

### Assignment 3

Please submit the completed assignment as a single legible PDF to Moodle by **5 pm on November 14**. You may complete this assignment **with a partner**, in that case only 1 person needs to upload the completed assignment.

Complete the following problems using your textbook, *Introduction to Applied Linear Algebra* by Stephen Boyd and Lieven Vandenberghe. Clearly explain your reasoning for each exercise. If working with a partner, each person must contribute to every exercise.

Exercises:

#### Problem 1

- a) Solve 9.1 in your textbook.
- b) Write a Python function that takes as input the initial amount of material in each compartment and a time  $t$ . The output should be the amount of material in compartments 1-3 for the time  $t$  as a function of time. You can assume that each timestep is 1 unit.
- c) Create a plot using matplotlib with 3 lines, 1 line for the amount of material in each compartment. Assume initially that there is 1 unit of material in compartment 1. Create a plot for 50 timesteps.
- d) At what timestep does the amount of material in compartment 1 reduce to 5% or less of its initial value?

#### Problem 2

- a) Solve 9.3 in your textbook.
- b) Confirm your answer is correct when  $z$  is a 2-vector, by choosing 3 sets of values of  $A$  and  $c$ , and plotting  $x_t$  for several timesteps when the initial condition is  $z$ . Use Python and matplotlib to make your plots.

#### Problem 3

Solve 9.4 in your textbook, finding the matrix  $B$  in terms of the other quantities given in the problem.

#### Problem 4

Solve the following problems in your textbook in Chapter 10.

- a) 10.6
- b) 10.10
- c) 10.18

d) 10.44

Problem 5

Solve problem 11.8 from your textbook.

Problem 6

Solve the following problems in Chapter 12 of your textbook.

a) 12.4

b) 12.5