MAC 190
Programming Assignment 1 - 45 Points
Due: July 14h , 2025, 11:59 PM

Write Java program for the following ----------

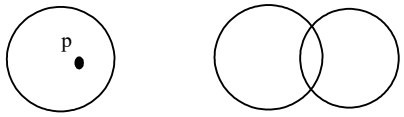
1. Understanding classical ciphers like the Caesar Cipher helps build a foundation in modern cryptography. Attributed to Julius Caesar, this simple substitution cipher shifts each letter in the plaintext by a fixed number of positions in the alphabet, wrapping around if needed.
   Your task is to implement the Caesar Cipher in Java. Your program should have 2 methods:
   - ***String Encryption (String)*** - shifts each letter forward by the key, preserving case and leaving non-letters unchanged.
   - ***String* Decryption *(String)*** - shifts each letter backward by the same key to recover the original message.

Users should give input for the text and key.
Example:

Plaintext: Hello, World!
Shift Key: 3

Encrypted: Khoor, Zruog!
Decrypted: Hello, World!

2. Define the Circle class that contains:
   - Two double data fields named x and y that specify the center of the circle with get methods.
   - A data field radius with a get method.
   - A no-arg constructor that creates a default circle with (0, 0) for (x, y) and 1 for radius.
   - A constructor that creates a circle with the specified x, y, and radius.
   - A method getArea() that returns the area of the circle.
   - A method getPerimeter() that returns the perimeter of the circle.
   - A method contains(double x, double y) that returns true if the specified point (x, y) is inside this circle. See Figure (a).
   - A method overlaps(Circle circle) that returns true if the specified circle overlaps with this circle. Two circles overlap if the distance between the two centers are less than or equal to sum of the radius of two circles (this.radius + circle.radius). See Figure (b).



(a) **(b)**

Fig: (a) A point is inside the circle. (b) A circle overlaps another circle.

Implement the class.
Write a test program that creates a Circle object c1 (new Circle(2, 2, 5.5)), displays its area and perimeter, and displays the result of c1.contains(3, 3) and c1.overlaps(new Circle(3, 5, 2.3)).

3. Write a program in a class **CountPoor** that counts the number of families that are considered poor. Write and use a class **Family** that has the attributes

    • income—a double value that is the income for the family

    • size—the number of people in the family and the following methods:

    • Family(income, size)—a constructor that sets the attributes

    • isPoor(housingCost, foodCost)—a method that returns true if housingCost + foodCost * size is greater than half the family income (foodCost is the average food cost for an individual, while housingCost is for the family)

    • toString—a method that returns a string containing the information about the family.

The program should read an integer *k* from the keyboard and then create an array of size *k* whose base type is Family. It should then create *k* objects of type Family and put them in the array, reading the income and size for each family from the keyboard. After reading an average housing cost and average food cost from the keyboard, it should display the families that are poor.

- ✓ Write comments in your program.
- ✓ Upload .java files and a .docx file containing all programs' source codes and input – output screenshots on Blackboard.
- ✓ Your .docx/ .pdf file should include the screenshot of your console with input and output.
- ✓ Do not upload .pages file.