Exercises on AF Methodology

Some useful steps for calculation:
1. From the achievement matrix, build the deprivation matrix
2. Build the 'weighted' deprivation matrix
3. Compute the deprivation score for each individual
4. Determine whether each individual is poor or not according with your selected k-value
5. Define the poverty matrix (which is weighted deprivation matrix censoring the deprivations of those who are not poor)
6. Now you are ready to compute MPI: it is just the mean of the weighted poverty matrix.

Exercise 1

Given the following matrix of distribution of four dimensions (income, years of education, BMI and access to clean water) and respective poverty lines:

$$X = \begin{bmatrix} 6 & 3 & 18 & 1 \\ 8 & 4 & 20 & 1 \\ 12 & 6 & 17 & 0 \\ 20 & 8 & 16 & 1 \\ 5 & 3 & 16 & 0 \end{bmatrix}$$

$$z = \begin{bmatrix} 10 & 6 & 18.5 & 1 \end{bmatrix}$$

a) Calculate the uncensored headcount ratio of deprivation in dimensions i.e. compute the percentage of population deprived in each dimension irrespective of other dimensions. [Note: A person is identified as deprived in a dimension if their score is less than the deprivation cut off vector z]

Assume the four dimensions are weighted equally.
b) Compute the deprivations score vector (c vector).
c) Calculate H, A and M0 assuming a union approach (k=1/4) and an intersection approach (k=1). Interpret the results. [Note: A person is identified as multidimensionally poor if the deprivation score is equal to or greater than the poverty cut off k]

Assume the poverty cut-off k=2.
d) Calculate H, A, and M0.
e) What is the censored headcount ratio in each dimension and what does it mean? How does it differ from the 'uncensored' headcount?
f) What is the contribution of each dimension to M0? [Hint: Use the censored headcount ratio and its relation to M0]

Assume that the first three people (3 first lines of the achievement matrix X) are women and the last two are men.
g) Compare H, A and M0 of men and women. Interpret the results.

h) Suppose individual 1 became deprived in water. How would that affect H and M0. Quantify.

i) What would happen to H and M0 if individual 1 would experience an income loss?

Assume income and education have a weight of 1.5, and BMI and water have a weight of 0.5.

j) Calculate H, A and M0. (Consider original achievement matrix X.)

Exercise 2

Given the following matrix of distribution of three dimensions (income, self-rated health and years of education) and respective poverty lines:

$$X = \begin{bmatrix} 4 & 1 & 5 \\ 8 & 4 & 6 \\ 12 & 1 & 11 \\ 3 & 4 & 6 \\ 15 & 1 & 9 \\ 12 & 5 & 12 \end{bmatrix}$$

$$z = \begin{bmatrix} 10 & 3 & 8 \end{bmatrix}$$

a) Calculate H, M0 using a cut-off value of k=2 and equal weights. [Where the weights sum up to 1].
   1. What is the contribution of each dimension to M0?
   2. What happens to M0 if individual 2 reported a health status of 2 instead of 4?
   3. What happens to M0 if individual 2 reported an income of 4 instead of 8? (Consider original X matrix.)