

OOP Assignment 3

Due: 11:59 p.m., 22 March 2016

Problem. Add the function of computing *the length of a vector* and *scalar product of a vector* to the code of [2016-0316](#).

The length of a vector $\mathbf{u} = [x, y]$ is

$$||\mathbf{u}|| = \sqrt{x^2 + y^2} \quad \text{(definition 1)}$$

or

$$||\mathbf{u}|| = \sqrt{\mathbf{u} \cdot \mathbf{u}} \quad \text{(definition 2)}$$

The scalar product of $\mathbf{u} = [x, y]$ and a is

$$a\mathbf{u} = [ax, ay]$$

Further, after you write up the function for calculating length of a vector, write a test to **verify** the following theorem of vector computation:

Let \mathbf{u} , and \mathbf{v} are vectors of the same dimensions. Then,

$$||\mathbf{u} + \mathbf{v}||^2 = ||\mathbf{u}||^2 + 2\mathbf{u} \cdot \mathbf{v} + ||\mathbf{v}||^2$$

Please complete the following list of tasks to solve the problem. Note that you must write unit tests in the test project.

T1. (30%) Move your production code and test code in homework 2 to production project and the test project, respectively.

T2. (20%) Write two unit tests for the length function based on the two definitions of length.

T3. (10%) Compute length of a vector. Name the function like this:

double length (double * const u, int d);

T4. (20%) Write scalar product and one test for it. Name the function like this:

double * product_scalar (double * const u, int d, int a);

T5. (20%) Write a test to verify that $||\mathbf{u} + \mathbf{v}||^2 = ||\mathbf{u}||^2 + 2\mathbf{u} \cdot \mathbf{v} + ||\mathbf{v}||^2$, where \mathbf{u} , and \mathbf{v} are vectors of the same dimension.