Derivation of Formulas for Position Change in Kola Analysis

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Abstract- In Kola Analysis of distributive regeneration of ordered system, when different sets of ordered system consisting of entities that are grouped into two or more columns and rows in simple or multiple dimension, are made to undergo Logico-Sequential Distribution, the entities undergo position change from one distribution to another. The formulas connecting the vertical and the horizontal position ranking values of these entities at any particular distribution obey either a linear equation or rectilinear equations. For example in Positiomatics of simple dimension, the formula for the mathematical relationship between the vertical position ranking value (P^{v}_{dx}) and the horizontal position ranking value (P^{h}_{dx}) of a given entity at distribution (x) is given as:

$P^{v}_{dx} = - 1/C\ P^{h}_{dx} + [r + 1/C]\ k^{v}_{dx}$

$1 \leq k^{v}_{dx} \leq C$

Index Terms- Distributive regeneration of ordered system, Kola analysis, logico-sequential distribution, positiomatics, position change.

I. Introduction

The derivation of formulas revealing the nature of things is inseparable from solving problems in Physics. The development of Physics is greatly based on gathering and articulation of facts through observation and experimentation to generate mathematical laws and formulas. Examples abound in the law of gravitation in which mathematical formulas are derived from the association between observation and experimentation of motion of earthly bodies by Galileo, and heavenly bodies by Kepler (Orlov, 2011). The Newton's three laws of motion in which mathematical formulas are generated are a result of coordination of facts of reproducible observations and experiments into mathematical equations. To harmonize the experience of theory and practice, special definition and relevant assumptions are made. The derivation of mathematical formulas governing nature and systems is very imperative in computing, programming, and prediction of events and occurrences (Ostler, 2011). Kola analysis is the mathematical analysis of a phenomenon called distributive regeneration of ordered system. Kola analysis involves derivation of formulas for solving problems related to an ordered system through the phenomenon of distributive regeneration of ordered system. By definition, distributive regeneration of ordered system is a phenomenon that occurs when a given system of order, comprising a number of entities that are grouped into two or more columns and rows, is subjected to a Logico-Sequential Distribution for the purpose of regeneration (Taylor, 2010). Kola analysis is divided into four parts: analysis of distributive regeneration of ordered system; positiomatics; complexity emergence in distributive regeneration of ordered system; and application of distributive regeneration of ordered system.

II. POSTIOMATICS IN KOLA ANALYSIS

Mathematical analysis of the position change, correlation, and location of entities in distributive regeneration of ordered system is called Positiomatics (Taylor, 2013). The word "Positiomatics" was derived from the two words "Position and Mathematics". Positiomatics is divided into two: simple dimension positiomatics, and multiple dimension positiomatics (Taylor, 2014). This paper centers on the steps involved in derivation of formulas for position change in Kola analysis using simple dimension positiomatics as a case study.

III. DATA COLLECTION: POSITION RANKING VALUES OF ENTITIES IN DISTRIBUTIVE REGENERATION OF ORDERED SYSTEM

Let numbers represent the entities in an ordered system as shown in Table I. The ordered system in Table I has total number of entities [n(E)] = 12, number of columns (C) = 4, number of rows = 3,and d0 represents the starting arrangement. The arrangement is in simple dimension with each column having three entities. Moreover, let P^{v}_{dx} denotes vertical position ranking value at distribution (x) and P^{h}_{dx} denotes horizontal position ranking value at distribution (x). Let K^{v}_{dx} denotes rank value of vertical class interval of entities at distribution (x), and K^{h}_{dx} denotes the rank value of horizontal class interval of entities at distribution (x).

Table I: Arrangement of entities in an ordered system at starting distribution (d0)

d0			
1	**2**	**3**	**4**
5	**6**	**7**	**8**
9	**10**	**11**	**12**

Table II: Position Ranking Values of Entities in Table I

Entity No	Vertical Position Ranking Values (P^{v}_{dx})	Horizontal Position Ranking Values (P^{h}_{dx})
1	3	1
2	6	2
3	9	3
4	12	4
5	2	5
6	5	6
7	8	7
8	11	8
9	1	9
10	4	10
11	7	11
12	10	12

d0				d1				d2				d3 = dt			
1	2	3	4	9	5	1	10	3	6	9	12	1	2	3	4
5	6	7	8	6	2	11	7	2	5	8	11	5	6	7	8
9	10	11	12	3	12	8	4	1	4	7	10	9	10	11	12

Figure 1: Distributive Regeneration of Ordered System, n(E) = 12 C = 4 r = 3

Subjection of entities in the ordered system of Table I to Logico-sequential distribution leads to distributive regeneration of ordered system in Figure 1. Let consider the position change of an entity designated by number 6 in the distributive regeneration system in Figure 1. The horizontal position ranking value (P^{h}_{dx}) of the entity designated by 6 at distribution (d0) = 6, also its vertical position ranking value (P^{v}_{dx}) at distribution (x) = 5 based on position ranking

So the coordinates of entity 6 at d0 = (P^{v}_{d0}, P^{h}_{d0}) = (5, 6)
So the coordinates of entity 6 at d1 = (P^{v}_{d1}, P^{h}_{d1}) = (2, 5)
So the coordinates of entity 6 at d2 = (P^{v}_{d2}, P^{h}_{d2}) = (6, 2)
So the coordinates of entity 6 at d3 = (P^{v}_{d3}, P^{h}_{d3}) = (5, 6)

IV. DERIVATION OF FORMULA FOR THE RELATIONSHIP BETWEEN PVDX AND PHDX THROUGH GRAPHICAL METHOD

d0			d1			d2		
1	2	3	10	7	4	9	5	1
4	5	6	1	11	8	10	6	2
7	8	9	5	2	12	11	7	3
10	11	12	9	6	3	12	8	4
d4			**d5**			**d6 = dt**		
3	6	9	4	8	12	1	2	3
12	2	5	3	7	11	4	5	6
8	11	1	2	6	10	7	8	9
4	7	10	1	5	9	10	11	12

Figure 2: Distributive Regeneration of Ordered System 2, n(E) = 12 C = 3 r = 4

Considering the position change of entities designated by numbers 12 and 8 in the distributive regeneration of ordered system in Figure 2 from d0 to d6, position ranking values were gotten as shown in Table III.

Table III: Table of position ranking values for entities designated by numbers 12 and 8

Entity (E) = 12							
dx	d0	d1	d2	d3	d4	d5	d6
p^v_{dx}	9th	10th	1st	4th	3rd	12th	9th
p^h_{dx}	12th	9th	10th	1st	4th	3rd	12th
Entity (E) = 8							
dx	d0	d1	d2	d3	d4	d5	d6
p^v_{dx}	6th	11th	5th	7th	2nd	8th	6th
p^h_{dx}	8th	6th	11th	5th	7th	2nd	8th

By using position ranking values of Table III, a graph of p^v_{dx} against p^h_{dx} was plotted. The graph is a rectilinear graph with three straight lines as shown in Figure 3

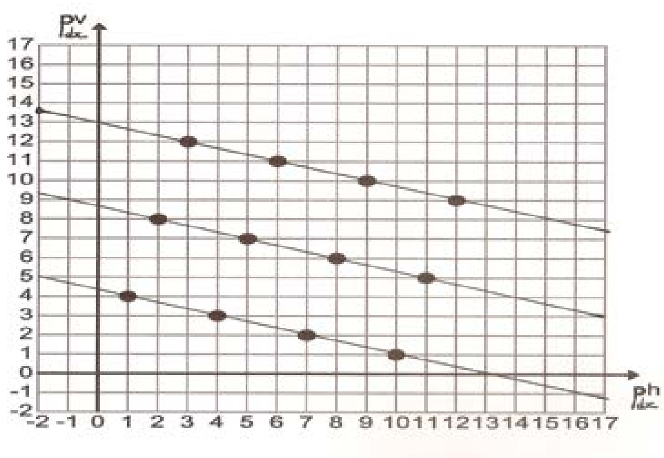

Figure 3: A graph of P^v_{dx} against P^h_{dx}

The slope of the three straight lines of the graph are the same

$$\text{Slope} = \frac{\Delta y}{\Delta x} = \frac{-1[4-1]}{10-1} = \frac{-1}{3}$$

Therefore the equations for the three straight lines of the graph in Figure 3 are as follows :

$$p_{dx}^{v} = \frac{-1}{3} p_{dx}^{h} + \left[\frac{13}{3}\right] \qquad (1)$$

$$p_{dx}^{v} = \frac{-1}{3} p_{dx}^{h} + \left[\frac{13}{3}\right] \times 2 \qquad (2)$$

$$p_{dx}^{v} = \frac{-1}{3} p_{dx}^{h} + \left[\frac{13}{3}\right] \times 3 \qquad (3)$$

Therefore the overall formula for arrangement : n(E) = 12, C = 3, & r = 4 is given as

$$p_{dx}^{v} = \frac{-1}{3} p_{dx}^{h} + \frac{13}{3} k_{dx}^{v} \qquad (4)$$

$$1 \le k_{dx}^{v} \le 3$$

K^{v}_{dx} is referred to as the rank of vertical class interval of the entities

d0		d1		d2		d3	
1	2	19	17	4	8	13	5
3	4	15	13	12	16	18	10
5	6	11	9	20	3	2	15
7	8	7	5	7	11	7	20
9	10	3	1	15	19	12	4
11	12	20	18	2	6	17	9
13	14	16	14	10	14	1	14
15	16	12	10	18	1	6	19
17	18	8	6	5	9	11	3
19	20	4	2	13	17	16	8

d4		d5		d6 = dt	
16	11	10	20	1	2
6	1	9	19	3	4
17	12	8	18	5	6
7	2	7	17	7	8
18	13	6	17	9	10
8	3	5	15	11	12
19	14	4	14	13	14
9	4	3	13	15	16
20	15	2	12	17	18
10	5	1	11	19	20

Figure 4: Distributive Regeneration of Ordered System 3, n (E) = 20, C = 2 & r = 10

Considering the position change of entities designated by numbers 3 and 10 in the distributive regeneration of ordered system in Figure 4 from d0 to d6, position ranking values were gotten as shown in Table IV.

Table IV: Table of position ranking values for entities designated by numbers 3 and 10

Entity (E) = 3							
dx	d0	d1	d2	d3	d4	d5	d6
p^{v}_{dx}	9th	6th	18th	12th	15th	3rd	9th
p^{h}_{dx}	3rd	9th	6th	18th	12th	15th	3rd
Entity (E) = 10							
dx	d0	d1	d2	d3	d4	d5	d6
p^{v}_{dx}	16th	13th	4th	19th	1st	10th	13th
p^{h}_{dx}	10th	16th	13th	4th	19th	1st	10th

By using position ranking values of Table IV, a graph of p^{v}_{dx} against p^{h}_{dx} was plotted. The graph is a rectilinear graph with two straight lines as shown in Figure 5.

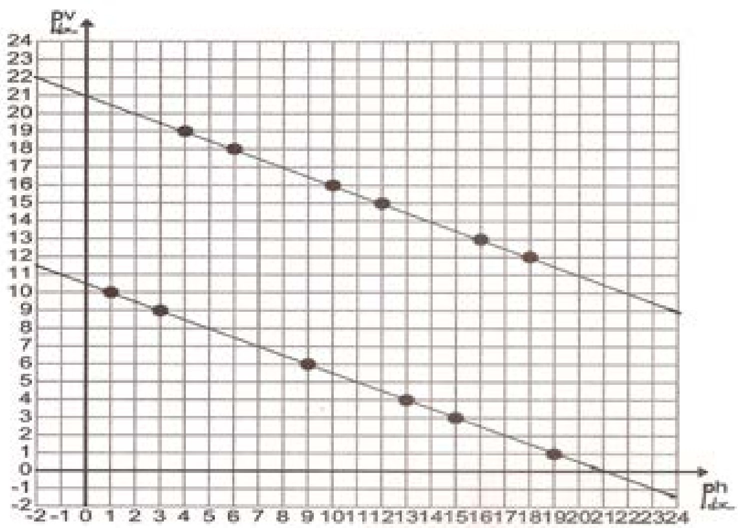

Figure 5: A graph of P^{v}_{dx} against P^{h}_{dx}

The slope of the two straight lines of the graph in Figure 5 are the same.

$$\text{Slope} = \frac{\Delta y}{\Delta x} = \frac{-1}{2}$$

Therefore the equations for the two straight lines of the graph in Figure 5 are as follows:

$$p^{v}_{dx} = \frac{-1}{2} p^{h}_{dx} + \left[\frac{21}{2}\right] \qquad (5)$$

$$p^{v}_{dx} = \frac{-1}{2} p^{h}_{dx} + \left[\frac{21}{2}\right] \text{ x } 2 \qquad (6)$$

Equations 5 & 6 are related.

The arrangement parameters: n (E) = 20, C = 2 & r = 10

Since we have 2 straight lines on the graph in Figure 5,

let k^{v}_{dx} denotes the rank of vertical class interval of the entities

For the first straight line, $k^{v}_{dx} = 1$, from equation 5

For the second straight line, $k^{v}_{dx} = 2$, from equation 6

since C = 2, $\frac{1}{C} = \frac{1}{2}$

Therefore the overall formula is given as

$$p^{v}_{dx} = \frac{-1}{2} p^{h}_{dx} + \frac{21}{2} k^{v}_{dx} \qquad (7)$$

$$1 \le k^{v}_{dx} \le 2$$

d0				d1				d2				d3				d4 = dt			
1	2	3	4	13	9	5	1	16	15	14	13	4	8	12	16	1	2	3	4
5	6	7	8	14	10	6	2	12	11	10	9	3	7	11	15	5	6	7	8
9	10	11	12	15	11	7	3	8	7	6	5	2	6	10	14	9	10	11	12
13	14	15	16	16	12	8	4	4	3	2	1	1	5	9	13	13	14	15	16

Figure 6: Distributive Regeneration of Ordered System, n (E) = 16, C = 4, r = 4

Table V: Table of position ranking values for entities designated by numbers 1, 11, 6 and 12

Entity (E) = 1						**Entity (E) = 6**				
dx	d0	d1	d2	d3	d4	d0	d1	d2	d3	d4
p^{v}_{dx}	4th	16th	13th	1st	4th	7th	11th	10th	6th	7th
P^{h}_{dx}	1st	4th	16th	13th	1st	6th	7th	11th	10th	6th
Entity (E) = 11						**Entity (E) = 12**				
dx	d0	d1	d2	d3	d4	d0	d1	d2	d3	d4

p^v_{dx}	10th	6th	7th	11th	10th	14th	5th	3rd	12th	14th
P^h_{dx}	11th	10th	6th	7th	11th	12th	14th	5th	3rd	12th

Considering the position change of entities designated by numbers 1, 11, 6 and 12 in the distributive regeneration of ordered system in Figure 6 from d0 to d4, position ranking values were gotten as shown in Table V. By using position ranking values of Table V, a graph of p^v_{dx} against p^h_{dx} was plotted. The graph is a rectilinear graph with four straight lines as shown in Figure 7.

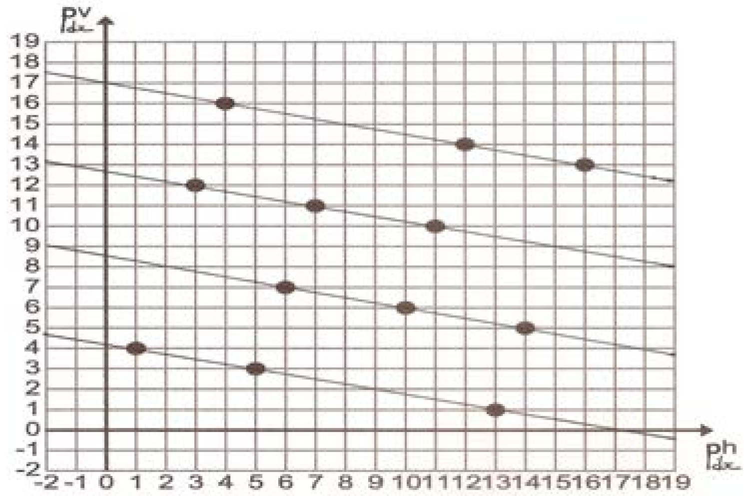

Figure 7: A graph of P^v_{dx} against P^h_{dx}

The slope of the three straight lines of the graph in Figure 7 are the same

$$\text{Slope} = \frac{\Delta y}{\Delta x} = \frac{-1}{4}$$

Therefore the equations for the three straight lines of the graph in Figure 7 are as follows:

$$p^v_{dx} = \frac{-1}{4} p^h_{dx} + \left[\frac{17}{4}\right] \quad (8)$$

$$p^v_{dx} = \frac{-1}{4} p^h_{dx} + \left[\frac{17}{4}\right] \times 2 \quad (9)$$

$$p^v_{dx} = \frac{-1}{4} p^h_{dx} + \left[\frac{17}{4}\right] \times 3 \quad (10)$$

$$p^v_{dx} = \frac{-1}{4} p^h_{dx} + \left[\frac{17}{4}\right] \times 4 \quad (11)$$

Equations 8, 9, 10 & 11 are related.

The arrangement parameters: n (E) = 16, C = 4 & r = 4

Since we have 4 straight lines on the graph as shown in Figure 7

let k^v_{dx} denotes the rank of vertical class interval of entities

For first straight line, $k^v_{dx} = 1$, from equation (8)

For second straight line, $k^v_{dx} = 2$, from equation (9)

For third straight line, $k^v_{dx} = 3$, from equation (10)

For fourth straight line, $k_{dx}^{v} = 4$, from equation (11)

Therefore the overall formula is given as

$$p_{dx}^{v} = \frac{-1}{4} p_{dx}^{h} + \frac{17}{4} k_{dx}^{v} \qquad (12)$$

$$1 \le k_{dx}^{v} \le 4$$

The general formula for the equations derived from the graphs in Figures 3, 5 & 7

From graph in Figure 3

$$p_{dx}^{v} = \frac{-1}{3} p_{dx}^{h} + \frac{13}{3} k_{dx}^{v} \qquad (7)$$

$$p_{dx}^{v} = \frac{-1}{3} p_{dx}^{h} + \left(4 + \frac{1}{3}\right) k_{dx}^{v}$$

n (E) = 12, C = 3, r = 4

$$\rightarrow p_{dx}^{v} = \frac{-1}{C} p_{dx}^{h} + \left(r + \frac{1}{C}\right) k_{dx}^{v} \qquad \text{(i)}$$

$$1 \le k_{dx}^{v} \le C$$

From graph in Figure 5

$$p_{dx}^{v} = \frac{-1}{C} p_{dx}^{h} + \frac{21}{2} k_{dx}^{v} \qquad (8)$$

$$p_{dx}^{v} = \frac{-1}{C} p_{dx}^{h} + \left(10 + \frac{1}{2}\right) k_{dx}^{v}$$

n (E) = 20, C= 2, r = 10

$$\rightarrow p_{dx}^{v} = \frac{-1}{C} p_{dx}^{h} + \left(r + \frac{1}{C}\right) k_{dx}^{v} \qquad \text{(ii)}$$

$$1 \le k_{dx}^{v} \le C$$

From graph in Figure 7

$$p_{dx}^{v} = \frac{-1}{C} p_{dx}^{h} + \frac{17}{4} k_{dx}^{v} \quad (9)$$

$$p_{dx}^{v} = \frac{-1}{C} p_{dx}^{h} + \left(4 + \frac{1}{4}\right) k_{dx}^{v}$$

n (E) = 16, C = 4, r = 4

$$\rightarrow p_{dx}^{v} = \frac{-1}{C} p_{dx}^{h} + \left(r + \frac{1}{C}\right) k_{dx}^{v} \quad \text{(iii)}$$

$$1 \leq k_{dx}^{v} \leq C$$

Therefore, considering equations (i), (ii) & (iii) t*he* general formula for the relationship between p_{dx}^{v} and p_{dx}^{h} in distributive regeneration of ordered system in simple dimension is given as:

$$p_{dx}^{v} = \frac{-1}{C} p_{dx}^{h} + \left(r + \frac{1}{C}\right) k_{dx}^{v} \quad (11)$$

$$1 \leq k_{dx}^{v} \leq C$$

V. CONCLUSION

Intelligence questions can be coined from the case studies used in the derivation of the general formula for the mathematical relationship between vertical position ranking value and horizontal position ranking value of entities in distributive regeneration of ordered system in simple dimension. For example:

In a football match opening ceremony, 20 pupils are needed to make a parade to grace the occasion. They are grouped into 2 columns and 10 rows with each column having 10 pupils. Moreover, their parade mechanism obeys distributive regeneration of ordered system. If a particular pupil at d2 has her vertical position ranking value (P^{v}_{d2}) = 10, calculate her horizontal position ranking value at the same distribution (P^{h}_{d2}).

Postiomatics in Kola analysis opens a new dimension for further research into programming, computing, and prediction of entities in an ordered system. It also provides a pragmatic approach for students to be acquainted with the basics of formula derivation as exemplified in physics. In mathematics learning, positiomatics would serve as an innovative way to develop and promote inductive-deductive reasoning among the students, and would also serve as a veritable tool in the hands of their instructors.

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