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A NEW SELECTION METHOD OF QUANTITATIVE INTERVALS IN THEMATIC CARTOGRAPHY

At interpretation of different quantitative data on physico-geographical, as well as on social-economical maps, with method of cartogram, cartodiagram and isolines, there is often a need to interprete the course of quantitative data, not continually i.e. by expressing of each individual value, but with the help of value intervals. The need of processing the values of mathematics sequences /measured values, statistical indexes etc./ into certain, not great number of intervals, usually arises from the reason of great number of individual members of mathematic sequences.

For processing of thematic maps, up to now, most frequently, the principle of selection either of rounded-off intervals /on the base of author`s or map processor´s free considerations/ or of defining intervals on the base of frequency curves /derivative ones, frequency ones, summation ones, cumulative and other ones/ are applied. Determination of rounded-off starting or terminal values ist most simple, however it is convenient for those thematic maps, which are assigned for instructional and popularizing purposes, eventually even for popular scientific purposes, where their function is limited for interpretation of generalising information. Intervals eliminated on the bases of frequences curves are characterized by their usually non-rounded starting and terminal values and they are assigned for scientific interpretation.

Beside certain advantages, both these selection methods of size intervals have certain basic disadvantage: they are in great deal subjective. While subjectivity of first method is evident, is second one it is often hidden in method of construction of derivative: the sequence of its construction presupposes preliminary grouping of frequences of examined

phenomena, what is made regularly according to first method.

We have tried to solve the selection of interval limiting values on the base of rules of graph theory. We have plotted experimentally the graph of mathematical sequence representing density population arranged data of individual village in district Nitra /West-Slovakian region, ČSSR/. These data are plotted as individual points in rectangular graph in Fig. 1. On abscissa, villages are plotted, on coordinate their density of inhabitants per sq. km. Density values are to be found in the range from 28 to 800.

We have proceeded from the presupposition that number as well as interval limiting values are determinated by graph-course iself, i.e. by its "behaviour". The solution of the problem was reduced to construction of such graph-abscissas, fully comprehanding its course, but at the same time each individual abscissa is differing sufficient expressively by tangent of its angle. We have applied the axiom that the points of graph, from which each abscissa can be calculated and constructed /plotted/, have homogeneous "behaviour" and consequently they form natural interval.

It is known that from points of graph the abscissa line can be calculated from general formula

$$y = a + bx \qquad /1/$$

The coefficient a on basis /1/ is calculated from the relation

$$a = Y - bX, \qquad /2/$$

where X, Y are coordinates of graph points.

The coefficient b is calculated from relation

$$b = \frac{n\sum XY - /\sum X/./\sum Y/}{n\sum X^2 - /\sum X/^2} \qquad /3/$$

where $\sum XY$ - the sum of products of points coordinates from the graph

$\sum X, \sum Y$ - coordinates sums of graph points

n - number of selected graph points, in final phase the interval points number.

If we take into consideration all points of graph we will obtain the following abscissa:

$$y = 1,7 + 1,9x , \qquad /4/$$

i.e. the dashed line on graph - Fig. 1.

Mathematically most cumbersome is the solution of equation /3/, specially at great number of data, but it is relatively easy to control by computation technique. By rather small number of points we´ll be able to manage even with handy computer.

The calculation of lines /abscissas = intervals/ takes place by approximation, i.e. by successive enlarging of coordinates points, until abscissas on graph make broken lines sufficiently comprehending the course of point graph. This solution is "objectified" by mathematic solution and by mathematic criteria of tangent differences on individual abscissas rise. These criteria are different for several mathematic sequences of arranged data, determined by cartographic interpretation and therefore the cooperation of mathematician-programmer, cartograpner, or other specialist is needed - according to character of interpreted phenomenon.

In our case the assertion of approximative graphic-numerical method has enabled /graph in Fig. 1/ to define abscissas, which can be considered as intervals between following values:

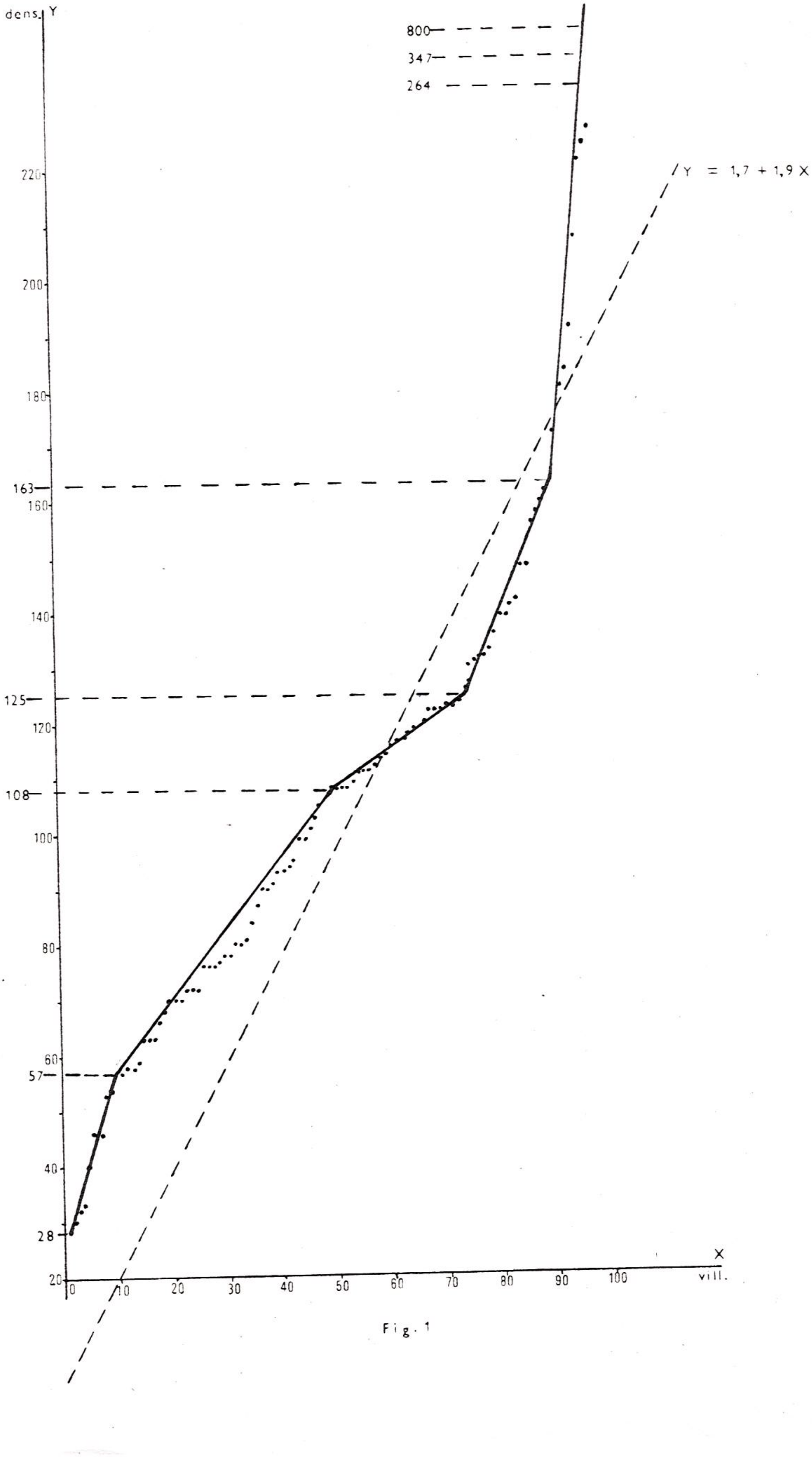
1. 28 - 54,
2. 57 - 107,
3. 108 - 125,
4. 130 - 163,
5. 172 - 227,

6. 264,
7. 347,
8. 800.

We consider these intervals for given mathematical sequence as n a t u r a l, because all values assigned for one abscissa have homogeneous "behaviour", i.e. they have in average high angle of climb. From sufficient logical appreciation it seems that with approximation in second interval, it was possible to cease already at about 80 /on coordinate Y/, which could subdivide this interval in two intervals adequately differentiated from each other. In this way, the total number of interval could be increased to 9, what is always still optimal.

Calculated intervals are interpreted with the help of cartogram in Fig. 2.

This method can be called approximative graphic-numerical delimitation of intervals. We suppose it can be applied not only by cartographic interpretation, of social-economic phenomena, but also in many physico-geographical ones.



dens. Y
800
347
264
Y = 1,7 + 1,9 X
220
200
180
163
160
140
125
120
108
100
80
60
57
40
28
20
0
10
20
30
40
50
60
70
80
90
100
X
vill.

Fig. 1

DISTRICT NITRA

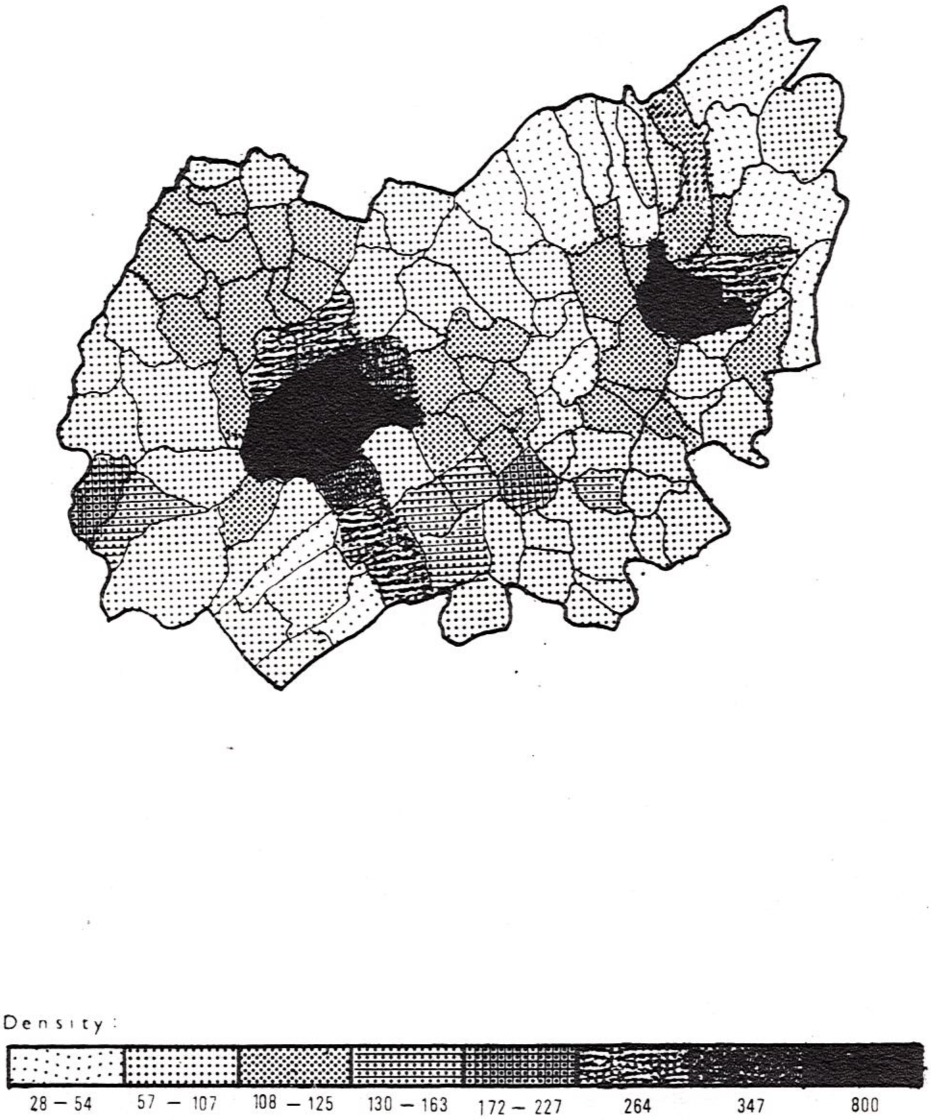


Fig. 2