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EDITORIAL

ISSI BOARD & PRESIDENT ELECTIONS – 2011

Once in every 4 years it is time to (partially) renew the composition of the ISSI board. In accordance with the current regulations of the ISSI, all those having been served for four years (president included), have to step down (all of them remain re-electable though).

Similarly to the previous elections, the procedure of 2011 also consists of two major parts: the *nomination* and the *voting*. Any ISSI member in good standing is eligible for being *nominated* as board member and/or president; however, for being *voted* one will be eligible only upon his/her explicit approval and declaration of intent. For this reason, all ISSI members are kindly requested to check their emails after the closure of nomination, and to reply about their intentions regarding their electability.

Both the nomination and the voting are carried out online, through the dedicated pages of the ISSI website. The whole election procedure is anonymous. In order to filter out unwanted spams and unwarranted votes, as well as to keep track of repeated votings, members are required to authenticate themselves by their usual ISSI login names and passwords, but no personal data will be connected to actual nominations or votes in any way.

Important deadlines: closure of nomination: Monday, 04 April, 23:59:59; reception of declaration of intent: Monday, 11 April, 23:59:59; closure of voting: Monday, 09 May, 23:59:59. All the times are meant in CET (GMT+1). For the fairness of the elections, all the above deadlines will be taken strictly. And now, please, let me invite you to nominate: www.issi-society.org/nom2011.

Balázs Schlemmer, election assistant

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Contributors to the newsletter should contact the editorial board by e-mail.

THE ROYAL SCHOOL OF LIBRARY & INFORMATION SCIENCE ANNOUNCES THE

16TH NORDIC WORKSHOP ON BIBLIOMETRICS AND RESEARCH POLICY.

22-23 SEPTEMBER 2011, AALBORG, DENMARK

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Bibliometric researchers in the Nordic countries have arranged annual Nordic workshops on bibliometrics since 1996. The general idea of the workshop is to present recent bibliometric research in the Nordic countries and to create better linkages between bibliometric research groups and their PhD students. The workshop language is English and the workshop is open to participants from any nation. The workshop is also open to participants who wish to take part without presenting. There are no fees for participating in the Nordic workshops on bibliometrics. However, travel, accommodation and all meals have to be financed by the participants themselves.

The Royal School of Library & Information Science's Aalborg department is located on the campus of Aalborg University.

Program and details concerning travel and accommodation will be announced on the workshops website in due time: http://www.iva.dk/nbw2011.

IMPORTANT DATES

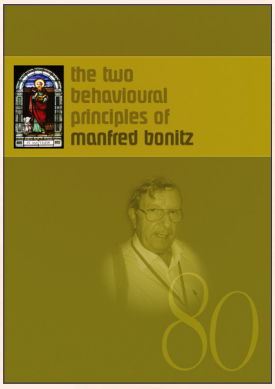
Deadline for registration and abstract submission: **August 15th, 2010**. Send registration (name, institutional affiliations) and abstracts (approximately 200 words) to the workshop coordinator: Jens Peter Andersen (*jpa [at] iva dot dk).*

Further questions can be addressed to the workshop coordinators:

- Jesper W. Schneider (*jws [at] iva dot dk),*
- Birger Larsen (*blar [at] iva dot dk)* or
- Jens Peter Andersen (*jpa [at] iva dot dk)*

MANFRED BONITZ 80

A FESTSCHRIFT



Dr. Manfred Bonitz, prominent researcher in the fields of physics, information science and scientometrics, celebrates his 80th birthday in March 2011.

The editors of the ISSI Newsletter wishes to honour him on the occasion of this event by publishing a special volume of our e-zine (vol. 25-S March 2011). This volume – a limited edition of which has also appeared in print – is available for reading and free download:

http://www.issi-society.info/manfredbonitz/.

This special volume of the ISSI e-Newsletter (vol. 25-S, March 2011) is the fourth one in its festschrift series, after Tibor Braun's, Olle Persson's and Peter Ingwersen's ones.

"AND THE AWARD GOES TO..."

PRICE-AWARDEE IN 2011: OLLE PERSSON

The Derek de Solla Price Award is the premier international award of excellence in scientometrics. It is handed out biennially to award an individual in recognition of excellence through outstanding, sustained career achievements in the field of quantitative studies of science and their applications.

After an official nomination procedure and thorough deliberation, the jury's made its decision, a consequence of which Olle Persson, prominent scientist in the field of bibliometrics and developer of the ever-since popular tool, BibExcel, has been chosen as the Derek de Solla Price Awardee in 2011.

According to the tradition, the awarding ceremony will take place at the upcoming ISSI conference, which is going to be held in Durban, South Africa (04-08 July 2011).

Dear Olle, congratulations!

PRICE AWARD MAPPING

OLLE PERSSON
Department of Sociology,
Umeå University, Sweden

Having received Derek de Solla Price Award for 2011, I got interested in the structure of the club. Figure 1 shows how awardees cite each other. Seems like a quite egalitarian club with a lot of interaction. Some old and some newly appointed awardees are more peripheral. Figure 2 shows how similar they are in terms of shared title words. Wolfgang and Loet are two major nodes. This is, of course, the result of more papers, but also of a broader span. Since shared title words among papers with overlapping authors are excluded, the similarity effect of co-authorships is eliminated.

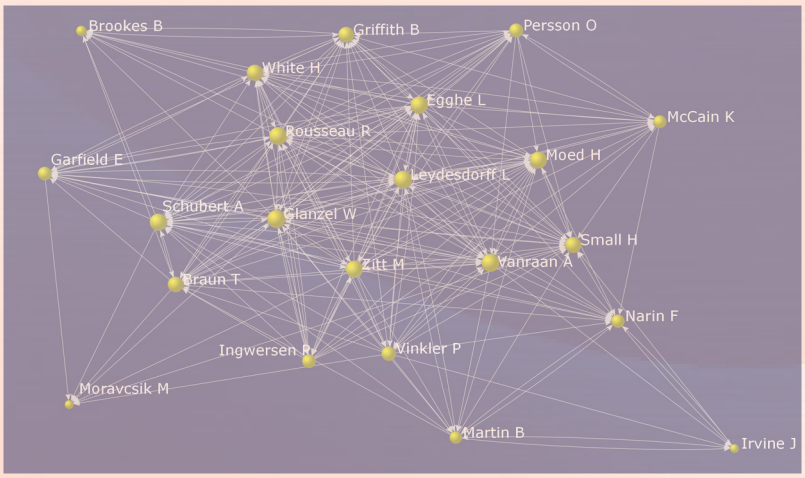


Figure 1. Citations among Derek de Solla Price Award Winners. Note: Based on a set of LIS journals used in Persson, O. Identifying research themes with weighted direct citation links. Journal of Informetrics, 4(3), 415-422

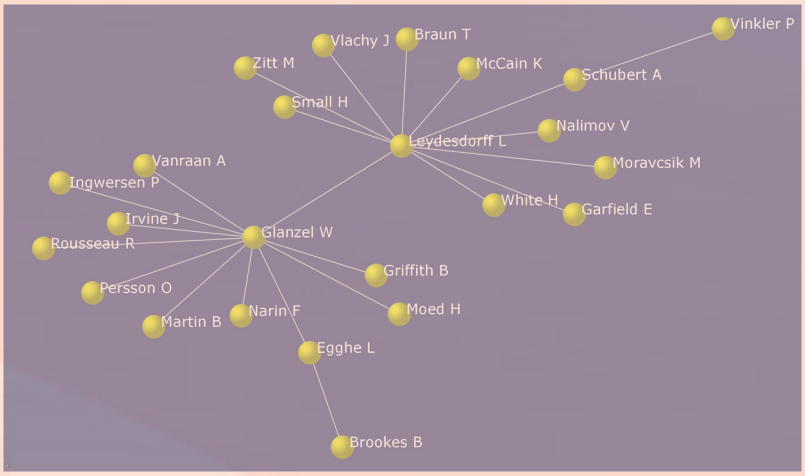


Figure 2. Shared title words among Derek de Solla Price Award Winners – strongest links only. Note: Shared title words between papers with overlapping authors are excluded. Based on a set of LIS journals used in Persson, O. Identifying research themes with weighted direct citation links. Journal of Informetrics, 4(3), 415-422.

SUBGRAPHS DERIVED FROM THE HIRSCH CORE IN UNDIRECTED, UNWEIGHTED NETWORKS

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Abstract: The *h*-index has been defined for many types of sets, including networks. In this contribution we strengthen the mathematical relations between the basic theory of the *h*-index and graph theory. With each graph five types of *h*-index related subgraphs are defined and an introductory investigation of their relations is carried out. Possible applications are mentioned.

Keywords: *h*-index; Hirsch core; construction of subgraphs

1. INTRODUCTION

Since its introduction in 2005 the *h*-index or Hirsch index (Hirsch, 2005) has been the topic of several hundreds of articles, often, but not always, within a publication-citation context. As citations can be considered links in a network of articles it is only natural that the notion of an *h*-index has been extended to a network context (Schubert et al., 2009). Soon after the introduction of the *h*-index the notion of a Hirsch core has been introduced (Rousseau, 2006). With every *h*-index one can associate a Hirsch core hence this can also be done in a network context (precise definitions are given in the next section). In this note we propose several definitions of subnetworks related

to the *h*-index of a graph and study their relationship. We assume that all graphs are undirected and that links have no weights, hence we only consider undirected, unweighted networks. Consequently an article citation network is not an example of the type of network studied in this article, but an author collaboration network (ignoring the number of collaborations) is. The terms network and graph are used as synonyms. A graph G is completely determined by the pair (N(G),L(G)), consisting of a node set and a link set.

2. THE *H*-INDEX

DEFINITION: THE H-INDEX

The *h*-index was introduced in 2005 by Hirsch (Hirsch, 2005) as an indicator to evaluate the lifetime achievement of a scientist. In that context it is defined as the largest natural number *h* such that the articles ranked *1* to *h* have at least *h* citations. The definition has been adapted to other cases besides scientists, such as journals (Braun et al., 2006), research groups (van Raan, 2006), topics (Banks, 2006; STIMULATE 6, 2007), countries (Csajbók et al., 2007), library classifications and loans (Liu & Rousseau, 2009), patentees (Guan & Gao, 2008), and to other periods, besides a scientist's lifetime (Liang & Rousseau, 2009). A large number of adapted or similar indices such as the *g*-index and the *R*-index have been proposed. For a description of these we refer the reader to the following review articles (Alonso et al., 2009; Egghe, 2010). Mathematicians generally do not agree with the methods used nowadays for research evaluation. These methods are considered crude at best and seriously flawed at worst (Adler et al., 2008; Arnold, 2010). In this short note we show how at least one of the indicators applied in research evaluation, namely the *h*-index, can be used to enrich the mathematical theory of networks.

DEFINITION: THE DEGREE H-INDEX OF A GRAPH

For our investigations we need the following definition. The degree *h*-index of a graph G is defined as the largest natural number *h(G)* such that *h(G)* nodes have degree *h(G)* or larger (Schubert et al., 2009). As we will only study the degree *h*-index of a graph we simply use the term "*h*-index", without further specification. As each graph has an *h*-index one may also determine the *h*-index of any subgraph of a given graph.

DEFINITION: THE HIRSCH CORE SET OF A GRAPH

In this note we define the Hirsch core set, denoted as H(G), as the set of nodes with at least $h = h(G)$ links (*h* being the *h*-index of the graph). Hence the only upper bound on the size of the Hirsch core is the number of nodes in the graph. This definition differs from the one given earlier by us (Rousseau, 2006) but has the advantage to be uniquely defined. It was suggested by Burrell (2007). In order to avoid ambiguities with other existing "h-cores", e.g. in nuclear physics, we will not use this term but will always write *Hirsch core*. The Hirsch core set of Figure 1 is {a,b,c}, corresponding to an *h*-index equal to 3. The Hirsch core set H(G) can be considered as a subgraph with an empty link set, such that each node has degree zero. For simplicity this subgraph will also be denoted as H(G).

3. NEW SUBGRAPHS: DEFINITIONS

Next we consider the problem of defining a more meaningful subgraph corresponding to the Hirsch core set of a graph G. We construct this graph based on two principles. The first principle is that the Hirsch core set must be a subset of the node set of

this subgraph. The second principle is that its link set must be a subset of the link set of G. This means that we do not want to create new links. Following these two principles we introduce four other subgraphs, related to the *h*-index of a graph.

DEFINITION: THE MINIMAL HIRSCH CORE SUBGRAPH OF A GRAPH G

The minimal Hirsch core subgraph of a graph G is defined as the subgraph of G for which the node set consists of the Hirsch core set and the link set consist of those links in G directly connecting nodes in the Hirsch core set. This subgraph of G is denoted as mH(G). Hence, by definition N(mH(G)) = H(G). In extreme cases its link set can be empty, as illustrated in Figure 1. In such cases the subgraph H(G) coincides with mH(G).

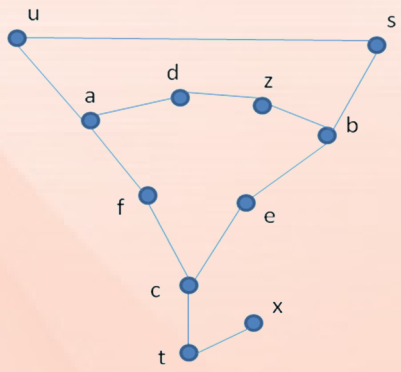

Figure 1. Graph G_o with $h(G_o) = 3$. Its Hirsch core set is {a,b,c}.

DEFINITION: THE SHORTEST PATHS HIRSCH CORE SUBGRAPH OF A GRAPH G

The shortest paths Hirsch core subgraph of a graph G, denoted as SH(G), is constructed as follows. First one considers H(G). L(SH(G)) consists of all shortest paths (in G) between the nodes of H(G). By adding shortest paths new nodes may be introduced. These too belong to the node set of the shortest paths Hirsch core subgraph. By definition mH(G) is a subgraph of SH(G). For Fig. 1 the node set of SH(G_o) consists of {a,b,c,d,z,e,f}. This is: all nodes except nodes u,s,t and x. Links are all links in G_o connecting the nodes in {a,b,c,d,z,e,f} (the part in the middle). We observe that the degree of a node in the Hirsch core set may be strictly smaller in SH(G) than in G. In G_o this is the case for nodes a, b and c.

DEFINITION: THE EXTENDED HIRSCH CORE SUBGRAPH OF A GRAPH G

The extended Hirsch core subgraph of a graph G, denoted as EH(G) is constructed as follows. One starts from the Hirsch core set: H(G). Then one considers all neighbours of this Hirsch core. These are added to N(EH(G)). Next one adds all links between these neighbours and the members of the Hirsch core set. This subgraph of G is the extended Hirsch core subgraph of a G. Note that the node set of EH(G) can be strictly larger than the Hirsch core set, but can never be strictly smaller. It is easy to see that the minimal Hirsch core subgraph of a graph is also a subgraph of EH(G), but SH(G) is not necessarily. The node set of EH(G_o) in Figure 1 consists of {a,b,c,d,u,z,s,e,t,f}; only node x belongs to G_o and not to EH(G_o). The links connecting u and s; t and x; and d and z do not belong to the link set of EH(G_o). All other links do. In this case there is no inclusion relation between EHC(G_o) and SH(G_o). By construction the degree of a node in the Hirsch core set is the same in EH(G) as in G. Other nodes in EH(G) may have a smaller degree in EH(G) than in G. In G_o this is the case for nodes u,s, t, d and z.

DEFINITION: THE MAXIMAL EXTENDED HIRSCH CORE SUBGRAPH OF A GRAPH G

The maximal extended Hirsch core subgraph of a graph G, denoted as MEH(G) is constructed as follows. One starts from H(G). Then one considers all neighbours of this Hirsch core. These are added to the (provisional) node set of MEH(G). Next one adds all shortest paths between these

nodes. In doing this new nodes may be introduced. The resulting graph is MEH(G) (maximal extended Hirsch core subgraph). For Figure 1 it consists of all nodes except x and all links except the one connecting t and x. By definition EH(G) and SH(G) are subgraphs of MEH(G). Figure 1 also illustrates that MEH(G) is in general a proper subgraph of G.

We note the following result regarding *h*-indices.

PROPOSITION 1

For each graph G we have:

$$h(EH(G)) = h(MEH(G)) = h(G).$$

Proof. This follows directly from the construction of these subgraphs.

4. RELATIONS BETWEEN THESE FIVE TYPES OF HIRSCH CORE RELATED SUBGRAPHS

In general we have the following relations

$$H(G) \subseteq mH(G) \subseteq \begin{matrix} SH(G) \\ EH(G) \end{matrix} \subseteq MEH(G) \subseteq G$$

If G is an *r*-regular graph, this is a graph for which each node has the same degree equal to r then $h(G) = r$, and the Hirsch core is equal to G. In this case all Hirsch core types of subgraphs coincide: H(G) = mH(G) = SH(G) = EH(G) = MEH(G) = G. In the graph G_0 of Figure 1 we have that $mH(G_0)$ is a strict subgraph of $SH(G_0)$ and of $EH(G_0)$. In this example $SH(G_0)$ and $EH(G_0)$ have no inclusion relation. Moreover, $SH(G_0)$ and $EH(G_0)$ are both proper subgraphs of $MEH(G_0)$. Finally, in this example $MEH(G_0)$ is a proper subgraph of G_0. Next we provide examples of graphs where the Hirsch core is strictly included in mH(G), where SH(G) is strictly included in EH(G), and where EH(G) is strictly included in SH(G).

First we consider a line graph, denoted as LINE, consisting of M nodes. Each node, except the two end nodes have degree 2. If M > 3, h(LINE) = 2. H(LINE) consists of all nodes except the two end nodes. mH(LINE) is the subgraph connecting the Hirsch core nodes. Hence we have a strict inclusion between these subgraphs. Further, mH(LINE) = SH(LINE), but EH(LINE) = MEH(LINE) = LINE. Hence we have the strict inclusion SH(LINE) ⊂ EH(LINE).

Next we consider the graph G_1 (Figure 2). Here $H(G_1) = \{c,a,b,d,g,h,i,k,l\}$. $L(mH(G_1))$ consists of all links except those connecting c and e; e and f; f and g, i and j, and finally j and k. $SH(G_1) = G_1$ (remember that ALL shortest paths must be added). We further have that $N(EH(G_1)) = N(G_1)$ but the link between e and f does not belong to $L(EH(G_1))$. Hence this is an example where EH(G) ⊂ SH(G). Finally $MEH(G_1) = G_1$.

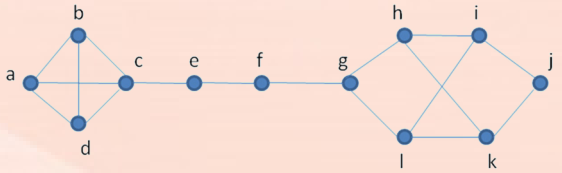

Figure 2. Graph G_1

5. CONCLUSION

In this note we brought together two topics which have gained a lot of attention in recent years: graphs and networks on the one hand and the *h*-index on the other. We have introduced five subgraphs derived from the Hirsch core in undirected, unweighted networks and studied their relationships. Examples illustrating special cases are provided. The above mentioned subgraph structure may lead to potential applications in graph theory and algorithmic design.

ACKNOWLEDGEMENTS

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SIMPLE ARITHMETIC VERSUS INTUITIVE UNDERSTANDING: THE CASE OF THE IMPACT FACTOR

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Abstract: We show that as a consequence of basic properties of elementary arithmetic journal impact factors show a counterintuitive behaviour with respect to adding non-cited articles. Synchronous as well as diachronous journal impact factors are affected. Our findings provide a rationale for not taking uncitable publications into account in impact factor calculations, at least if these items are truly uncitable.

Keywords: synchronous and diachronous impact factors; ranking invariance with respect to non-cited items

INTRODUCTION

In this note we show how simple arithmetic may influence our understanding of the impact factor. Concretely, it is possible that the impact factor of journal J is larger than the impact factor of journal J' and that adding the same number of non-cited articles to both reverses the mutual order. Although completely natural from a mathematical point of view, we consider such behaviour as counterintuitive. Indeed, journal J seems more visible than journal J': how can then adding non-cited items make journal J' more visible than journal J?

JOURNAL IMPACT FACTORS

We recall the definitions of the synchronous and the diachronous journal impact

factor. The n-year synchronous impact factor of journal J in year Y is defined as (Rousseau, 1988):

$$IF_n(J,Y) = \frac{\sum_{i=1}^{n} Cit(Y,Y-i)}{\sum_{i=1}^{n} Pub(Y-i)} = \frac{\frac{1}{n}\sum_{i=1}^{n} Cit(Y,Y-i)}{\frac{1}{n}\sum_{i=1}^{n} Pub(Y-i)} \quad (1)$$

In this formula the number of citations received by journal J (from all members of the pool of sources under consideration) in the year Y, by articles published in the year X, is denoted as $CIT_J(Y,X)$, where for simplicity we have not included the index J in equation (1). Similarly, PUB(Z) denotes the number of articles published by this same journal in the year Z. We made it clear in equation (1) that the standard synchronous journal impact factor is a ratio of averages (RoA). Hence we will denote it as RAIF. When n = 2 one obtains the classical Garfield (1972) journal impact factor. Since a few years also the 5-year journal impact factor is provided in Thomson Reuters' Web of Science. The term 'synchronous' refers to the fact that the citation data used to calculate it are data collected in the same year. We next recall the definition of the diachronous impact factor.

The n-year diachronous impact factor of journal J for the year Y, denoted as $IMP_n(J,Y)$, is defined as

$$IMP_n(J,Y) = \frac{\sum_{i=s}^{s+n-1} Cit(Y+i,Y)}{Pub(Y)} \quad (2)$$

where $s = 0$ or 1, depending on whether one includes the year of publication or not. The term 'diachronous' refers to the fact that the data that are used to calculate this impact factor derive from a number of different years with a starting point somewhere in the past and encompassing subsequent years (Ingwersen *et al.*, 2001).

RANKING INVARIANCE WITH RESPECT TO NON-CITED ITEMS

We consider the following form of invariance. If a performance indicator I is calculated for journals J_1 and J_2 and $I(J_1) < I(J_2)$ then, if we add the same number of publications with zero citations, we require that also for the new situation $I(J_1) < I(J_2)$. We refer to this requirement as ranking invariance with respect to non-cited items. This notion is totally different from the consistency notions introduced by Waltman and van Eck (Waltman & van Eck, 2009; Waltman et al., 2011) or by Marchant (2009) (under the name of independence). Recall that, for good reasons, the notion of consistency as defined by these authors refers to cases where the number of publications (in the denominator) is the same for both journals. We do not require this.

Next we show that impact factors are not ranking invariant with respect to non-cited items. Consider the following example (see Table 1).

Table 1: Data for the calculation of the Garfield impact factor (RoA case) for the year Y.

	J_1	J_2
Pub(Y-1)	10 (+25)	30 (+25)
Pub(Y-2)	10	30
Cit(Y,Y-1)	30	60
Cit(Y,Y-2)	30	60

On the basis of Table 1, the Garfield impact factors of journals J_1 and J_2 are $IF_2(J_1,Y) = 3$ and $IF_2(J_2,Y) = 2$, so that $IF_2(J_1,Y) > IF_2(J_2,Y)$. However, adding 25 non-cited publications, yields the new impact factors: $IF_2(J_1,Y) = 60/45 = 1.33$ and $IF_2(J_2,Y) = 120/85 = 1.41$, so that for the new situation the relation between the impact factors reverses.

We note that for the classical synchronous impact factor IF_2 ranking invariance with respect to non-cited items always holds for the special case that both $IF(J_1) < IF(J_2)$ and the sum of Cit(Y,Y-1) and Cit(Y,Y-2) is smaller for journal J_1 than for journal J_2 (or is equal). Indeed: denoting

the 2-year impact factor of journal J_i (i = 1,2) simply by C_i/P_i we have:

$$\frac{C_1}{P_1} < \frac{C_2}{P_2} \quad \text{and} \quad C_1 \le C_2$$

If now Z denotes the added number of publications with no citations we have to show that:

$$\frac{C_1}{P_1+Z} < \frac{C_2}{P_2+Z} \Leftrightarrow$$

$$\Leftrightarrow C_1(P_2+Z) < C_2(P_1+Z) \Leftrightarrow$$

$$\Leftrightarrow C_1P_2 + C_1Z < C_2P_1 + C_2Z$$

This is clearly true since $C_1P_2 < C_2P_1$ and $C_1Z \le C_2Z$. We also note that if

$$\frac{C_1}{P_1} < \frac{C_2}{P_2} \text{ and } P_1 \le P_2 \text{ then } \frac{C_1}{C_2} < \frac{P_1}{P_2} \le 1,$$

$$\text{hence also } C_1 \le C_2 .$$

This implies that also under these conditions ranking invariance with respect to non-cited items holds. Denoting by $IF_Z(J)$ the impact factor of journal J when Z non-cited items are added leads us to the following characterization result.

Proposition. If $IF(J_1) < IF(J_2)$ then rank reversal, i.e. $IF_Z(J_1) > IF_Z(J_2)$ occurs if and only if $C_1 > C_2$ and

$$Z > \frac{D}{C_1 - C_2}$$

where $D = P_1C_2 - P_2C_1$.

Proof. We already know that if $C_1 \le C_2$ then there is no rank reversal. If now $IF(J_1) < IF(J_2)$ this implies that $P_1C_2 > P_2C_1$. Its (positive) difference $P_1C_2 - P_2C_1$ is denoted as D. We have now the following equivalences:

$$IF_Z(J_1) > IF_Z(J_2) \Leftrightarrow (P_1+Z)C_2 < (P_2+Z)C_1 \Leftrightarrow$$

$$\Leftrightarrow P_2C_1 + D + ZC_2 < P_2C_1 + ZC_1 \Leftrightarrow$$

$$\Leftrightarrow D < (C_1 - C_2)Z \Leftrightarrow Z > \frac{D}{C_1 - C_2}$$

This proves the proposition.

This result shows the exact requirements to have rank reversal in the case of the classical synchronous impact factor, and hence when it does not occur. We continue our investigations by considering the diachronous impact factor. A simple variation of Table 1 shows that also the diachronous impact does not satisfy this property either, see Table 2.

Table 2: Data for the calculation of the dynamic (=diachronous) impact factor (RoA case) for the year Y.

	J_1	J_2
Pub(Y)	20 (+25)	60 (+25)
Cit(Y,Y)	10	20
Cit(Y,Y+1)	20	40
Cit(Y,Y+2)	30	60

With s = 0, we have $IMP_3(J_1,Y) = 60/20 = 3$ and $IMP_3(J_2,Y) = 120/60 = 2$. Adding 25 non-cited publications yields the new diachronous impact factors: $IMP_3(J_1,Y) = 60/45 = 1.33$ and $IMP_3(J_2,Y) = 120/85 = 1.41$. The rank-order of the two journals in terms of their impact factor is thus reversed by adding an equal number of non-cited items to both.

The characterization provided above also holds for the diachronous impact factor as it too is determined by dividing a number of citations by a number of publications.

AoR VERSUS RoA

We have shown that the standard synchronous impact factor is of the RoA-form and that it does not satisfy ranking invariance with respect to non-cited items. Let us analyze whether perhaps an Average of Ratios (AoR) form of the synchronous impact factor behaves better in this respect. First we define the ARIF as:

$$ARIF_n(J,Y) = \frac{1}{n}\sum_{i=1}^{n}\frac{Cit(Y,Y-i)}{Pub(Y-i)} \qquad (3)$$

However, it turns out that the AoR-form behaves even worse with respect to ranking invariance. Indeed, consider the case of a two-year impact factor ($ARIF_2$) and

assume that journals J_1 and J_2 have in each year equal numbers of publications. If $RAIF_2(J_1,Y) > RAIF_2(J_2,Y)$, (or, $IF_2(J_1,Y) > IF_2(J_2,Y)$), this means that journal J_1 received more citations than journal J_2 (in the year Y). Adding the same number of zero-cited publications to both, does not change the total number of citations received, and hence J_1's standard impact factor remains smaller than J_2 (of course both impact factors decrease by increasing the denominators). The same argument holds for the n-year synchronous impact factor (RA-case). This, however, does not hold for ARIF. Consider the example shown in Table 3.

Table 3. Data for the calculation of a two-year synchronous impact factor (AoR case) for the year Y.

	J_1	J_2
Pub(Y-1)	30 (+10)	30 (+10)
Pub(Y-2)	20	20
Cit(Y,Y-1)	10	120
Cit(Y,Y-2)	80	10

Based on the data shown in Table 3, we have: $ARIF_2(J_1,Y) = (0.5).(10/30+80/20) = 2.17$ and $ARIF_2(J_2,Y) = (0.5).(120/30+10/20) = 2.25$ so that $ARIF_2(J_1,Y) < ARIF_2(J_2,Y)$. However, adding 10 publications in the year Y-1 yields the new impact factors: $ARIF_2(J_1,Y) = (0.5).(10/40+80/20) = 2.13$ and $ARIF_2(J_2,Y) = (0.5).(120/40 + 10/20) = 1.75$, so that for the new situation $ARIF_2(J_1,Y) > ARIF_2(J_2,Y)$. ARIF is more sensitive to adding publications with no citations to the denominator than RAIF *because* ARIF is an average (cf. Ahlgren et al., 2003); RAIF, however, is not an average, but a quotient between two summations (Egghe & Rousseau, 1996).

It is easy to find similar examples of violations against the assumption of ranking invariance for any n-synchronous impact factor calculated in the AoR way.

A REMARK CONCERNING THE FRAMEWORK OF IMPACT FACTOR CALCULATIONS: "UNCITABLE" ITEMS

When Garfield introduced the impact factor, he decided to introduce the notion of uncitable items. The idea was that journals should not be 'punished' for publishing obituaries, corrections, editorials and similar types of publications, which usually receive no or few citations. Although this seems reasonable, there are in practice two problems with this notion. One is to decide which publications are uncitable, and the other one is the fact that Garfield also decided to include citations to these "uncitable" articles – when they occur - to the total number of received articles. It has been shown, see e.g. (Moed & van Leeuwen, 1995) that this practice may lead to serious distortions in journal impact.

Assume now that if uncitable items could be defined unambiguously, and that they are really never cited, which way of calculating an impact factor is then better? Taking all publications into account (including the – uncited – "uncitable" ones), or taking only the 'citable' ones (cited or not)? The answer is clearly that the second method should be used, as otherwise it would be possible that journal J obtains a higher impact than journal J' due to uncitable publications.

CONCLUSION

We have shown that, as a consequence of simple arithmetic, not satisfying the requirement of ranking invariance with respect to non-cited items is a normal mathematical property related to taking ratios. For the calculation of synchronous

impact factors, the standard RoA approach is to be preferred above the AoR approach, as the RoA approach satisfies ranking invariance with respect to non-cited items for journals with the same number of publications, while the AoR approach may fail even in this case. We characterised when standard impact factors fail to have the property of ranking invariance with respect to non-cited articles. Our findings provide a rationale for not taking uncitable publications into account in impact factor calculations, at least if these items are truly "uncitable", that is, are really never cited. Furthermore, they provide another argument against using averages in the case of highly skewed distributions (Ahlgren et al., 2003; Bornmann & Mutz, 2011; Leydesdorff & Opthof, 2011).

ACKNOWLEDGEMENTS

The authors thank Raf Guns (UA), Wolfgang Glänzel and two anonymous reviewers for helpful suggestions.

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DIRECTORY AND DATABASE

OF INDIAN SCIENCE, TECHNOLOGY AND MEDICAL PERIODICALS (DIP)

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The research journal is the primary source for scholarly communication; acting as a referee for validating a scientific research as acceptable to the community. New scientific information does not become scientific knowledge until it has been communicated, criticized, and validated by other scientists in the field. Societies play a significant role in scholarly communication. Primary publications (Periodicals or Journals) contain the work of contemporary scholars who are contributing to the advancement of their subject. The proliferation of freely accessible online journals, the development of subject specific pre- and e-print archives and collections of learning objects provides valuable supplement of scientific knowledge to the existing types of published scientific information (books, journals, databases etc.). However these important collections are difficult to overview and integrate in the library and information services provided by libraries for their user constituency.

There are an estimated half a million serials which qualify as journals or serials published in English and other languages throughout the globe. The current figure in the ISSN register of the ISSN International Centre, Paris is 9997-0003. Most of these contain articles with some original research published in non-English periodicals, although of variable quality. Admittedly, many of them do not qualify for inclusion in the highly competitive secondary information services which demand stringent criteria of quality and standard. Not surprisingly, many journals do not figure in a majority of reputed secondary international databases of periodicals such as Index Medicus, Chemical Abstracts or even lists of scholarly periodicals brought out by various publishers/agencies The Ulrich's International Periodicals Directory 2010, the premier serials reference source, for example, provides information on 215880 serials published throughout the world under 897 subject headings.

Due to varied reasons, serials from developing countries find maximum exclusion from international databases / directory or bibliographic lists. One of the prime reasons for this exclusion is the lack of initiatives by developing countries to keep up-to-date their record of serials that are published therein. The same problem has been observed in India. The present research work we report has made an effort to create an up-to-date directory of periodicals published from India.

INDIAN SCENARIO

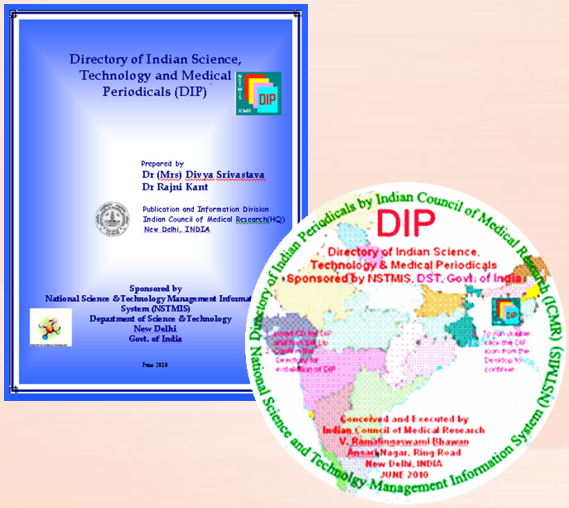
The Directory of Periodicals Published in India lists 2000 bibliographic information on about 12,000 serials including 681 newspapers. The Directory of Indian Scientific Periodicals 1992, brought out by the Indian National Scientific Documentation Centre, New Delhi, lists only 1991 journal titles including about 120 secondary publications, but the updated version is not available in printed form to the users. Another directory of "Indian Periodicals" is being published by a private publisher "Sapra & Sapra". This directory contains all the serial publications from all the fields of Knowledge. The orientation is not for Science and Technology Scholarly Journals only. Because of this unavailability of single source for the Indian S & T Journals, many Indian Journals are not able to come in the fore front of Scientific Community, thereby resulting in a limited coverage of Indian research activity.

In many forums on Scholarly Communication, the idea of creating a comprehensive directory of Indian S&T Journals was discussed. It was felt that one of the reasons of Indian research activity not visible in a comprehensive manner was due to a 'proper' record of the sources that address Indian research activity. Department f Science and Technology (DST), the nodal agency in India for S&T funding, was interested that a comprehensive directory be created to promote ease of use of scientific and technical scholarly Indian journals, their increased usage and impact.

With this objective, the experts from the Indian Council of Medical Research, India were commissioned by DST (NSTMIS Division) the creation of "Directory of Indian Periodicals (DIP 2010)"- a Directory of Journals and Periodicals published in India in the areas of Science, Technology and Medicine and Agriculture.

OUTCOME OF THE EFFORTS

The 'Directory' that was finally created from the sponsored study brings together the latest bibliographic serial details in one location.



Cover of the printed copy and CD Label of the Directory

The Directory is comprehensive and covers all Indian scientific and technical, including biomedical, agriculture scholarly journals from India, that use a quality control system to guarantee the content. In short a one stop shop for users to Indian Journals. The journals have been selected on the following Selection Criteria:

- **Quality control:** The journal should exercise quality control on submitted papers through an editor, editorial board and/or a peer-review system.
- **Periodical:** The journal should have an ISSN (International Standard Serial Number), as per the information at http://www.issn.org.
- **Research Journal:** Only those Journals were included that report primary results

of research or overviews of research results to a scholarly community.

- **Periodical:** A serial appearing or intended to appear indefinitely at regular intervals, generally more frequently than annually, each issue of which is numbered or dated consecutively and normally contains separate articles, stories, or other writings.
- **Coverage of Journals:**
  - **Subject:** All scientific & Technical, Biomedical and Agriculture subjects are covered.
  - **Types of resource**: Scientific and scholarly periodicals that publish research or review papers in full text.
  - **Acceptable sources**: Academic, government, commercial, non-profit private sources are all were accepted as publisher.
  - **Content:** A substantive part of the journal consists of research papers. All content are available in full text.
  - **Languages:** Only English

This directory provides comprehensive bibliographical information of the India's scientific and technical "periodicals information" in "Science & Technology includes Medical and Agriculture, electronics, communications, engineering, computers and computing, and information technology. It also has significant coverage in areas such as materials science, oceanography, nuclear engineering, geophysics, biomedical engineering, and biophysics. The efforts have been made to include as many communication channels eg. Serials, Journals, Advances, Progress, Annual Review, Letter Journals, Reports, Published Conference Proceedings, as was available. DIP (Directory of Indian Periodicals/Journals Science Technology and Medicine) is the authoritative source of bibliographic and publisher information on Indian periodicals/journals of Science Technology and Medical–academic and scholarly publication. The aim is to facilitate researchers to enhance understanding and explore inter disciplinary linkages among the identified subjects; to enable more effective searching and increase access of the journals/periodicals for users.

The basic information about the journals were collected by physically consulting the journals (where-ever was possible), by making visits to different libraries and other places of interest, writing to the editor/publisher of the journals. Once the basic data for Indian journals were captured, it was converted into searchable database format. ASP.Net with C#.Net with backend SQL Server was used for developing the Web Based on-line Directory. The digital version of the Directory, is searchable by journal title, and Address of the publisher/Editor. The searchable fields for data base are:

> Journal Full Title (Ti), Journal Abbreviated Title (Ta), Remarks, ISSN No, Frequency, Coverage in secondary services: BIOSIS, Current Contents, Web of Science, MEDLINE, SCOPUS, Physics Abstracts, Chemical Abstracts, Indian Science Abstracts, Any Other Secondary Service, Publisher's /Editors address, City, State, Web /Email address.
>
> Whether available: Available in Public Domain, Major Key word, Minor Key word.

One can browse journals by subject also. To search for a phrase of more than one word, the search terms can be enclosed in quotation marks. To browse the full list of titles alphabetically, "Any category" could be chosen as a subject category. The directory (DIP) is available for stand alone system on User CD and the internet version is available on the site of NSTMIS. Another set of Admin CD is also there, having facility to update, edit and insert at fixed intervals.

For the researchers, who do not have accesses to Internet, a hard copy of the directory is also available.

SCOPE & COVERAGE OF DIP:

The subject scope of DIP is 'Science & Technology including Medicine' broadly defined to encompass those areas of the life scienc-

es, behavioral sciences, chemical sciences, and engineering needed by professionals and others engaged in basic & applied research in the field of science and technology, environmental studies, Atmosphere, earth sciences, environmental pollution, ecology, different aspects of forestry, clinical care, public health, health policy development, or related educational activities. The 'Directory' also covers life sciences vital to researchers, and educators, including aspects of biology, environmental science, marine biology, plant and animal science as well as biophysics and biochemistry. A large number of journals have been included from the field of Mathematical side and Computers along with Physical Sciences and some journals from Agricultural side.

The majority of the publications covered in DIP are scholarly journals; a small number of newsletters, bulletins, some selected periodicals and some house magazines, considered useful to particular segments of DIP's broad user community are also included.

This directory provides comprehensive bibliographical information of the total 2412 India's scientific and technical "periodicals information" in "Science & Technology, Medical and Agriculture, electronics, communications, engineering, computers and computing, and information technology. It also has significant coverage in areas such as materials science, oceanography, nuclear engineering, geophysics, biomedical engineering, and biophysics. The efforts have been made to include as many communication channels eg. Serials, Journals, Advances, Progress, Annual Review, Letter Journals, Reports, Published Conference Proceedings as was available.

ABACUS
ABACUS
Frequency: Semiannual ISSN: 0973-8339
Major SA: OTHERS
Minor SA: Accounting, Finance and Business Study
Covered in Secondary Services:

ISA	: Y	TDB	: N	SCOPUS	: N
MEDLINE	: N	WOS	: N	BIOSIS	: N
EMBASE	: N	INSPEC	: N	CHEM ABSTR	: N
PHYS ABSTR	: N			COMPENDEX	: N

Publisher: Birla Institute of Technology and Science
Address: Department of Architecture, Mesra
Ranchi, Bihar
E Mail: abacus@bitmesra.ac.in
Website: www.bitmesra.ac.in
Open Acces: Y

Acta Ciencia Indica Phys
Acta Ciencia Indica Physics
Frequency: Monthly ISSN: 0253-732X
Major SA: PHYS SCI
Minor SA: Physics
Covered in Secondary Services:

ISA	: Y	TDB	: N	SCOPUS	: N
MEDLINE	: N	WOS	: N	BIOSIS	: N
EMBASE	: N	INSPEC	: N	CHEM ABSTR	: N
PHYS ABSTR	: N			COMPENDEX	: N

Publisher: Pragati Prakashan
Editor: Dr AK Bhatnagar
Address: Pragati Bhavan 241 W.K. Road
Meerut, Uttar Pradesh
Website: www.pragatiprakashan.com

Acharya Nagarjun J Math Inform Technol
Acharya Nagarjun Journal of Mathematics and Information Technology
Frequency: Semiannual ISSN: 0973-3477
Major SA: MATH
Minor SA: Mathematics
Covered in Secondary Services:

ISA	: N	TDB	: N	SCOPUS	: N
MEDLINE	: N	WOS	: N	BIOSIS	: N
EMBASE	: N	INSPEC	: N	CHEM ABSTR	: N
PHYS ABSTR	: N			COMPENDEX	: N

Publisher: Acharya Nagarjun University
Address: Nagarjun Nagar
Nagarjun Nagar, Andhra Pradesh 522510

Acta Ciencica Indica Math
Acta Ciencica Indica Mathematics
Frequency: Quarterly ISSN: 0950-0455
Major SA: MATH
Minor SA: Mathematics
Covered in Secondary Services:

ISA	: Y	TDB	: N	SCOPUS	: N
MEDLINE	: N	WOS	: N	BIOSIS	: N
EMBASE	: N	INSPEC	: N	CHEM ABSTR	: N
PHYS ABSTR	: N			COMPENDEX	: N

Publisher: Pragati Prakashan
Address: P O Box -62
Meerut, Uttar Pradesh
E Mail: info@insio.com
Website: www.insio.com

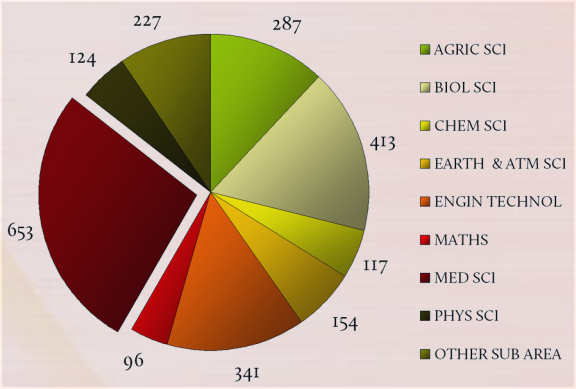
Acta Bot India
Acta Botanica India
Frequency: Semiannual ISSN: 0379-508X

Acta Clin Sci
Acta Clinica Scientia

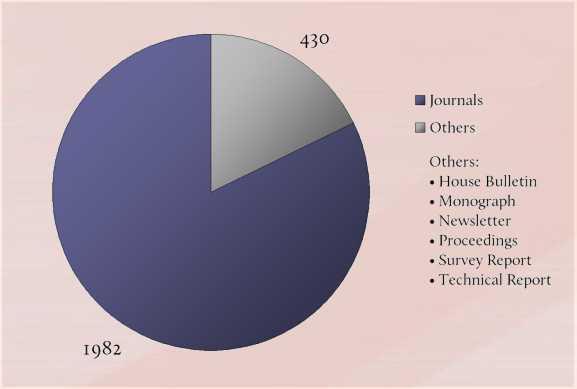
Sample page of the Directory

Internet Version of the Database(DIP)

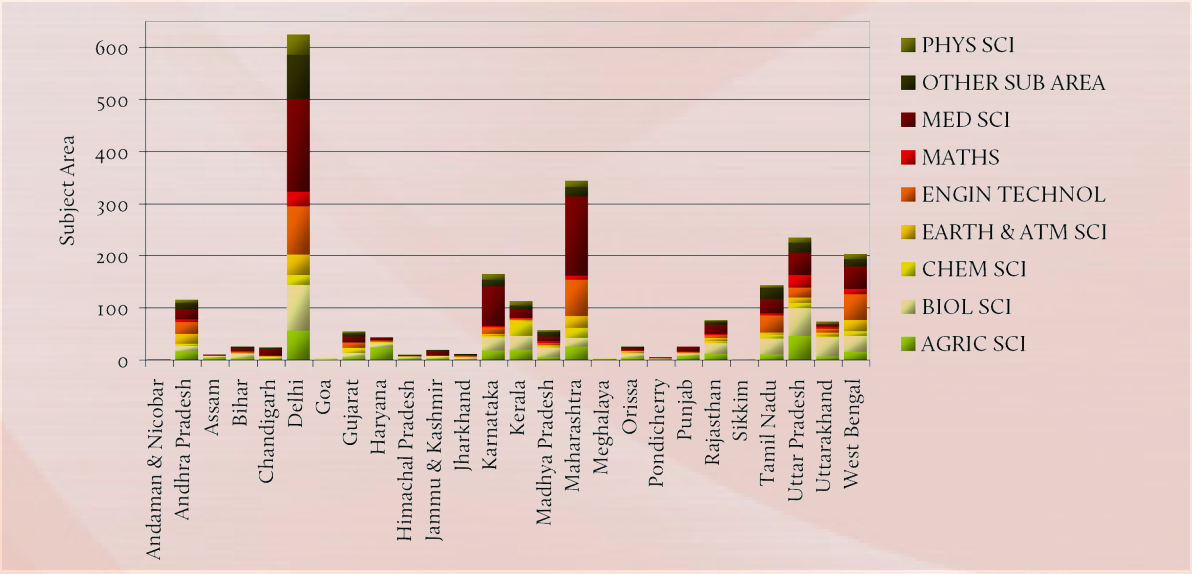
Windows Version of the Database (DIP)



Major Subject Area wise distribution of periodicals. Total = 2412



Inclusions of Journals / Others in the Directory Total = 2412



AN OVERVIEW OF THE DIRECTORY

Details of addresses, editor's name and inclusion of journals in secondary services were obtained from the original journal (wherever possible), Ulrich's International Periodicals Directory (2008), List of Journals indexed in MEDLINE (2008), list of journals abstracted in EMBASE (2008), list of journals included in BIOSIS (2007), Indian Science Abstracts, Tropical Diseases Bulletin, WoS, Chemical Abstracts, COMPENDEX & INSPEC (2008). The Directory contains 2412 selected periodicals being published from India. The coverage of individual journals in various secondary services indicates that the maximum journals are covered in Indian Science Abstract (ISA) followed by SCOPUS, Tropical Disease Bulletin (TDB), MEDLINE, BIOSIS, WoS, EMBASE, INSPEC, Chemical Abstract (CA), COMPENDEX and Physics Abstract. In the hard copy, journals are arranged alphabetically according to abbreviations as per MEDLINE or BIOSIS. The Directory contain (i)Journal Index (Subject Category wise); (ii)Journals according to place of publication; (iii)Web address of Journals; (iv)Journal covered by different secondary services; (v)Email address (wherever available), List of changed titles, journals available as 'Open Source' and Full text/E-journals in the hard copy, an extensive listing of 'Subject key words along with the page no. has also been included in the Hard copy of the Directory.

We will be glad to provide CD of this directory. For this purpose, please send us an e-mail: drdivya dot srivastava [at] gmail dot com.

HOW TO OBTAIN ERDŐS NUMBER 1 IN THE 21TH CENTURY?

SOME THOUGHTS ON POSTHUMOUS CO-AUTHORSHIP

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Posthumous co-authorship is not uncommon in scholarly communication but it is and remains an exceptional phenomenon. It is certainly one of the unfortunate circumstances if scientists have to finalise research work jointly planned and conducted with a colleague who passed away and who is not able to share the results of the joint efforts. It is quite normal that these scientists wish to continue and complete the joint projects, or to publish hitherto unpublished material and to honour their deceased colleague by including his/her name in the lists of co-authors. Such deserved acknowledgement is legitimate since a co-author is not necessarily a co-writer as Blaise Cronin convincingly argued (e.g. Cronin, 2004). The question of how long the laudable intention to honour a deceased colleague by indicating his/her name and last affiliation in the byline of the follow-up publications of formerly joint research, depends on many factors such as, among others, on the subject of the research and the position and reputation of the deceased person. In slowly ageing theoretical fields of the sciences such as mathematics and in cases where the deceased person has lastingly shaped the fields, in which he/she was active, one expects a longer lasting impact, too, and the continuation of his/her work by others for a quite long period. Above all in mathematics, a person, who formulated a problem, often acts as co-author of the paper in which others solve the problem, e.g., by presenting a proof of the conjecture – or a counterexample. However, in this context several questions arise, namely

of how this lasting impact to the field may be acknowledged in an adequate manner, by co-authorship or rather by other forms of sub-authorship (cf. Cronin, 2003). Furthermore, can scientists, who have not been close collaborators of the deceased, still become co-authors and when would legitimate posthumous co-authorship turn into honorific co-authorship (cf. Cronin, 2001) used for strategic purposes? To draw here a borderline is actually very difficult, if not completely impossible.

Long lasting posthumous co-authorship is in actual fact an extremely rare phenomenon. One of the most known and most interesting cases are the posthumous papers by the "most profilic mathematical genius of the 20th century"[1], the legendary Paul Erdős (1913–1996). He died in September 1996 during a conference in Warsaw, and has left behind innumerable unresolved problems, unfinished projects and open issues in almost all subfields of mathematics. Some of these problems have been taken up by his colleagues and solved after his death. Several results were being published posthumously almost up to now.

After the 'Paul Erdős memorial collection' – a collection of his posthumous papers organised by A. Hajnal, A. Sárközy, V. T. Sós – was published in the journal *Discrete Mathematics* in 1999, still further eleven papers co-authored by Paul Erdős has appeared between 2000 and 2008, i.e., up to 12 years after his death. These papers are indexed in the *Mathematical Reviews* database. For the following discussion I will also indicate the *date received* along with the publication year. In mathematical papers the publication date is, because of the well-known publication delay, just as interesting as the date when the paper was received and/or finally accepted by the journal. I mention one of my own papers just as an example. A note[2] of just three pages, was submitted and received in spring 1985 and it finally appeared in spring 1988. This means a publication delay of three years.

In several posthumous papers by Paul Erdős (received by the corresponding journals in 2000 or later), the circumstances of their realisation are described. Below I give some examples.

Bollobás et al. (2002 – received on 21 November 2000) mention in Note 1 on p. 254:

> "This paper deals with results obtained in the spring of 1996, during the last visit by Paul Erdős to Memphis. We apologize for the delay in its submission."

The paper by Duke et al. (2003) appeared one year later, but was received on 5 February 2003. In their *Historical Remark* on p. 353, the authors mention that

> "... Lacking the continued inspiration of Paul Erdős, the remaining authors allowed these studies to lapse, and they take full responsibility for the resulting delay in publication."

In their article on large intersecting subfamilies of uniform setfamilies, Alon et al. (2002) mention in the byline: "*N. Alon, D. S. Gunderson and M. Molloy would like to dedicate this article to the memory of Paul Erdős.*" And in the acknowledgment at the end of the article they reveal further details of the history.

> "... A few months later, Erdős passed away, and due mostly to procrastination on the part of the remaining authors, the article was not completed until March 2000. During the intervening years, some results in the article were improved, but we strongly feel that the crucial early collaborations fully justify the inclusion of Erdős as a coauthor."

This paper was received on 10 April, 2000.

I have finally found a paper with two posthumous co-authors submitted to the journal *Discrete Mathematics* and received on 9 May 2001. The co-authors of Erdős et al. (2003) explain the reasons for the posthumous co-authorship of Paul Erdős and Geert C.E. Prins in a footnote (p. 53) as follows.

1 Hajnal et al., (1999), Foreword to the 'Paul Erdős memorial collection' (Discrete Mathematics, 200, pp 206)

2 Glänzel, W., A characterization of the normal distribution. *Studia Scientiarum Mathematicarum Hungarica*, 23 (1-2), 1988, 89–91.

> "In a letter to Hedetniemi from Antwerp, Belgium, dated April 14, 1965, Prins commented: 'I like your proof very much, but I cannot understand your objections to Erdős's and mine, because the principle of the proofs seems identical.' Indeed, Prins was quite right. Since much of the material in Section 3 of this paper was contained in this 1965 letter, and has never been published, we include both Erdős and Prins as co-authors."

In several other posthumous papers by Erdős published in the new millennium, I could not find any explanation for the co-authorship. The paper by Diaconis and Erdős (2004) is apparently a reprint of an older internal report (Diaconis and Erdős, 1977). Nevertheless, this paper of 2004 resulted in Diaconis's Erdős number 1. The official Website of the *Erdős Number Project* at Oakland University (ENP, 2010) reports four persons who obtained Erdős number 1 after the year 2000. The last paper posthumously co-authored by Erdős appeared just more than two years ago (Erdős et al., 2008) and, at present, altogether 511 authors have Erdős number 1. It is not very likely but very well possible that this number will still increase.

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