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 ***u* = [x, y]** is

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

or

$$||\boldsymbol{u}|| = \sqrt{\mathbf{u} \cdot \mathbf{u}} \qquad \textbf{(definition 2)}$$

The scalar product of ***u* = [x, y]** and *a* is

$$a\boldsymbol{u} = [a\mathbf{x}, a\mathbf{y}]$$

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 u, and v are vectors of the same dimensions. Then,

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

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 $||\boldsymbol{u} + \boldsymbol{v}||^2 = ||\boldsymbol{u}||^2 + 2\boldsymbol{u} \cdot \boldsymbol{v} + ||\boldsymbol{v}||^2$ **,** where ***u,*** and ***v*** are vectors of the same dimension.