

# The Inner Product problems

Coding the Matrix, 2015

For auto-graded problems, edit the file `The_Inner_Product_problems.py` to include your solution.

**Problem 1:** For each of the following problem, compute the norm of given vector  $v$ :

- (a)  $v = [2, 2, 1]$
- (b)  $v = [\sqrt{2}, \sqrt{3}, \sqrt{5}, \sqrt{6}]$
- (c)  $v = [1, 1, 1, 1, 1, 1, 1, 1]$

**Problem 2:** For each of the following  $a, b$ , find the vector in  $\text{Span}\{a\}$  that is closest to  $b$ :

- 1.  $a = [1, 2], b = [2, 3]$
- 2.  $a = [0, 1, 0], b = [1.414, 1, 1.732]$
- 3.  $a = [-3, -2, -1, 4], b = [7, 2, 5, 0]$

## Projection Orthogonal to $a$ and along $a$

**Problem 3:** For each of the following  $a, b$ , find  $b^{\perp a}$  and  $b^{\parallel a}$ .

- 1.  $a = [3, 0], b = [2, 1]$
- 2.  $a = [1, 2, -1], b = [1, 1, 4]$
- 3.  $a = [3, 3, 12], b = [1, 1, 4]$

$$\rightarrow b^{\parallel a} = \sigma \cdot a$$

$$\rightarrow b^{\perp a} = \langle b^*, a \rangle = [b_0^* \ b_1^*] \cdot \begin{bmatrix} a_0 \\ a_1 \end{bmatrix} = 0$$

$$\Rightarrow \text{eg } [b_0 \ b_1] \begin{bmatrix} 3 \\ 0 \end{bmatrix} = 0$$