composes Line Class. Similarly, the Line Class composes the Point Class.

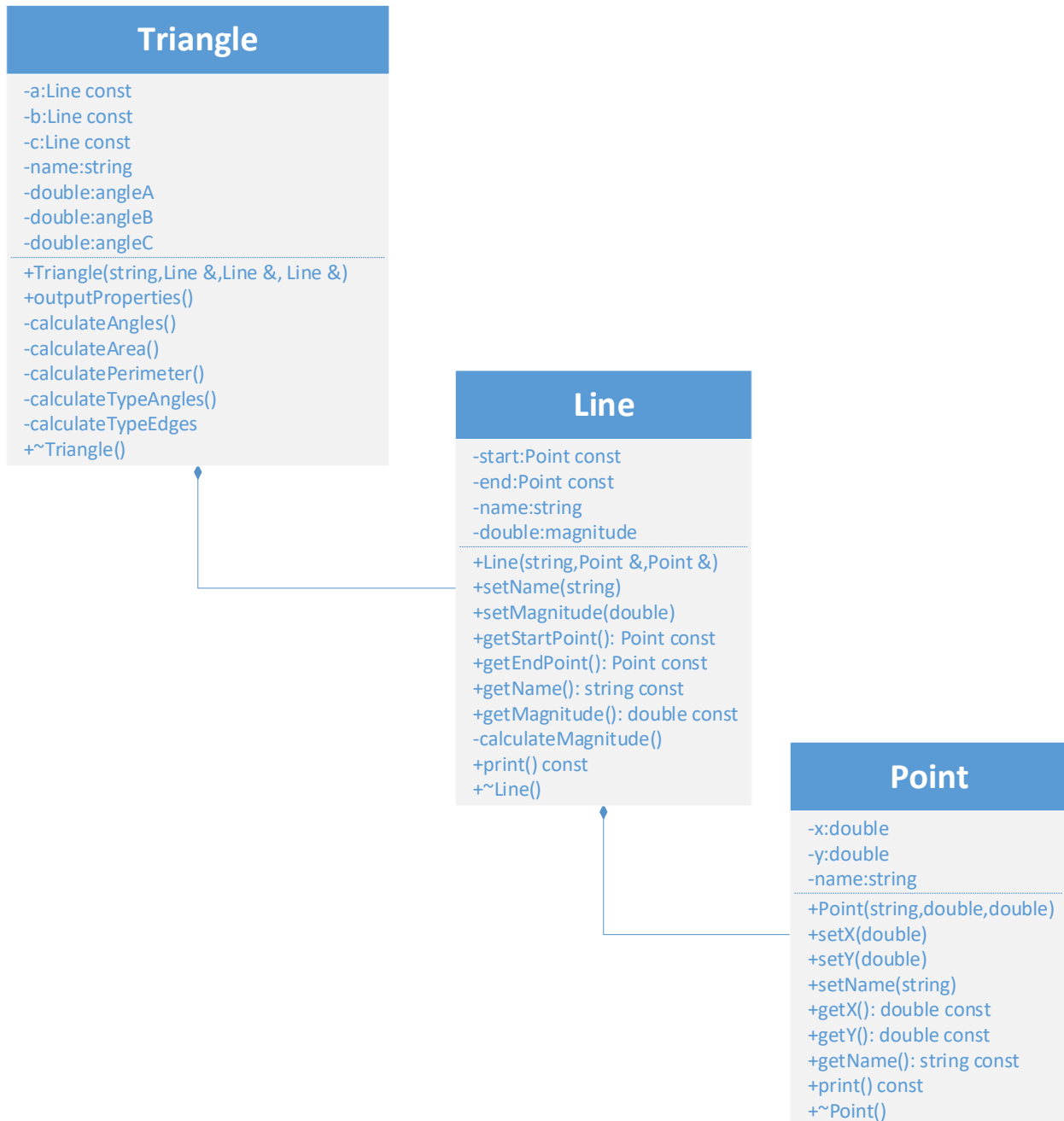


Fig 1. UML Class Diagram for Triangle, Line and Point Classes

Point Class

- i) The constructor of the class is default constructor with values 0.0 for x and y. **In constructor, use set functions and print the object name.**
- ii) In print function, print the point in the following format **name(x , y)**.

Line Class

- i) In constructor, use member initializer (:) and print the object name. Call *calculateMagnitude* function.
- ii) In print function, print the line in the following format
SP(x,y) ----- EP(x,y)
- iii) Include *calculateMagnitude* function, **calculate** and **print** magnitude of the line segment. Use following formula:

$$|L| = \sqrt{(s_x - e_x)^2 + (s_y - e_y)^2}$$

(Hint: Include **cmath** to use math library functions)

Triangle Class

- i) In constructor, use member initializer (:) and print the object name.
- ii) In *outputProperties* function, call *calculateAngles*, *calculateArea*, *calculatePerimeter*, *determineTypeAngles*, *determineTypeEdges* functions.
- iii) In *calculateAngles* function, use following formulas to calculate angles of the triangle. Angles must be **in terms of degree**. Print the angles.

$$\text{angleA} = \cos^{-1} \left(\frac{b^2 + c^2 - a^2}{2bc} \right)$$

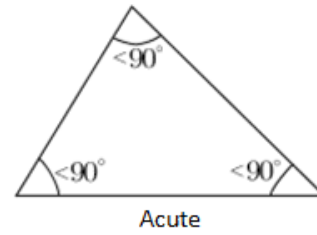
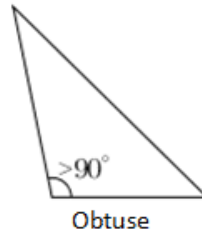
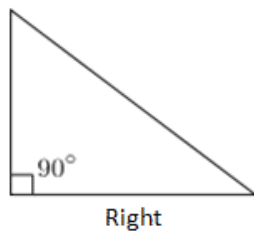
$$\text{angleB} = \cos^{-1} \left(\frac{a^2 + c^2 - b^2}{2ac} \right)$$

$$\text{angleC} = \cos^{-1} \left(\frac{a^2 + b^2 - c^2}{2ab} \right)$$

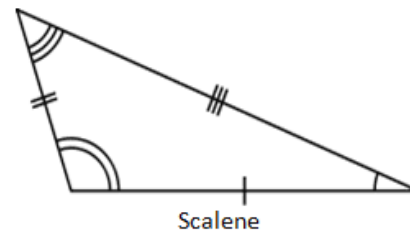
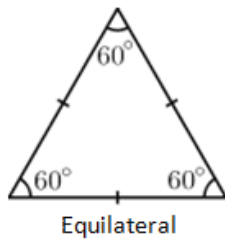
- iv) In *calculateArea* function, use following formula to calculate area of the triangle. Print the area.

$$\text{area} = \frac{1}{2} ab \sin(\text{angleC})$$

- v) In *determineTypeAngles* function, use following definition to determine type of the triangle in terms of angle. Print the type.



- vi) In *determineTypeEdges* function, use following definition to determine type of the triangle in terms of edge. Print the type.



Test your program with following driver program.

```

8  main()
9  {
10     const Point A("A",6,6+4*sqrt(3));
11     A.print();
12     const Point B("B",2,6);
13     B.print();
14     const Point C("C",10,6);
15     C.print();
16
17     const Line a("a", B,C);
18     a.print();
19     const Line b("b", A,C);
20     b.print();
21     const Line c("c", A,B);
22     c.print();
23
24     Triangle t("t",a,b,c);
25     t.outputProperties();
26 }
```

Test your program with

- i) A(8,8), B(8,15), C(32,8)
- ii) A(-2,3), B(-5,-4), C(2,-1)