import numpy as np

threshold = 1e-13

beta = 0.85

A = np.array([[0.7, 0, 1, 0.5], [1, 0, 1.5, 0.1], [1, 1, 0, 0], [1, 1, 0, 1]])

M = A / A.sum(axis=0)

print("Transition Matrix : \n")

print(M)

r = np.ones(len(M)) / len(M)

for i in range(0, 20):

r\_new = beta \* M.dot(r) + (1 - beta) / len(M)

print(f"Iteration {i+1}:")

print("The rank vector:")

print(r\_new)

if np.sum(np.abs(r\_new - r)) < threshold:

break

r = r\_new