CORRESPONDENCE.

ON THE CONSTRUCTION OF TABLES OF POLICY VALUES.

To the Editor of the Journal of the Institute of Actuaries.

SIR,—As a small contribution to Mr. Manly's subject of the construction of Tables of Policy Values allow me to send you the following formula, of which I have made use in the computation of tables for surrenders.

By being stated in terms of the annual premium it is suitable both for the purpose for which it was originally intended and (by the substitution of the net for the real or "loaded" premium) for ascertaining the values as in Mr. Manly's form, while, the *final* results being arrived at in series, a check at any point detects an error in the intermediate process of taking out the numbers to the logarithms.

Since the value of a policy for £1 at age x, the annual premium "ϖ" for which is just due, is

$$1-(1-v+\varpi)\mathrm{a}_x$$

which for brevity may be written

$$1-\mathrm{Q}\mathrm{a}_x$$

the difference between this and the next higher value, that is

$$\mathrm{Q}(a_x-a_{x+1})$$

is the quantity to be first formed, and the addition of each term of this successively gives the final value required.

This is comparatively easy work, the logarithm (a_x-a_{x+1}) being, as in Mr. Manly's process, tabulated once for all, and Q being a constant factor for one column of the final result.

The continuous method of computation may be applied also to the formation of $\log[\mathrm{Q}(a_x-a_{x+1})]$; the differences of this series being obviously the differences of the series $\log(a_x-a_{x+1})$. Hence, if these last differences be found, $\log[\mathrm{Q}(a_x-a_{x+1})]$ may also be found by continuous addition.

I am, Sir,

Your most obedient servant,

2, *King William Street,*
London, 30*th April,* 1869.

H. AMBROSE SMITH.

NEW EXPERIENCE MORTALITY OBSERVATIONS.

To the Editor of the Journal of the Institute of Actuaries.

SIR,—The tables of mortality which Mr. Woolhouse has deduced from the more important part of these observations, and which have been recently published in the *Journal* of the Institute, appear to coincide to a great extent with the tables formed by the same gentleman from the "Experience of the Seventeen Offices." In fact, this part of the investigations has been chiefly valuable as verifying and confirming the "Experience" table, and redeeming it from the reproach directed against it by many

actuaries, that it was based upon policies, not lives. We may therefore take it for granted that, with respect to ordinary tables of mortality, the New Experience Observations will not advance us far beyond the stage already reached.

There is, however, another subject of great importance to actuaries, upon which the New Experience Observations were confidently expected to throw considerable light. I refer to the "effect of selection," or in other words, to the ascertaining of how long and to what extent lives assured are healthier than those of the same age longer assured.

Now my object in writing this letter is to point out to your readers what appears to me to be an oversight in the book, affecting directly this very question of "selection." In calculating the numbers exposed to risk for each separate age at entry and year of assurance, the discontinuants in the "year 0" of assurance have been virtually neglected altogether, that is, although they must have been on the Office Registers for, on the average, a sensible portion of the "year 0" of assurance, they have not been considered as at risk at all. Thus, to make my meaning clear,

let N be the number of "entrants" at any age,
p ,, "existing" at end of "year 0,"
q ,, "discontinued" in the "year 0,"
r ,, deaths, ,,
M ,, who enter upon "year 1" of assurance;

then we shall have

$$N=p+q+r+M.$$

Now, in the Observations, the number exposed to risk for "year 0" of assurance is taken as equal to $\frac{1}{2}N-\frac{1}{2}q$.

But
$$\frac{1}{2}N-\frac{1}{2}q=\frac{1}{2}(p+q+r+M)-\frac{1}{2}q$$
$$=\frac{1}{2}(p+r+M)$$

and is therefore independent of q.

No mention is made of this fact in the late President's able preface to the book; but, as "selection" is a subject of great interest to the profession, I have ventured to call your readers' attention to it.

Another point which I think requires to be noticed is the phrase "year 0" of assurance. The lives assured were on the average exposed to risk during six months of the calendar year of entry, so that the data at the disposal of the Institute did not enable the mortality during the first twelve months after entry to be calculated. All that could be obtained was the rate of mortality for the first six months after entry, and then the rate for each succeeding year. To obtain the rate of mortality for the first twelve months, it has been *assumed* that it will be the same as for the first six, a method, I think, by no means satisfactory.

I am, Sir,
Your obedient servant,
WILLIAM SUTTON.

18, *Lincoln's Inn Fields*,
3rd September, 1870.