#! usr/bin/env python

from scipy import signal

import numpy as np

def prob3\_15a():

arrA = np.array([[0, 1, 5, 0],[0, 0, 1, 0],[0, 0, 0, 1],[-7, -9, -2, -3]])

arrB = np.array([[0],[5],[8],[2]])

arrC = np.array([1, 3, 6, 6])

arrD = np.array([0])

sys = signal.StateSpace(arrA, arrB, arrC, arrD).to\_tf()

print('\n ~~ PROBLEM 3-15a ~~ \n')

print(sys.num)

print('-'\*30)

print(sys.den)

def prob3\_15b():

arrA = np.array([[ 3, 1, 0, 4, -2],

[-3, 5, -5, 2, -1],

[ 0, 1, -1, 2, 8],

[-7, 6, -3, -4, 0],

[-6, 0, 4, -3, 1]])

arrB = np.array([[2],

[7],

[8],

[5],

[4]])

arrC = np.array([1, -2, -9, 7, 6])

arrD = np.array([0])

sys = signal.StateSpace(arrA, arrB, arrC, arrD).to\_tf()

print('\n ~~ PROBLEM 3-15b ~~ \n')

print(sys.num)

print('-'\*30)

print(sys.den)

prob3\_15a()

prob3\_15b()

Script Output

~~ PROBLEM 3-15a ~~

[ 75. -96. -2331. -209.]

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[ 1. 3. 2. 44. 7.]

~~ PROBLEM 3-15b ~~

[-2.4000e+01 -2.9100e+02 1.6790e+03 1.6282e+04 3.1875e+04]

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[ 1.000e+00 -4.000e+00 -3.200e+01 1.480e+02 -1.153e+03 -4.480e+03]