

Oxford Poverty and Human Development Initiative (OPHI)<http://ophi.keh.ox.ac.uk>*Oxford Dept of International Development,
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Paper-Based Problems

1. Consider a poverty measure P that satisfies symmetry, replication invariance, scale invariance, focus, monotonicity, and transfer. Please use the axioms to rank the following pair of distributions given the corresponding poverty lines. Please state which axioms and what logic you use.
 - a. $x = (3, 1, 12, 6)$ with $z = 8$ and $y = (3, 9, 2, 6)$ with $z = 8$
 - b. $x = (2, 4, 10)$ with $z = 15$ and $y = (2, 10, 10, 4, 2, 4)$ with $z = 15$
 - c. $x = (3, 6, 12)$ with $z = 10$ and $y = (12, 4, 5)$ with $z = 10$

2. Consider the distribution $x = (6, 13, 18, 40)$. Suppose the income of the third person increases by 5 units over time and distribution $y = (6, 13, 23, 40)$ is obtained.
 - a. If the poverty line is $z = 20$, should poverty increase or decrease over time? Why?
 - b. Please calculate the Income Gap Ratio (I) of both x and y . What do you find?
 - c. Now calculate the Poverty Gap Ratio (PG). What do you find?

3. Consider the following three distributions: $x=(3, 6, 9, 30)$, $y=(3, 8, 9, 31)$, and $u=(4, 5, 9, 30)$.
 - a. Calculate the headcount ratios for x , y , and u if $z = 10$. Are they different: yes or no? Should the headcount ratios be different for x and y ? Why? Should the headcount ratios be different for x and u ? Why?
 - b. Calculate the poverty gap ratios for x , y , and u if $z = 10$. Are they different: yes or no? Why? How do your results differ from the results of part a.?
 - c. Calculate the squared poverty gaps for x , y , and u if $z = 10$. Are they different: yes or no? Why? How do your results differ from the results of part a. and part b.?
 - d. Can you state if any of these three distributions has unambiguously higher poverty than others when poverty is measured by the headcount ratio. [Hint: Draw the cumulative distribution functions (CDF)]

Extra Question (for Interested Students)

4. Consider the following two distributions: $x = (3, 6, 9, 12)$ and $y = (3, 6, 8, 10, 12)$. Can you verify if one distribution has unambiguously higher poverty than another distribution if poverty is assessed by a measure that satisfies symmetry, scale invariance, replication invariance, and focus?