International Journal of Mathematical Education.
ISSN 0973-6948 Volume 13, Number 1 (2023), pp. 27-31

http://www.ripublication.com

Multiple-Authored Research Publications: Quantitative Schemes to Assign Commensurable Credits to Authors

Arjun Tan

Department of Physics, Alabama A & M University,
Normal, AL 35762, U. S. A.
E-mail: arjun.tan@aamu.edu; arjun.tan@mail.com

Abstract

Many concerns regarding the proliferation of authors in multiple-authored publications, including 'gift authorship', 'ghost authorship', etc., have been raised in the recent years. However, there has been no consensus about a remedy acceptable to all. In this paper, we propose quantitative schemes to assign commensurable credits to authors of multiple-authored publications which will be fair to both solitary researchers and group researchers. Four distinct schemes, including one based on a geometric sequence and another based on the harmonic sequence, are proposed. The principle of 'conservation of author credits', which equates the total author credits to the paper count, is followed. It is found that the harmonic sequence scheme is the least disadvantageous to most authors.

INTRODUCTION

Research publications are of paramount importance in the field of science. Nobel prizes awarded in this area largely depend upon fundamental original research published in reputed journals. In the academic institutions, '***Publish or Perish***' is the motto followed by young faculty in their quest for promotion and tenure (cf. [1]). In this context, the promotion and tenure committees follow certain criteria to recommend or reject promotion and/or tenure of applicants. However, there is no uniformity in these criteria followed among various committee members. Overall, the success of promotion and tenure depend largely upon the quantity and quality of the publications of a candidate. Since the quality of a publication is a relatively subjective matter, the quantity of publication becomes the most important factor. However, the proliferation of journal papers, and especially, the ***multiple-authored papers*** have drawn wide-spread criticisms of the ethics and morality of the multiplicity of authors

[2−4]. Suggestions about assigning credits to the various authors in multiple-authored papers have been proposed [2−4], but little consensus has been achieved in this matter. In this paper, we attempt to explore quantitative schemes to assign proper commensurable credits to the various authors in multiple-authored research publications.

SCHEMES TO ASSIGN PROPER CREDITS TO AUTHORS

It is axiomatic that in a ***single-authored paper***, full credit goes to the sole author. In a multiple-authored paper, the largest share of credit goes to the first author and progressively smaller credits to accorded to the subsequent authors. Overall, the first authorship of any paper is of paramount importance since the author's name always comes first in any ***citation*** of the paper. The second authorship is of next higher importance as the author's name appears in the citations of double-authored papers. The subsequent authorships of multiple-authored papers are of progressively diminishing importance as the authors names are covered under '***et al.***' in the citations. The following are some schemes proposed in this paper and examined for suitability.

Scheme A. In this scheme, every author – first, last, or in-between – are given full credit for the paper. This is the most ***inclusive scheme***. In fact, this scheme is actually wide-spread, without ever being noticed. In most researcher's ***résumé***s or ***curriculum vitae***s, all publications are listed regardless of the author's positions and added to give the total number of publications. A major drawback of this scheme is the proliferation of total ***author credits*** with the number of authors. This scheme favors ***group researchers***.

Scheme B. In this scheme, only the first author of a paper is accorded full credit and all others are ignored. This is the most ***exclusive scheme*** and is the diametrical opposite of Scheme A. It has been sometimes adopted by the promotion and tenure committees to emphasize originality and to eliminate potential '***gift authorship***' or '***ghost authorship***' papers. This scheme favors ***solitary researchers***.

Scheme C. In this scheme, the author credits are given by a ***geometric sequence***: with first term 1 and common ratio ½.

$$\left(\frac{1}{2^{i-1}}\right) = \left(1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8} \dots, \frac{1}{2^{n-1}}\right) \tag{1}$$

where i = ***author sequence number***, and n = the ***number of authors***. The sum of this sequence is the following series:

$$S_C = \sum_{i=1}^{n} \frac{1}{2^{i-1}} = 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots + \frac{1}{2^{n-1}} \tag{2}$$

It is well-known that the ***sum of this series rapidly converges to 2*** for $n \rightarrow \infty$. In this scheme, the first author gets at least 50% of the total credit of the paper, which serves as a strong deterrent to adding to the authors list. It also relegates trailing authors meaningless with vanishingly small credits for large n.

Scheme D. In this scheme, the author credits are given by the ***harmonic sequence***:

$$\left(\frac{1}{i}\right) = \left(1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4} \dots, \frac{1}{n}\right) \quad (3)$$

The sum of this sequence is the following series:

$$S_D = \sum_{i=1}^{n} \frac{1}{i} = 1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \cdots + \frac{1}{n} \quad (4)$$

This series is a ***slowly divergent series*** and approaches infinity as $n \rightarrow \infty$. It is not too dissimilar from Scheme C, but is free from convergence for high n. In this scheme, both solitary and group researchers have ample opportunity to receive credit. It is our choice for assigning proper credits in multiple-authored publications. There is however, still another factor that needs to be incorporated in this process which is discussed below.

NORMALIZATION OF AUTHOR CREDITS

It is obvious that only in Scheme A, the author credit is the same as the paper count: $S_A = 1$. In other words, there is no proliferation of author credit. This is sometimes referred to as the ***conservation of total credit*** [2]. In all the other schemes, there is a proliferation of author credits. In Scheme B, for example, the total author credit is multiplied by a factor of n, the total number of authors: $S_B = n$. Thus, a ***normalization procedure*** is called for in which the total author credit is the same for all papers, i.e., equal to unity. For Scheme D, the division of Eq. (3) by Eq. (4) yields the required normalized credit sequence:

$$\frac{\left(\frac{1}{i}\right)}{S_D} = \frac{1}{S_D}\left(1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{n}\right) \quad (5)$$

The normalization is a two-step process: First, S_D is calculated from Eq. (4); and next, the normalized sequence is computed using Eq. (5).

RESULTS AND DISCUSSION

The results are displayed in Tables I – IV for multiple-authored papers with number of authors n ranging from 1 to 10 in Scheme D. Tables I and II show the author credits according to the harmonic sequence (3) from which the total author credits S_D are found by addition, vide Eq. (4). The increase in S_D with n for n ranging from 1 to 10 is evident. This reflects the effect of proliferation of author credits with the unnecessary addition of authors which has been criticized by many [2]. Tables III and IV show the normalized author credits resulting from divisions of the entries of Tables I and II by the respective S_Ds. The sum of the elements in any vertical column adds up to unity, thus confirming the normalization. Clearly, the author credits for any sequence diminishes with the number of authors *n*, which reflects a negative effect of the proliferation of authors. In conclusion, it can be said that the normalized harmonic sequence scheme is the least adverse to most publishers, whether solitary or belonging to a group. It must be added that these schemes pertain to normal publications by the academicians. They are not applicable to publications from national laboratories where the numbers of authors can run into the hundreds and the principle of conservation of credits and normalization are not relevant.

Table I. Author Credits for Number of Authors 1–5 in Scheme D

Author Sequence	Number of Authors *n*				
	1	2	3	4	5
1	1.000	1.000	1.000	1.000	1.000
2	–	0.500	0.500	0.500	0.500
3	–	–	0.333	0.333	0.333
4	–	–	–	0.250	0.250
5	–	–	–	–	0.200
6	–	–	–	–	–
7	–	–	–	–	–
8	–	–	–	–	–
9	–	–	–	–	–
10	–	–	–	–	–
$S_D \rightarrow$	1.000	1.500	1.833	2.083	2.283

Table II. Author Credits for Number of Authors 6–10 In Scheme D

Author Sequence	Number of Authors *n*				
	6	7	8	9	10
1	1.000	1.000	1.000	1.000	1.000
2	0.500	0.500	0.500	0.500	0.500
3	0.333	0.333	0.333	0.333	0.333
4	0.250	0.250	0.250	0.250	0.250
5	0.200	0.200	0.200	0.200	0.200
6	0.167	0.167	0.167	0.167	0.167
7	–	0.143	0.143	0.143	0.143
8	–	–	0.125	0.125	0.125
9	–	–	–	0.111	0.111
10	–	–	–	–	0.100
$S_D \rightarrow$	2.450	2.593	2.718	2.829	2.929

Table III. Normalized Author Credits for Number of Authors 1−5 in Scheme D

Author Sequence	Number of Authors *n*				
	1	2	3	4	5
1	1.000	0.667	0.545	0.480	0.438
2	–	0.333	0.273	0.240	0.219
3	–	–	0.182	0.160	0.146
4	–	–	–	0.120	0.109
5	–	–	–	–	0.088
6	–	–	–	–	–
7	–	–	–	–	–
8	–	–	–	–	–
9	–	–	–	–	–
10	–	–	–	–	–
Sum→	1.000	1.000	1.000	1.000	1.000

Table IV. Normalized Author Credits for Number of Authors 6−10 In Scheme D

Author Sequence	Number of Authors *n*				
	6	7	8	9	10
1	0.408	0.386	0.368	0.353	0.341
2	0.204	0.193	0.184	0.177	0.171
3	0.136	0.129	0.123	0.118	0.114
4	0.102	0.096	0.092	0.088	0.085
5	0.082	0.077	0.074	0.071	0.068
6	0.068	0.064	0.061	0.059	0.057
7	–	0.055	0.053	0.050	0.049
8	–	–	0.046	0.044	0.043
9	–	–	–	0.039	0.038
10	–	–	–	–	0.034
Sum→	1.000	1.000	1.000	1.000	1.000

REFERENCES

[1] M. Gad-el-Hak, Publish or Perish − An ailing enterprise?, *Phys. Today*, **57**(**3**), 61 (2004).

[2] P.J. Wyatt, Commentary: Too many authors, too few creators, *Phys. Today*, **65**(4), 9 (2012); and 21 Comments.

[3] 5 authors comment on authorship commentary, *Phys. Today*, **65**(8), 8-10 (2012).

[4] Wyatt’s reply to Comments on authorship commentary, *Phys. Today*, **65**(8), 11 (2012).