**ICSI 201 Fall 2019. Homework Assignment 4**

**Objects  
(100 points)**

# Assignment goals

* Build experience creating new classes.
* Build experience creating instant methods.
* Build experience creating static methods.

# Description

In this assignment, you must use Java language to create and demonstrate a class that describes a 3D vector (to learn more about vectors, see the link <https://en.wikipedia.org/wiki/Vector_(mathematics_and_physics)>).

The class must have:

|  |  |
| --- | --- |
| a **constructor** with three coordinates as parameters *x*, *y*, *z*. |  |
| a method that calculates the **length** of a vector |  |
| a method that calculates the **scalar product** |  |
| a method that calculates the **vector product** |  |
| a method that calculates ***cos*** of the angle between **two** vectors |  |
| a method that calculates **sum** and **difference** of two vectors |  |
| toString() method that overrides default toString() and returns the word “Vector” and three coordinates |  |
| a **static** method that returns an *n*-size array of randomly generated vectors |  |

For the methods that operate with two vectors, one must be “this” vector, and another must be a parameter.

If any method returns a vector, it must be a new vector, so your vectors must be **immutable** objects (see more here <http://www.javapractices.com/topic/TopicAction.do?Id=29>).

Write a program that demonstrates the use of your new class.

# Recommendations

Read the description carefully. Feel free to clarify requirements with the instructor or TA. Discuss the problem with your friends (see “Programming Assignments Requirements and Recommendations” to evaluate the **acceptable level of collaboration**).

For each method, define the input (parameters) and the output (return value).

Use the lecture slides and the textbook to refresh the following concepts:

* class Math,
* passing objects to methods,
* returning objects from methods,
* instance methods,
* static methods,
* method toString.

Plan your work wisely. You have two programming assignments running parallel: Homework 4 and Project 2. There is much sense to start with this homework. You must be able to do it in a week. Then you will be better prepared for Project 2.

# Submission

Please review your work carefully before submitting it. Read “**Programming Assignments Requirements and Recommendations**.” Check the grading rubric before you submit to make sure you are meeting all of the requirements.

Submission should include:

Java source code as files named *HW4Vector.java* and *HW4VectorDemo.java.*

A screenshot with your program dialog and outputs.

To submit your files, click the assignment title, then in the submission window, click the “Browse My Computer” button to add files to the submission.

If you need it, you may add any comments in the comments area. Click the “Submit” button.

* You have three submission attempts; only **the last one** will be considered and graded.
* You **may not** retract your submission or resubmit for re-grading after the due date.
* Late submissions **will not be accepted**.
* If you have trouble with the submission, please contact your TA for assistance.