

CORRESPONDENCE.

THE GRAPHIC METHOD OF GRADUATION.

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

SIR,—If I make no reply to Mr. Higham's letter which you printed in your April number, it may probably be thought that I acquiesce in the views he expresses. I think it, therefore, desirable to state that I cannot accept the two propositions which he enunciates, as giving a fair account of the conclusions arrived at in my paper. I would rather describe my conclusions as follows: the series of numbers which represent, either the probabilities of dying at different ages, or the expectation of life at different ages, does not proceed by constant third differences; therefore a graduation by such formulas as Mr. Woolhouse's and Mr. Higham's, will not give theoretically correct results; but will have a tendency to distort, to some extent, the law of the facts. To what extent they do this, is a question I have not investigated. Judging from the example to which Mr. Higham refers us, namely, Mr. Woolhouse's adjustment (*J.I.A.*, xv, 396), the distortion is probably very small; but, even in that case, I think that clear indications may be found that it exists.

I agree with Mr. Higham, that the object of a good graduation, is to faithfully reproduce every well-pronounced characteristic in the original; but when a graduation has been made by the graphic method, we can best judge whether the desired object has been accomplished, by comparing the graduated results with the original facts, rather than with another adjustment, made by Mr. Woolhouse's or Mr. Higham's formula. This is the course I pursued myself, in making the graduation which I lately submitted to the Institute; and I am not conscious of having obtained any assistance from the study of Mr. Higham's adjustment.

I am not sure that I correctly understand the concluding paragraph of Mr. Higham's letter. He speaks of the possibility of labor being bestowed on his untouched results, which might possibly produce results better than anything hitherto produced; but he does not indicate in what way such labor is to be applied. I have felt an objection to Mr. Higham's method of procedure because, as hitherto explained by him, it is a mechanical procedure, which does not admit of the application of any judgment or skilled labor. In fact, I have looked upon the results given by his formula, as final results, which he intended should be left untouched; and, if I have done him injustice in this respect, I trust that he will explain how he would proceed, in

the event of his desiring to rectify and beautify the results given by his formula.

I am, Sir,
Your obedient servant,

Edinbro',
1 July 1887. T. B. SPRAGUE.

CLAIM ACCELERATION RESERVE, &c.

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

SIR,—For some time past I have been intending, with your permission, to correct an oversight on *J.I.A.*, xxiv, 76, for it would seem that claim acceleration reserve should be based on the theoretical instead of on the actual date for payment, at any rate as long as the fraction combined with the annuity-value in capitalizing future premiums is dependent on the date of their falling due rather than of their being received. That is, that the interval necessary for proof of death and title ought not to be taken into account, unless the grace days allowed for renewals are considered on the other side; or, in other words, if claims are payable immediately, a full half-year's (not five months') interest must be reserved, unless the $\frac{1}{2}$, or whatever it is, used with the a in valuing the premiums is not fixed by the average of their due-dates only, but regard is also had to any delay there may be in the cash reaching the office.

And, as I am writing, I would add that the formula on *J.I.A.*, xxvi, 54, looks less formidable if y be written for $\frac{x-1}{2}$; while, later on, $\frac{2x^2}{x^3}$ instead of $\frac{2}{x}$ is an ugly mishap.

I am, Sir,
Your obedient servant,

C. D. HIGHAM.
3, Princes Street, Bank, London,
26 May 1887.

FRIENDLY SOCIETY LEVIES.

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

SIR,—In the last number of the *Journal* (p. 389) Mr. King refers to the above subject, and gives very simple demonstrations of the formula for the value of the future death levies,

$$W = \frac{m(m-1)}{2} \bar{A}_{xx},$$

where m is the number of members, x the average age, and l the sum paid by each member at a levy. The proof he gives of the above, by the use of contingent assurances, I may say, was suggested to me some years ago by Mr. H. J. Rothery.

It frequently happens that levies are made not only at the deaths of the members but also at the deaths of their wives, and a similar method of dealing with these leads to an equally convenient formula by which to value them. If we assume that all the members are married, and that $w_1, w_2, w_3, \&c.$, represent the ages of the wives of