OPTI- Lab 1

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import numpy as np
from matplotlib import pyplot
import pandas as pd

#Datos

m = 5
n = 9

A = np.random.rand(m,n)
r = np.linalg.matrix_rank(A)
Q = np.random.rand(n,n)
b = np.random.rand(m)

c = np.ones(n)

# Descomposición en valores singulares

U,S,Vh = np.linalg.svd(A, full_matrices=True)

V = Vh.T

# Hacemos la matriz Z que da la base del espacio nulo de A
Z = V[:,m:n]

# Comprobamos vector de zeros

matriz_ceros = np.dot(A,Z) # Debe ser una matriz de zeros

matrizSinv = np.diag(1/S)
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matrizSinv = np.concatenate((matrizSinv,np.zeros((n-m,m))))
matrizAux1 = np.dot(matrizSinv,U.T)
matrizAestrella = np.dot(V,matrizAux1)

# Obtenemos la sol particular



xParticular = np.dot(U.T,b)
xParticular = np.dot(matrizSinv,xParticular)
xParticular = np.dot(V,xParticular)

w = np.dot(A,xParticular)
error = w-b

matrizAuxSE1 = np.dot(Z.T,np.dot(Q,Z))

matrizAuxSE2Suma = np.dot(Q,xParticular)+ c
matrizAuxSE2 = -np.dot(Z.T,matrizAuxSE2Suma)

xzSol = np.linalg.solve(matrizAuxSE1, matrizAuxSE2)
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matrizAestrella
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```
array([[ 3.43216690e-01,  4.84628849e-01,  1.47870386e-01,
        -5.24127758e-01, -3.34336619e-01],
       [ 1.37198152e-01,  2.14275734e+00, -1.84809720e+00,
         5.17524294e-01, -3.77387394e-01],
       [-3.66859084e-01,  3.19295743e-01,  1.12990105e-03,
         8.20969104e-01, -4.23745466e-01],
       [ 1.75262837e-01, -5.79682468e-01,  5.20226276e-02,
         2.50931940e-01,  2.71259077e-01],
       [-1.72516094e-01, -4.86187574e-01,  8.81942697e-01,
        -9.95764133e-01,  6.09869949e-01],
       [ 9.19313189e-01,  1.13457869e-01, -1.09216865e+00,
         4.51996514e-01,  1.64010169e-01],
       [ 2.23220341e-01, -7.23029876e-01,  7.94736108e-01,
        -2.25514593e-01,  4.68690253e-02],
       [ 1.18764225e-01,  2.30585865e-01, -3.19104465e-01,
         2.66142466e-02,  1.58168060e-01],
       [-8.38037568e-01, -1.77619970e+00,  1.85117406e+00,
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       -6.99061944e-02,  6.79595855e-01]])
```

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xzSol
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```
array([ 2.68954185, -0.00686966, -4.66906372,  0.71212549])
```