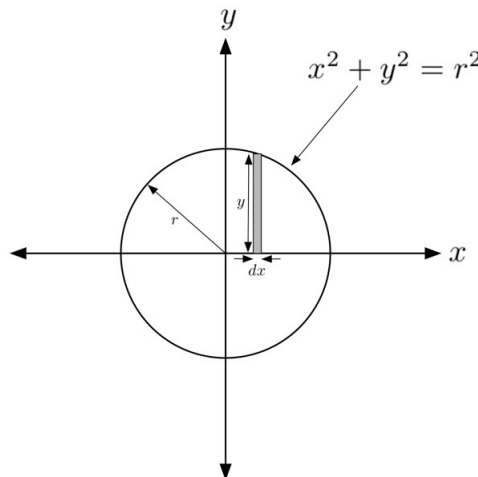


CSC 230: Elementary Data Structures and Algorithms
Fall 2022
Assignment 1

- General programming guidelines:
 - Create a separate NetBeans project with the name `QuestionXX`, where `XX` is the question number.
 - Do not forget necessary javadoc comments before classes and methods.
 - You should use *single line* or *multiline* comments, **if it is required**. Do not put unnecessary comments (Do not state the obvious!!!).
 - Use meaningful identifier.
 - Throw `IllegalArgumentException` if appropriate after argument checking.
 - Don't forget to check the parameters of your methods and throw appropriate exceptions as necessary.
 - **Creating correct NetBeans projects, zipping your final assignment folder, and testing it before uploading are your responsibilities. If any of these steps fails, you will receive a grade of zero.**
- Academic integrity policy
 - You are **not** allowed to use any online resources EXCEPT the book, class lecture notes and Java documentation.
 - All programs/ code must be your own work.
 - You should be able to clearly explain every line of your code, if instructor requests you to do so.
 - Any violation of these policies will be considered as plagiarism and dealt accordingly.

Question 1 (25 points) Write a method to *approximate* the area of a circle centered at origin with radius r . Note that you should forget the existence of the well known formula $area = \pi r^2$.



Hint: The equation of a circles with radius r , centered at origin is $x^2 + y^2 = r^2$. Divide the area of the first quadrant in to small rectangles of width of your choice – smaller the better and you should pass this as a parameter to your method (or you can pass number of rectangles, and then calculate the width of the rectangle inside the method) – and add these areas of all these rectangles to approximate the area of the first quadrant of the circle. Multiplying that value by 4 gives the approximate area of the circle.

You must test your results with known radius values (If you set your radius to 1, Then you should see the approximate π value as the answer for the area).

Note: You don't need any Calculus knowledge to solve this problem, and only CSC 130 coding skills are required.

Example method headers:

```
public static double circleArea(double radius, int numOfRectangles) or public  
static double circleArea(double radius, double widthOfRectangle)
```

Question 2 (75 points) Write a Java program that prompts the user to enter number of rows (m) and column (n) of a 2-D array where $m, n \geq 4$. Fill this array with random upper case letters (from 'A' to 'Z').

Now, extend your program by writing a method to test whether this 2-D array has four consecutive letters ('D', 'E', 'F', 'G' / 'Z', 'A', 'B', 'C' / 'X', 'Y', 'Z', 'A' are a few examples) either *horizontally-left to right*, *vertically-top to bottom* or *diagonally-down*.

Note: The goal of this programming question is to check your code factorization skills. Make sure to break the problem in to pieces and solve one piece at a time. In other words, think about all the ways possible and write separate methods to solve each case. Then put them together to solve the entire problem. You should use a paper/ pencil to analyze the problem. Make sure to have test cases. You may create test cases inside a separate method and use hard coded arrays for each case.

Note: Only CSC 130 coding skills are required.