NOTE FROM MR. FRANCIS GALTON TO MR. GEORGE K. HOLMES ON THE SUBJECT OF DISTRIBUTION.

62 RUTLAND GATE,
LONDON, OCT. 17, 1892.

DEAR SIR:

I have read the paper on "Distribution" in the *Publications of the American Statistical Association*, which you were so good as to send me, but it strikes me that an "Index of Inequality" could be got in a simpler and yet more exact way, as follows: I take the figures from the 2nd and 3rd columns of the Maryland part of Table III, p. 150, having first reduced the 950 owners to 100, and the amounts owned proportionally, multiplying both sets of entries by $\frac{100}{950}$. I have also only cared to work to the nearest 10,000 dollars.

A. Number of Owners.	B. Amounts Owned.	C. Amounts that would have been Owned if each Person had the same Amount.	D. Inequalities, that is to say, the Differences between B and C, irrespective of Sign.
25	$10,000	$190,000	$180,000
20	20,000	152,000	132,000
19	30,000	144,000	114,000
13	50,000	99,000	49,000
11	90,000	84,000	6,000
7	120,000	53,000	67,000
3	110,000	23,000	87,000
2	330,000	15,000	315,000
100	$760,000	$760,000	$950,000

Whence —

Mean amount owned by each (E), $7600.

Mean inequality (F), $9500.

Index of inequality $= \frac{F}{E} = 1.25$.

For some purposes F alone might be wanted; for others, F and $\frac{F}{E}$. E is, of course, implicitly given in the latter case.

Permit me to criticise the terms of your query in p. 141, viz., "Is wealth more widely, evenly, and generously distributed in . . . ?" Either those three adjectives mean the same thing, or they do not. If they do, two of them are superfluous, and, in fact, I have assumed them all to mean *evenly*. If they do not, your query involves three independent variables, and could not be answered without explaining how they are to be rendered commensurable.

Yours faithfully,

FRANCIS GALTON.

The preceding letter from Mr. Galton will attract attention, not only because it comes from the most eminent authority on mathematical measures of distribution, but because of its original process of computing index numbers. An accurate measure of the inequality of the distribution of wealth within a group of wealth owners is the problem, and the solution proposes to ascertain the inequalities of the actual distribution as compared with a perfectly even distribution, and to establish the ratio between the average individual holding and the average individual inequality. It is an attractive scheme, and I have made some computations to discover comparative results.

The index numbers that measure the distribution of the amount of certain classes of government bonds among male, female, and total holders in 1880, in Maryland, are these: males, 1.253; females, 1.249; total, 1.255.

The table of facts from which these index numbers are computed is published in the issue of the *Quarterly Publications of the American Statistical Association*, for June and September, 1892. Upon comparison of the index numbers, it is evident that they must be computed without approximations, because their differences are so small. These are often not found until the third decimal place is reached.

Until a standard is agreed upon, a scheme for measuring the distribution of wealth can be criticized only by subjecting it to mathematical judgment, and by determining whether it is practically consistent in its results. A distribution in which one person owns $1000 and another $100,000 would seem to be half as unequal in degree as one in which one person owns $2000 and another $200,000. Mr. Galton's index number, however, is the same in these cases, since the average holding and the average inequality are precisely doubled by the doubling of the actual holdings.

The average inequality does not always vary with the index number, and its use is not clear. Whether a group is composed of nine persons worth $2000 each, and one person worth $1,000,000, or is composed of one person worth $2000, and nine persons worth $1,000,000 each, makes no difference with the average inequality, although it does with the index number.

Since the average in this scheme does not preserve the distinction between rich and poor, the question arises whether it may not produce an erroneous index number of inequality of distribution.

Perhaps I have not sufficiently experimented with this scheme to

be sure that its application to the groups of wealth owners mentioned above does not lead to objections that are more apparent than real.

Regarding Mr. Galton's criticism, that the measure of the distribution of wealth proposed by me employs three independent variables, the reply may be made that the distribution of wealth has these three aspects: —

1. All individuals of the population do not own wealth. Less than half of the people possess wealth in sufficient quantities to be worth an account, and the proportion of the owners ought to be represented to measure what I have termed the width of distribution.

2. Another measure is wanted to determine the inequality of the distribution of wealth, not among all the people, but among its owners. An index can be computed that is a compound of width and of inequality, but it seems to me to be undesirable.

3. The generosity of distribution calls for a third measure. There may be no substantial difference between two communities in respect to the width and the inequality of distribution, but one community may have much more wealth than the other. The average, or Mr. Galton's E, affords this measure.

GEORGE K. HOLMES.

REGISTRATION REPORT OF MASSACHUSETTS.

Fiftieth Report of Births, Marriages, and Deaths in the Commonwealth, and returns of Deaths investigated by the Medical Examiners, for the Year 1891. Pp. 145. Boston, 1892.

To those who are familiar with the precise and elaborate registration reports of Massachusetts, the report of 1891 will be a surprise and a great disappointment. We are at a loss to account for the change from a compilation which has been universally accepted by statisticians as a model of tabulation and presentation to the present inadequate number.

The reports of previous years were compiled for the use of statisticians as well as for the general public. This, as the editor says, is no longer the case. A student of social science must either go without data hitherto furnished or else laboriously work them out for himself. The principle upon which the work is compiled is expressed on page 113, as follows: "It is not intended, however, in this report to pre-