Assignment 3
School of Mathematics
The University of Edinburgh
Year: 2022/2023

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For this assignment you should submit a report and your python code. You must include a written answer in support of your code for question 2 and a detailed description of the example you construct for question 3.

Exercise 1 Write an AHP function (3 marks)

Write a function that takes as input a pairwise comparison matrix and returns the relative importance weights and the consistency index (CI).

Exercise 2 Compute the random index (2 marks)

When checking for consistency in the AHP, the consistency index is compared with a random index called RI. The RI ic calculated by computing the average CI over 500 randomly generated matrices with the only requirement that the diagonal entries equal 1 and $a_{ij} = 1/a_{ji}$ where a_{ij} is the entry corresponding to the pair (i, j) in the pairwise comparison matrix. You may also want to limit the values in in the pairwise comparison matrix to be no larger than 9 and non-zero. Write a function that takes as input a scaler n, which denotes the dimension of the pairwise comparison matrix, and returns the random index RI by generating 500 random pairwise comparison matrices. Comment on how close your RI value is to the results presented in class.

Exercise 3 Apply the AHP (5 marks)

Construct an example where you consider between 3-6 alternatives in terms of 3-6 different objectives. You should use your functions that you wrote above. You need to completely describe how you construct the pairwise comparison matrices, include a discussion on how consistent you are as a decision maker and discuss how you arrive at your final choice.