

11-13

CS 53, Fall 2017

Due Nov. 15 at 2:59 pm

Be sure to show your work in calculations. (I don't mean show your arithmetic.) Be neat! Write legibly! You can use a calculator for the arithmetic but show your non-arithmetic calculations.

Problem 1: The helicopter is located at $[4, 4, 5]$ over the ground, which is (at least locally) located at the plane through the three points $w_0 = [1, 0, 2]$, $w_1 = [1, 2, 3]$, $w_2 = [2, 3, 1]$. Your goal is to find the altitude of the helicopter—how far it is from the ground—and to find the coordinates of the point on the ground closest to the helicopter.

Your first job is to translate the situation to one where the plane includes the origin. Subtract w_0 from all the other points. You will get a translated helicopter location, which we call b , and two other vectors v_1 and v_2 by translating w_1 and w_2 respectively. The translated plane is the space \mathcal{V} spanned by v_1 and v_2 .

1. What are b, v_1, v_2 ?
2. What is the point in \mathcal{V} closest to b ? Use orthogonalization and `project_onto(b, vlist)` but do it without a computer (or at least show your work).
3. What is the distance between them? Show how you got this.
4. What is the point in the original plane closest to the helicopter at $[4, 4, 5]$?