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Some comments on the life and publications of Jerzy K. Baksalary (1944–2005)☆

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Following some biographical information on Jerzy K. Baksalary (1944–2005) and some comments by Tadeusz Caliński, Oskar Maria Baksalary, and *Image* Editors-in-Chief: Bryan L. Shader and Hans Joachim Werner, this article continues with personal remarks on the life and publications of Jerzy K. Baksalary by R. William Farebrother, Jürgen Groß, Jan Hauke, Radosław Kala, Erkki Liski, Xiaoji Liu, Augustyn Markiewicz, Wiesław Migdałek, Friedrich Pukelsheim, Tarmo Pukkila, Simo Puntanen, C. Radhakrishna Rao, George P.H. Styan, Tomasz Szulc, Yongge Tian, Götz Trenkler, Júlia Volaufová, Haruo Yanai, and Fuzhen Zhang. These remarks are followed by a detailed list of, and some comments on, Jerzy Baksalary's publications prepared by the editors of this article. Four photographs of Jerzy Baksalary illustrate the article, with three of these also including some of his coauthors, colleagues, and Ph.D. students.

Introduction

Professor Jerzy K. Baksalary passed away in Poznań, Poland, on 8 March 2005. He was 60 years old. Although suffering, he remained active in his research work

☆ Revised version of "Some comments on the life and work of Jerzy K. Baksalary (1944–2005)" by Oskar Maria Baksalary and George P.H. Styan [*Research Letters in the Information and Mathematical Sciences* 8 (2005), 1–43, <www-ub.massey.ac.nz/~wwiims/research/letters/volume8/>].

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Fig. 1. Jerzy K. Baksalary talking about "Admissibility and sufficiency of linear estimators in the Gauss–Markov model" at the International Workshop on Linear Models, Experimental Designs and Related Matrix Theory (First International Workshop on Matrices and Statistics): Tampere, Finland, 8 August 1990. [Photograph: University of Tampere].

to the very end. Jerzy Baksalary is survived by his wife Mirosława, son Oskar Maria, daughter Katarzyna Baksalary-Iżycka and son-in-law Dariusz Iżycki, and granddaughters Natalia, Dominika, Marianna, and Iga Iżyckie. He is also survived by his sister Grażyna Michalska and brother-in-law Maciej Michalski.

Jerzy K. Baksalary was born in Poznań on 25 June 1944. His middle name "Kazimierz" was not the name his parents wanted to give him but in 1944 the choice was limited to certain names only; Jerzy did not like this middle name and never used it.

For the years 1969–1988, Jerzy Baksalary worked at the Agricultural University of Poznań, where he was associated with the Department of Mathematical and Statistical

Methods from 1975 to 1988. He completed his Ph.D. in 1975 and his Habilitation[1] in 1984, both at the Adam Mickiewicz University, Poznań. His Ph.D. dissertation [4] in linear statistical models was written under the supervision of Tadeusz Caliński and his Habilitationsschrift, also in linear statistical models, was published as [55]. In 1990, Jerzy Baksalary received the title of Professor in Mathematical Sciences from the President of Poland.

Jerzy Baksalary joined the academic community in Zielona Góra in 1988, first working in the Department of Mathematics of the Tadeusz Kotarbiński Pedagogical University and then in the Institute of Mathematics of the University of Zielona Góra after it was founded in 2001. He was the Rector of the Tadeusz Kotarbiński Pedagogical University in Zielona Góra from 1990 to 1996 and then the Dean of its Faculty of Mathematics, Physics, and Technology from 1996 to 1999. For the 1989–1990 academic year, he was Professor of the Finnish Academy of Sciences in the Department of Mathematical Sciences of the University of Tampere in Tampere, Finland.

Jerzy Baksalary published extensively on matrix methods for statistics. He is the author or coauthor of more than 170 research publications in linear algebra and statistics, including 45 papers published in *Linear Algebra and its Applications* (LAA). The Third Special Issue on Linear Algebra and Statistics of LAA [117] was edited by Jerzy K. Baksalary and George P.H. Styan.

At the funeral service for Jerzy Baksalary held in Poznań on 15 March 2005, Tadeusz Caliński eulogized him (in Polish):

> Let me express our feelings particularly on behalf of those who were close to you in the early years of your academic career, in the seventies and eighties of the past century, at the Agricultural University of Poznań. At that time you were for us an encouraging example of a person full of scientific ideas and willing to work hard. Your works in the theory and application of mathematical statistics and linear algebra drew us into the streams of worldwide scientific literature.
>
> Your personality stimulated younger colleagues and students, for whom you soon became a master and promoter of their careers. Among our joint scientific results of those years, your achievements shine with a particular brilliance. Your contributions to the Poznań school of mathematical statistics and biometry are highly esteemed at present and will be acknowledged by future generations.

A Special Memorial Session for Jerzy Baksalary was organized by Oskar Maria Baksalary, Simo Puntanen, George P.H. Styan, and Götz Trenkler and held on 31 March 2005 at the 14th International Workshop on Matrices and Statistics (Massey University—Albany campus, Auckland, New Zealand, 29 March–1 April 2005). For

[1] "Habilitation is a term used within the university system in Poland, and in some other European countries, to describe either a qualification, the process of earning that qualification, or—incorrectly—the thesis written as part of that process (which is called Habilitationsschrift). A Habilitation qualifies for being admitted as a professor at a university".—*Wikipedia.*

this Memorial Session a set of handouts was prepared which included a reprint of a booklet prepared for the "Session on the occasion of the 60th birthday of Jerzy K. Baksalary" held at the Mathematical Research and Conference Center, Polish Academy of Sciences, Będlewo, Poland, on 17 August 2004, just before the 13th International Workshop on Matrices and Statistics. For the Auckland Memorial Session, Oskar Baksalary wrote about his father:

> Although from the formal point of view I am a physicist and not a mathematician or statistician, with the death of JKB I have lost not only my father, but also my scientific master. On the one hand, this makes his passing away twice as hard for me to bear, but on the other hand I am very happy that for about the last four years I have been sharing with my father his great passion—mathematics.
>
> During this period we have been spending lots of time together, for instance travelling, visiting jazz clubs and art galleries, attending Thursday seminars on linear algebra organized at the Agricultural University of Poznań, chatting, and above all . . . doing mathematics.
>
> JKB really loved his subject and especially he was in love with everything having to do with matrices. This means he also loved the Workshops on Matrices and Statistics. My father and I have been participating in these Workshops since 2000, when the Workshop was held in Hyderabad, India, and thus the one organized this year in Auckland was to be the sixth which we would jointly attend[2] . . . JKB used to sit in the first row. Please leave an unoccupied seat for him.

The set of handouts distributed at the Memorial Session for Jerzy K. Baksalary in Auckland was revised and updated into a single 24-page handout for the Southern Ontario Matrices and Statistics Days: Dedicated to Jerzy K. Baksalary (1944–2005) held in Windsor, Ontario, Canada, 9–10 June 2005. This article is a further revision of the Windsor handout.

Jerzy Baksalary made extensive contributions to *Image: The Bulletin of the International Linear Algebra Society*. As noted by *Image* Editors-in-Chief Bryan L. Shader and Hans Joachim Werner in *Image* issue number 34 (Spring 2005), page 13:

> Recently *Image* lost one of its strongest supporters, contributors, and friends. Jerzy Baksalary read and revised nearly every problem submitted to the *Image* Problem Corner. In addition, he often provided his own (always elegant and illuminating) solutions. Jerzy actively solicited lead articles, book reviews, and reports. Jerzy, we (and the readers of *Image*) will miss you.

A list of Jerzy Baksalary's 30 contributions to *Image* appear in the article by Oskar Maria Baksalary and George P.H. Styan in *Image* 34 (2005), 14–15.

[2] Jerzy Baksalary also attended the International Workshop on Linear Models, Experimental Designs, and Related Matrix Theory (First International Workshop on Matrices and Statistics), Tampere, Finland, August 1990, see Fig. 1.

Fig. 2. Jerzy K. Baksalary (second from left) with Idzi Siatkowski (left), Hanna Kiełczewska, and Augustyn Markiewicz: Poznań, May 1984. [Photograph: Simo Puntanen.]

Apart from this introduction, the present article is in two parts. In Part 1 we present further personal comments on the life and publications of Jerzy K. Baksalary by R. William Farebrother, Jürgen Groß, Jan Hauke, Radosław Kala, Erkki Liski, Xiaoji Liu, Augustyn Markiewicz, Wiesław Migdałek, Friedrich Pukelsheim, Tarmo Pukkila, Simo Puntanen, C. Radhakrishna Rao, George P.H. Styan, Tomasz Szulc, Yongge Tian, Götz Trenkler, Júlia Volaufová, Haruo Yanai, and Fuzhen Zhang.

In Part 2 we discuss in detail the publications of Jerzy Baksalary, and in Table 2.1 we present an annotated list which we believe to be complete of Jerzy Baksalary's publications in research journals and collections (conference proceedings, Festschriften, and other edited books), proposed problems and solutions to problems, and journal special issues, including references to reviews of his papers in *Mathematical Reviews* (MR) and *Zentralblatt MATH* (Zbl); for signed reviews the reviewer's name is given in parentheses.

Personal comments on the life and publications of Jerzy K. Baksalary

I have known Jerzy Baksalary in various guises for more than thirty years. In the 1970s and early 1980s I received a steady stream of postcards from him requesting copies of my published and unpublished papers.

Unfortunately, Jerzy was not able to attend the 1983 Tampere Seminar on Linear Statistical Models. Thus I met him for the first time at a Multivariate Statistics Conference in Łódź (Poland) in 1986. At the Voorburg Workshop on Matrices and

Statistics in 2001, Jerzy reminded me that Heinz Neudecker had reprimanded me in Tampere for not speaking proper 'Continental English' which has a different stress pattern from ordinary Received Pronunciation (e.g., *CE: ana-l ysis* rather than *RP: a-nalўsis*).

Jerzy and I met again at the 1987 Tampere Meeting and I recollect having prompted him to express the difficulty that Eastern Europeans then experienced in obtaining academic books and journals. The situation is only gradually being remedied following the accession of Poland and other Eastern European countries to the European Union. [As a continuing tribute to Jerzy's memory, may I urge anyone thinking of disposing of their surplus academic books and journals to send them to any of the numerous universities around the world that are still in urgent need of such donations.]

In Jerzy's review in *Mathematical Reviews* [MR567938 (82e:62097)] of my paper entitled "Estimation with aggregated data" [*Journal of Econometrics* 10 (1979), 43–55] and in a subsequent paper [45] of his, Jerzy pointed out that the procedures I employed are formally invariant to the choice of a grouping matrix so that the distinct numerical results associated with the various choices of a generalised inverse are due to the presence of rounding errors. But for the fact that I had already done so, this observation may have prompted me to move on to other areas of research.

I do not recollect having cited Jerzy's work in any of my research papers, but in [142] he certainly helped me in generalising the solution to my problem entitled 'A class of square roots of involutory matrices' which I had proposed in *Image* [Problem 27-1 (2001), p. 36] from the set of real nonsingular matrices to the set of nonzero complex matrices with group inverses. Despite the fact that my principal fields of interest were distinct from his own, I have always found Jerzy to be very kind and considerate. What proved to be our final farewell after the Dortmund Workshop in 2003 was particularly touching.

R. William Farebrother
University of Manchester

I came across the papers of Jerzy K. Baksalary written together with numerous coauthors when I was working on my Ph.D. thesis on mixed linear models, trying to adapt approaches in linear estimation to the estimation of fixed and random effects. Being myself inclined to linear algebra and matrix theory, I was intrigued by the statistical concepts such as linear sufficiency, linear admissibility, or minimum biased estimation, and their connection with linear matrix algebra. The papers by Jerzy that I read had a clarity and aesthetic appeal in both the presentation and the way proofs were carried out which I had not encountered before. Therefore, I tried to learn as much as possible, still today admiring the unrivalled ingenuity of the "Baksalarian way of thinking". Only later did I discover numerous papers by Jerzy and his coauthors concerned with topics more in linear algebra than statistics, which then strongly

influenced and stimulated the direction of my own research. Since Jerzy Baksalary has restarted to publish papers in recent years, I was eager to open a new file containing a collection of these. It is very sad, indeed tragic, that this file must now be closed so soon just when it seemed that a lot more fruitful research was to be expected.

Jürgen Groß
Universität Dortmund

In 1976 when I started to work at the Department of Mathematical and Statistical Methods of the Agricultural University of Poznań there was a group of people there who were highly active scientists. Jerzy stood out among them for the clarity of presentation of his results and the precision of his questions at regularly held seminars. In 1978, Jerzy accepted me as a member of his team of collaborators and two years later I coauthored with Jerzy (and Radosław Kala) an article [32] published in 1980.

During the first Solidarity period (1980–1981) Jerzy was engrossed in the union's activity at the Agricultural University of Poznań, and even outside it. Still, he was able to find time for scientific work. After the imposition of martial law, Jerzy was harassed by the secret police. This delayed the publication of his Habilitationsschrift in *Mathematische Operationsforschung und Statistik*, *Series Statistics* [55] (published in former East Germany) and hence he could not be the supervisor of my Ph.D. dissertation, whose postulates were the results I had obtained in cooperation with him. Radosław Kala, his principal coauthor, was chosen to act as supervisor. This was no obstacle to my further cooperation with Jerzy and our next joint papers [56,69,89,122] were published, respectively, in 1984, 1987, 1990 and 1994.

In the 1990s Jerzy was involved in administrative work at the Tadeusz Kotarbiński Pedagogical University in Zielona Góra (serving two terms as the Rector and one as Dean), which forced a break in our cooperation. We started to work together again in 2002, and the effect was another three papers [143,144,156]. Two projects have been left unfinished because of his death. Work with Jerzy, consisting of hours of scientific discussion interwoven with discussion of the political and economic changes occurring in Poland, will always be one of my fondest memories of those years.

Jan Hauke
Adam Mickiewicz University, Poznań

I met Jerzy for the first time in the early 1970s. I do not remember the exact date, but it was on a Friday, probably in the spring of 1972. Every Friday morning starting at 9:00 there was a seminar on Mathematical Statistics and Its Applications, which was conducted by Professor Tadeusz Caliński, who was then the head of the Department of Mathematical and Statistical Methods at the Agricultural University of Poznań. This

seminar has a long tradition and of course a complicated history which is ongoing. It is worth noting that this seminar was initiated in 1963 by Regina C. Elandt.[3]

During the aforementioned seminar someone (I do not remember his name) was presenting the analysis of a complex nonorthogonal experiment and posed the problem, how to locate the columns of the design matrix which form a basis for its range. The next week at the seminar both of us, Jerzy and I, proposed almost exactly the same algorithm for solving that problem. This solution was published in 1973 in the paper [1] in Polish, which is Jerzy's first and also our first joint publication; see also [10] with Anita Dobek, published in English in 1977. On that day, our close scientific cooperation started. It was focused on statistical inference and matrix algebra. We were doing almost everything in parallel. We spent many hours studying papers and books, discussing unsolved problems, and preparing joint papers.

Jerzy defended his Ph.D. dissertation on exactly the same day, 29 September 1975, that I defended mine, and after that we continued our cooperation with a new energy for the next ten years. In all these activities Jerzy was very imaginative, extremely precise, and persistent in finding new problems and their solutions. His standard question was, when the "if" word can be supplemented by the second "f". In all we published 50 papers together from 1973 to 1986 (see Table 2.1).

At the beginning of the 1980s Jerzy started his activity in the Solidarity movement. Simultaneously he completed his Habilitation at the Faculty of Mathematics and Physics of the Adam Mickiewicz University in Poznań, and intensified cooperation with a group of younger members of the Department. In 1988, he moved to Zielona Góra, where he took a position of associate professor at the Tadeusz Kotarbiński Pedagogical University. Two years later, he was elected the Rector (President) there.

The last time I met Jerzy was at Będlewo at the 13th International Workshop on Matrices and Statistics in August 2004.

Radosław Kala
Agricultural University of Poznań

The first time I met Jerzy in person was in 1984 when I attended, with Simo Puntanen, the *International Conference on Linear Statistical Inference* in Poznań.

[3] Born in Poland in 1918, Regina Cecylia Elandt joined the Department of Agricultural Experimentation and Biometry at the Agricultural University of Poznań in 1946, receiving a Ph.D. degree in agricultural sciences (applications of statistical methods in agriculture) in 1955. In 1964 she married Norman Lloyd Johnson (1917–2004) and joined the Department of Biostatistics at The University of North Carolina at Chapel Hill and then published under the name Regina C. Elandt-Johnson; the 1980 Wiley book *Survival Models and Data Analysis* by Regina C. Elandt-Johnson and Norman L. Johnson was reprinted in the Wiley classics library in 1999. In 2001, Regina C. Elandt-Johnson received an honorary doctorate from the Agricultural University of Poznań "in view of her invaluable contributions, both scientific and didactic", and she is now Professor Emerita of Biostatistics at The University of North Carolina at Chapel Hill. [References: Zofia Hanusz: *Biometric Bulletin* 19 (1) (January–March 2002), 14, and "A conversation with Norman L. Johnson" by Campbell B. Read, *Statistical Science* 19 (2004), 544–560.]—*Eds.*

Fig. 3. Jerzy K. Baksalary (left) with Paweł Pordzik and Radosław Kala at the main railway station in Poznań, Friday, 29 August 1980. [Photograph: George P.H. Styan.]

The party organized by Jan Hauke was memorable and Jerzy was a leading figure there. For example, discussions on Poland's political situation were very fascinating. Jerzy was an activist in the free noncommunist Solidarity labour union and had taken part in many actions. He was kept under surveillance by the state security service and sometimes detained. His vivid descriptions and his strong personal opinions about these historical events were unforgettable. I also remember his personal way of proposing a toast to empty sets. I feel that the four papers [15,53,60,66] by Jerzy have influenced my research work the most.

Erkki Liski
University of Tampere

In pursuing my doctor degree, I was lucky enough to obtain surpervision by Prof. Jerzy. I never met Prof. Jerzy in person, but in the last three years, we were in close contact using e-mail. When we were preparing the papers [151–154], we discussed the problems every day at that time. From his e-mail letters, I learned how to do scientific

research and how to write papers, and with his encouragement and guidance, we proceeded to do some work on generalized projectors [168,175]. Although not so formally, Prof. Jerzy was really my Ph.D. supervisor. I am very sorrowful to know of his passing away. I have lost the best teacher in my research and I will remember him forever.

Xiaoji Liu
Guangxi University for Nationalities, Nanning

I first met Jerzy K. Baksalary in the late 1970s when I was looking for a topic for my M.Sc. thesis. Jerzy proposed a topic and helped me substantially with my work on it. I could come to his office at any time, ask him questions and discuss any research problem we were working on. I was especially welcome with solutions and new results. In such a case, he would postpone everything else to ask me for details and to study my results very carefully and most critically. Many of my conjectures were quickly rejected by him: he was a real master at constructing counter-examples!

At about this time I started to attend a seminar on linear models guided by Jerzy and Radosław "Radek" Kala. Jerzy's clear and precise talks accompanied with beautiful handwritten and well-organized presentations on the blackboard allowed us all to follow his lectures easily. His very good knowledge of almost all possible papers in his research area was extremely helpful in our discussions. He used to give from memory precise references to cited results. I had the opportunity to continue my research with Jerzy as the adviser for my Ph.D. dissertation, publishing the results in six joint papers [60,66,77,82,90,125] and [115,124].

Our collaboration stopped in 1990 when Jerzy moved to Zielona Góra. A few years ago he started to attend a seminar on linear algebra and its applications guided by Tomasz Szulc and me in the Department of Mathematical and Statistical Methods of the Agricultural University of Poznań. His participation was warmly welcomed by everybody but especially by our Ph.D. students, who were impressed by his talks, activity in discussions, presentations of open problems (often from *Image*) and proposals for their solutions. We all learnt a lot from our common work on these problems. A result of one such meeting is my joint paper [173] with Jerzy and his Ph.D. student Paulina Kik.

After 1990, I continued my research on admissible estimation in the linear model, the main topic of my M.Sc. thesis and Ph.D. dissertation. This research was based on my papers with Jerzy as well as his papers: [38,65] with Radek Kala, [67,78] with Thomas Mathew, and [106] with Götz Trenkler. Also another direction of my research—matrix orderings—was inspired by Jerzy's work and based on his papers: [84] with Friedrich Pukelsheim and George P.H. Styan, [102] with Sujit Kumar Mitra, [103] with Friedrich Pukelsheim, [122] with Jan Hauke and George

P.H. Styan, and many others. Studying experimental design theory with my Ph.D. students, I used to recommend the paper [55] to them; in [55] Jerzy compared, in a very nice and clear way, a linear model with its augmentation by nuisance parameters.

Augustyn Markiewicz
Agricultural University of Poznań

In 1988, having behind me a two-year-long work experience and army service, I was about to start my studies at the Tadeusz Kotarbiński Pedagogical University (TKPU) in Zielona Góra. After a decent break in my education, I was very eager to restart my studies and, moreover, I was very curious as to who will teach and guide me throughout the next five years. On the other hand, I also had doubts as to whether I had chosen the right university, for TKPU was commonly thought of more as a secondary school than a university.

So the first days of my studies were filled with a mixture of hope and fears. And then it happened—we had the first lecture in linear algebra and we met Him for the very first time. Already at first glance professor Jerzy Baksalary seemed to be different than his colleagues. He had long hair and he had this unique friendly attitude towards the students. We had called him "Baks" and it was that way to the end.

He disappeared for a year to Finland and returned in September 1990. This was an important year in the history of TKPU, for this was a year when the new rector was to be elected. And the votes of the students counted. There were three candidates and Baks was one of them. We had talks and negotiations with each of the candidates. We were interested in their programs, how they were going to improve the academic stature of TKPU, and what they each had to offer us.

What did we expect? Having in mind a strike at TKPU in 1988, we wanted to have more freedom and independence to make the decisions that concerned us. According to Polish law at that time, the students had rights to decide on various social matters such as distribution of the places at dormitories (the number of which was always too small), to whom the university should provide support, and so on.

Baks was reliable. He had a vision on how to guide TKPU to a better future and ideas as to how to solve our problems. He won the election and became the Rector of our university. Then the hard work began, for Baks was not giving anything away for free. Do you want to have a computer lab in the dorm?—no problem, just find a safe place to house the computers. Do you want to earn some money?—no problem, just teach the administration of the university how to use computers. Do you want to take over the distribution of the financial support that TKPU provides to the students?—no problem, just write the computer programs to deal with it. This is the way he was—Baks manager.

We discussed with him various matters concerning students. We had influence on certain expenses from the TKPU budget—it was up to us what fraction of the amount of money available would be spent to run dorms, what fraction to run the campus restaurant, and so on. Baks rearranged the administration of TKUP in such a way that every single penny was under control. We also had influence on the study programs—we got rid of some useless subjects replacing them with new ones. Baks did not forget what he had promised us—we had freedom and independence to make the decisions that concerned us.

At that time, many of the student councils in Poland were truly envious of what we had achieved at TKPU. But it was all due to Baks. If it had not been for him and his friendly attitude towards the students, I would not write this text today. I am glad that in 1990, we elected the right person and thus we managed to solve some very important student problems.

Wiesław Migdałek
Zielona Góra
Former student at the Tadeusz Kotarbiński Pedagogical University

It is with great sadness that I have learnt of Jerzy's death. I have had the great privilege of being a quadruple coauthor of his [62,84,103,111]. Our cooperation was started in 1985 by what I later came to view as a typical characteristic of Jerzy: the quest for mathematical completeness and elegance. During the 1984 Poznań Conference I had presented a joint paper with my colleague Karin Christof, who was my student then, presenting a sufficient condition for two matrices originating in the design of experiments to be Löwner comparable. Jerzy instantly asked whether our condition was also necessary. This gave rise to our first joint publication [62] in 1985, which did sharpen the condition to become indeed necessary and sufficient.

Jerzy insisted on a meticulous line-up of arguments to provide not just some answer to a question asked, but a complete answer which, in addition, could claim the maximum possible degree of mathematical elegance, and this prevailed throughout our further collaboration.

I will certainly remember Jerzy as one of the Kings of Matrices that I had the pleasure to count among my coauthors.

Friedrich Pukelsheim
Universität Augsburg

Science is the area of human life that should show and open new avenues for the future. Therefore science also needs pioneers who have a vision on the future and who have the capability and energy to open new paths. Professor Jerzy K. Baksalary was such a person. His scientific contributions are great.

Professor Baksalary, besides being a great scientist, was also an administrator. He served several years as the university rector. After the rectorship he returned to his scientific career, which evidently is not so common in the scientific community. This describes Jerzy K. Baksalary's versatile mental capabilities.

As the Rector of the University of Tampere, I had the pleasure and great honour to have Jerzy K. Baksalary as a visiting professor. During the year he spent in our Department of Mathematical Sciences, he wrote some 40 articles later published in top journals. This is a convincing indication on his scientific productivity.

Jerzy K. Baksalary was very interested in social questions and especially in the events, which had important consequences for Poland during the last decades. I am convinced that he was happy to live in the middle of the events which have also had an impact worldwide and which have led to deep changes in the Polish society.

Tarmo Pukkila
Ministry of Social Affairs and Health, Helsinki
Former Professor and Rector of the University of Tampere

Jerzy was a unique person and he was one of the most important people in my academic career. I am a keen photographer, and I value having a substantial collection of photos of Jerzy. At the same time I also have a remarkable set of memories of events that involve him in a very colourful way.

In 1981, Erkki Liski and I jointly wrote a letter to Jerzy (and to his coauthor Radosław Kala) expressing our interest in their research. Indeed Jerzy's research interests and his style of writing papers were so surprisingly similar to mine that I would often enthusiastically photocopy a paper of his whenever I saw one ... and I saw many!

Jerzy was invited to the Tampere Seminar on Linear Statistical Models in 1983 but, unfortunately, he could not come. The first time I met him face to face was in Poznań, 1984. In particular, Erkki and I enjoyed enormously a party held at Jan Hauke's home. Since then, I have had many good laughs with Jerzy and written several Baksalarian-style joint papers with him.

The important factors between Jerzy and me over the years: research and sense of humour. One of the highlights was meeting him again at the Workshop on Matrices and Statistics in Hyderabad, India, December 2000, after a ten years' break (Jerzy's rectorship period): hugging took place immediately once we recognised each other, and there was Oskar also 10 years older!

Our society has lost a unique person but will not forget him.

Simo Puntanen
University of Tampere

I was shocked to learn about the passing of Professor Jerzy K. Baksalary when he was still active in research and making fundamental contributions to matrix theory and its applications to statistics. I was glad to see him with his son at the workshop held in Hyderabad in 2000 and was looking forward to his visit to Hyderabad in December 2004 to attend the International Conference on Statistics I was organizing. We missed him due to his poor health.

Professor Baksalary used to visit the Center for Multivariate Analysis at the Pennsylvania State University to work with me. I am one of his co-authors having written two papers [115,124] jointly with him. I remember one day, after I left him in his office after discussing a problem with him, his roommate in State College called me to say that Professor Baksalary was missing. Next day in the morning when I went to his office, I found him sleeping on the table. When I woke him up, he said that he was working all night and fell asleep in the early hours of the morning after solving the problem we were discussing. Such was his devotion to research.

I had an opportunity to visit him in Zielona Góra when he was the Rector of the Tadeusz Kotarbiński Pedagogical University. He was doing a wonderful job in trying to develop the University as a first rate research center. I also remember the notices he posted all over university buildings banning smoking within the university campus to safeguard the health of students.

Besides being a scholar of great depth with massive achievements, he was a kind and friendly person and all those who worked with him enjoyed his company. His death is indeed a great loss to the statistical community.

C. Radhakrishna Rao
Pennsylvania State University

I think that the first paper by Jerzy Baksalary I read was [12] joint with Radosław "Radek" Kala, published in 1977, which I reviewed for *Mathematical Reviews*. In [12] it is shown that in the linear model $E\mathbf{y} = \mathbf{X}\boldsymbol{\beta}$ with dispersion matrix $D\mathbf{y} = \mathbf{V}$, the Markov or best linear unbiased estimator (BLUE) of $\mathbf{X}\boldsymbol{\beta}$ equals the ordinary least-squares estimator (OLSE) if and only if $\sum_{i=0}^{h} \operatorname{rank}(\mathbf{X}'\mathbf{P}_i) = \operatorname{rank}(\mathbf{X})$, where $\mathbf{V}$ has $h+1$ distinct eigenvalues and $\mathbf{P}_0, \mathbf{P}_1, \ldots, \mathbf{P}_h$ are matrices of corresponding orthonormalized eigenvectors. Here $\mathbf{X}$ may be of less than full column rank and $\mathbf{V}$ may be singular. The result for $\mathbf{X}$ possibly of less than full column rank but with $\mathbf{V}$ positive definite was established by me [*Multivariate Statistical Inference* (D.G. Kabe and R.P. Gupta, Eds.), North-Holland, 1973, pp. 241–246] extending the earlier result with $\mathbf{X}$ of full column rank and $\mathbf{V}$ positive definite due to T.W. Anderson [Theorem 10.2.1 (p. 561) in *The Statistical Analysis of Time Series*, Wiley, 1971].

The paper [12] prompted me to read further papers by Baksalary and Kala, and by the end of 1979 they had published 28 papers together (see Table 2.1). In 1980, I was invited by Andrzej Kozek to visit Poland and to give a lecture at the Institute of

Mathematics of the Polish Academy of Sciences in Wrocław and Andrzej arranged for me, with help from Baksalary and Kala, also to give a lecture at the Agricultural University of Poznań. Both Jerzy Baksalary and Radek Kala met me at the main railway station in Poznań on Wednesday, 27 August 1980 (see also Fig. 3). On Thursday 28 August, Poznań's public transit went on strike (this was the beginning of the Solidarity movement) and everybody ended up walking to attend my talk. In Poznań during this visit, I also met Jan Hauke, Augustyn Markiewicz and Paweł Pordzik for the first time, and Jerzy, Paweł and Radek saw me off at the railway station on Friday, August 29 (see Fig. 3).

I began a correspondence with Jerzy and then met him again in June 1987 at The Second International Tampere Conference on Statistics in Tampere, Finland. The paper [68] on algebraic characterizations and statistical implications of the commutativity of orthogonal projectors that Jerzy presented at this conference remains today, in my opinion, to be the best survey on this subject. I invited him to Montréal in May 1988. During this visit Jerzy had "lobstairs" (as he would say) for the first time. We then went together (with Markku Nurhonen, Tapio Nummi and Simo Puntanen) to the Third SIAM Conference on Applied Linear Algebra in Madison, Wisconsin, where Ingram Olkin and I gave a Short Course on Linear Algebra and Statistics. My first joint publication with Jerzy was [84] (also with Friedrich Pukelsheim); this survey paper, published in 1989, concerned properties of three types of matrix partial orderings in the set of complex matrices: the Drazin ordering, the minus or rank subtractivity ordering, and the Löwner ordering.

For the 1989–1990 academic year, Jerzy was a Professor of the Finnish Academy of Sciences in the Department of Mathematical Sciences of the University of Tampere. And during this academic year he produced 31 research reports in the departmental A series of which at least 26 were later published in research journals.

Jerzy and I published two joint research papers [98,99] (both also with Simo Puntanen) in 1990: in [98] we examined T.W. Anderson's contributions to solving the problem of when the ordinary least-squares (OLS) estimator is best linear unbiased (BLU) and to characterizing the rank additivity of matrices. This paper is built in part on the key result by Baksalary and Kala in [12], mentioned above. In [99] solutions are derived for three different versions of the problem of when the dispersion matrix of the best linear unbiased estimator of the expectation vector in the general Gauss–Markov model can be expressed in a form characteristic for the usual least-squares theory.

Jerzy joined me at the conference on "Directions in Matrix Theory" held in Auburn, Alabama, March 1990, and we drove there (from Atlanta, Georgia) with Kenneth Nordström. The three of us worked on Löwner-ordering antitonicity of generalized inverses of Hermitian matrices, which resulted in the paper [92] published in 1990. This paper formed part of Kenneth's Ph.D. dissertation, and both Jerzy and I were at the thesis defense in August 1990, with Friedrich Pukelsheim as the opponent.

In Auburn Jerzy and I worked together on the paper [120] in which we give a new proof (obtained while we were in Auburn) of the rank formula

$$\operatorname{rank}(\mathbf{A}^*\mathbf{B}) = \operatorname{rank}(\mathbf{A}) + \operatorname{rank}(\mathbf{B}) - \operatorname{rank}(\mathbf{A} : \mathbf{B}) + \operatorname{rank}(\mathbf{A}^*\mathbf{Q}_\mathbf{B}\mathbf{Q}_\mathbf{A}\mathbf{B}),$$

where $\mathbf{Q}_\mathbf{A}$ and $\mathbf{Q}_\mathbf{B}$ are the orthogonal projectors on the orthocomplements of the ranges, respectively, of $\mathbf{A}$ and $\mathbf{B}$, and $(\mathbf{A} : \mathbf{B})$ is the partitioned (block) matrix with $\mathbf{A}$ placed next to $\mathbf{B}$. The matrices are complex with the superscript $*$ indicating conjugate transpose. I remember with great pleasure our working together on this proof in Auburn and then later with Jerzy (who was then on leave in Tampere, Finland) communicating by e-mail (with a seven-hours time difference between Tampere and Montréal) while we completed [120] for publication.

We next met in August 1990 in Tampere, Finland, at the International Workshop on Linear Models, Experimental Designs and Related Matrix Theory [First International Workshop on Matrices and Statistics] and collaborated together in editing its proceedings in two journal special issues [117,121]. The special issue [121] was completed while I visited Jerzy in April 1991. He was by then the Rector of the Tadeusz Kotarbiński Pedagogical University in Zielona Góra and we worked together in a huge council room. With Jan Hauke we studied distributional properties of quadratic forms in normal variables and some associated matrix partial orderings which was published as [122] in 1994. In [126] with Peter Šemrl, published in 1996, we extended some rank-additivity results for matrices to range-additivity results for three bounded linear operators acting on an infinite-dimensional Hilbert space.

For most of the 1990s, however, Jerzy's focus was on university administration. But by June 2000 when I visited the Agricultural University of Poznań and met Jerzy again (for the first time in almost ten years), he was back into mathematical research. I introduced him to the linear algebra newsletter *Image*, which I then edited, and in particular to its Problem Corner. During the next few years Jerzy published 28 solutions in the *Image* Problem Corner and two research problems. My collaboration (as editor) with Jerzy (as problem solver) was considerable and every moment a pleasure.

I invited Jerzy to the Ninth International Workshop and Short Course on Matrices and Statistics, in celebration of C.R. Rao's 80th birthday, Hyderabad, India, December 2000, and we met again at the Workshops in Voorburg, The Netherlands (August 2001), Lyngby, Denmark (August 2002), and Dortmund, Germany (August 2003).

My joint research with Jerzy started again in 2000. In [145] we studied the problem of developing conditions under which generalized inverses of a partitioned matrix can be expressed in Banachiewicz–Schur form. This strengthened a theorem of mine with George Marsaglia [*Sankhyā Series A* 36 (1974), 437–442]. In [140] with Jerzy's son Oskar, we studied the idempotency of linear combinations of an idempotent matrix and a tripotent matrix and in [179] with Oskar and Jerzy's Ph.D. student Katarzyna Chylińska, in work still in progress, we obtain new results concerning generalized inverses of the possibly rectangular complex matrix $\left(\begin{smallmatrix}\mathbf{A} & \mathbf{B}\\ \mathbf{C}' & \mathbf{0}\end{smallmatrix}\right)$, which are useful in statistics, especially linear models and econometrics.

I was delighted when Jerzy invited me to give a talk at the "Session on the occasion of the 60th birthday of Jerzy K. Baksalary" held in Będlewo, Poland, 17 August 2004 (just before the 13th International Workshop on Matrices and Statistics, 18–21 August 2004), and sady this was to be the last time we met. In the booklet published for this 60th birthday session, Jerzy's passions are given as: Family, Paintings (especially Vermeer), Jazz, New York, and ... Mathematics. Jerzy was one of the most talented, hard-working and meticulous mathematicians with whom I have collaborated and it was a great pleasure for me to have been able to work with him. His marked enthusiasm for mathematics seemed also to spill over into other aspects of his daily life, especially to subjects such as politics and language usage. His untimely death at age 60 creates an unexpected void. I join those who will miss him tremendously.

George P.H. Styan
McGill University, Montréal

I was deeply saddened to learn that Jerzy has passed away. For the very last time we saw each other in mid-February at the seminar held at the Agricultural University of Poznań. This was a consecutive meeting in a series of seminars organized since 1999 every second Thursday. Participants of these seminars were: Jerzy K. Baksalary, Oskar Maria Baksalary, Jan Hauke, Augustyn Markiewicz, Tomasz Szulc and a group of Ph.D. students—our group was called by Jerzy: PLAG, which is an acronym for the Poznań Linear Algebra Group. Our meetings were instructive and fruitful, and without any doubt, this was mainly due to Jerzy.

The activities of PLAG are well reflected in the problems and solutions in subsequent *Image* Problem Corners, for the problems proposed therein were extensively discussed and analyzed during our seminars. The fruit of the cooperation between Jerzy and myself within the PLAG meetings resulted in two joint papers [141,170] published in *Linear Algebra and its Applications*.

Jerzy Baksalary was a referee of my Habilitationsschrift. He was known to be demanding and I was pleased that my scientific achievements were appreciated by him. With the death of Jerzy Baksalary, the linear algebra community has lost a truly great specialist in matrix analysis and PLAG has lost its leader.

Tomasz Szulc
Adam Mickiewicz University, Poznań

Some of Baksalary's work is concerned with solving linear matrix equations using generalized inverses of matrices; this work started in the late 1970s. Using generalized inverses, Penrose [*Proceedings of the Cambridge Philosophical Society* 51 (1955),

406–413] had shown that the matrix equation $AX = B$ is solvable for X iff $AA^-B = B$, and then the general solution can be written as

$$X = A^-B + (I - A^-A)U,$$

where U is arbitrary; similarly $AXB = C$ is solvable iff $AA^-CB^-B = C$, and in this case the general solution can be written as

$$X = A^-CB^- + (I - A^-A)U_1 + U_2(I - BB^-),$$

where U_1 and U_2 are arbitrary. These two results give the key applications of generalized inverses for solving linear matrix equations.

Great difficulty is encountered, however, in solving some more general linear matrix equations. Jerzy K. Baksalary and Radosław Kala were two pioneers in solving the two matrix equations $AX - YB = C$ and $AXB + CYD = E$ using generalized inverses. In two papers [23,38] by Baksalary and Kala published in 1979 and 1980 and in the paper [43] by Baksalary in 1982, it was established that $AX + YB = C$ is consistent iff

$$(I - AA^-)C(I - B^-B) = 0,$$

and in this case the general solution is

$$X = AC^- + A^-Z + A^-ZB + (I - AA^-)W,$$
$$Y = -(I - AA^-)C^-B + A^-Z - (I - AA^-)ZBB^-,$$

where W and Z are arbitrary. This result shows that the solvability condition and the general solution of the equation can be expressed by generalized inverses.

Moreover, Baksalary and Kala [38] gave the solvability condition and the general solution of the equation

$$AXC + CYD = E$$

by generalized inverses. This inspired a variety of subsequent works in the 1990s and 2000s on $AX + YB = C$ and $AXC + CYD = E$, for example, properties of their solutions, least-squares solutions of the two equations, minimal ranks of $AX + YB - C$ and $AXC + CYD - E$, etc.

Yongge Tian
Shanghai University of Finance and Economics

I first came across Jerzy's name when I attended the International Tampere Seminar on Linear Statistical Models and their Applications in Tampere, Finland, in 1983.

Several people from the Eastern European countries had also been invited by the organizers but almost none of them showed up. Jerzy Baksalary and Radek Kala from the Agricultural University of Poznań were not allowed to come to Tampere. After all, we were at the height of the Cold War then.

In the 1980s I had become interested in the performance of restricted least squares and pre-test estimators, which are of some importance in econometrics. One of my favourite topics was the "Comparison of Least Squares and Restriced Least Squares Estimators". Consider the linear regression model $\mathbf{y} = \mathbf{X}\boldsymbol{\beta} + \mathbf{u}$, where $\mathbf{X}$ is of full column rank, $E(\mathbf{u}) = \mathbf{0}$, and $\operatorname{cov}(\mathbf{u}) = \sigma^2\mathbf{I}$. Then the least squares estimator (LSE) of $\boldsymbol{\beta}$ is $\hat{\boldsymbol{\beta}} = (\mathbf{X}'\mathbf{X})^{-1}\mathbf{X}'\mathbf{y}$. Suppose we have additional linear restrictions on the parameter vector $\boldsymbol{\beta}$ in the form $\mathbf{R}\boldsymbol{\beta} = \mathbf{r}$, where $\mathbf{R}$ is of full row rank. The corresponding Restricted Least Squares Estimator (RLSE) is

$$\mathbf{b} = \hat{\boldsymbol{\beta}} - (\mathbf{X}'\mathbf{X})^{-1}\mathbf{R}'[\mathbf{R}(\mathbf{X}'\mathbf{X})^{-1}\mathbf{R}']^{-1}(\mathbf{R}\hat{\boldsymbol{\beta}} - \mathbf{r}).$$

It is well-known that

$$\operatorname{cov}(\hat{\boldsymbol{\beta}}) = \sigma^2(\mathbf{X}'\mathbf{X})^{-1}, \quad \operatorname{cov}(\mathbf{b}) = \sigma^2[(\mathbf{X}'\mathbf{X})^{-1} - \mathbf{G}],$$

where

$$\mathbf{G} = (\mathbf{X}'\mathbf{X})^{-1}\mathbf{R}'[\mathbf{R}(\mathbf{X}'\mathbf{X})^{-1}\mathbf{R}']^{-1}\mathbf{R}(\mathbf{X}'\mathbf{X})^{-1}.$$

If the condition $\mathbf{R}\boldsymbol{\beta} = \mathbf{r}$ is violated, the RLSE($\mathbf{b}$) becomes biased. Nevertheless there is some potential in $\mathbf{b}$ to outperform the LSE $\hat{\boldsymbol{\beta}}$ with regard to the matrix mean square error (MMSE) criterion. Actually, the difference of the MMSE matrices is given by

$$\mathbf{M}(\hat{\boldsymbol{\beta}}) - \mathbf{M}(\mathbf{b}) = \sigma^2\mathbf{G} - \mathbf{H}\boldsymbol{\delta}\boldsymbol{\delta}'\mathbf{H}',$$

where

$$\mathbf{H} = (\mathbf{X}'\mathbf{X})^{-1}\mathbf{R}'[\mathbf{R}(\mathbf{X}'\mathbf{X})^{-1}\mathbf{R}']^{-1} \quad \text{and} \quad \boldsymbol{\delta} = \mathbf{R}\boldsymbol{\beta} - \mathbf{r}.$$

Consulting a well-known result from matrix theory, we see that $\mathbf{M}(\hat{\boldsymbol{\beta}}) - \mathbf{M}(\mathbf{b}) \geqslant_L \mathbf{0}$, i.e., $\mathbf{b}$ is better than $\hat{\boldsymbol{\beta}}$ with respect to the MMSE criterion if and only if

$$\boldsymbol{\delta}'\mathbf{H}'\mathbf{G}^{-1}\mathbf{H}\boldsymbol{\delta} \leqslant \sigma^2.$$

A similar result had been achieved by Toro-Viczarrondo and Wallace [*Journal of the American Statistical Association* 63 (1968), 558–572], but I was happy to derive the preceding equivalence without using their tedious derivations involving eigenvalues. Using this approach, I was able to obtain a number of additional theorems, relying heavily on the matrix $\mathbf{G}^{-1}$. The manuscript was soon ready for submission, but one day before sending it off to the Editor of *Communications in Statistics–Theory and Methods*, I realized that the matrix $\mathbf{G}$ was *singular*. The paper disappeared into a dark corner of my study to slumber there for two years.

In 1983, by chance I browsed through some not so well-known journal in our library entitled *Bulletin of the Polish Academy of Sciences* and found the article [48] by Baksalary and Kala under the title: "Partial orderings between matrices one of which is of rank one". Its main result saved my paper:

Theorem. *Let* $\mathbf{A} \in \mathbb{C}^{n\times n}$ *be Hermitian*, $\mathbf{a} \in \mathbb{C}^n$ *and* $\alpha > 0$. *Then* $\alpha\mathbf{A} - \mathbf{a}\mathbf{a}^* \geqslant_L \mathbf{0}$ *if and only if*

(i) $\mathbf{A} \geqslant_L \mathbf{0}$,
(ii) $\mathbf{a} \in \mathscr{R}(\mathbf{A})$,
(iii) $\mathbf{a}^*\mathbf{A}^-\mathbf{a} \leqslant \alpha$,

where $\mathbf{A}^-$ *is any generalized inverse of* $\mathbf{A}$.

Using this important theorem, I could revive and repair my manuscript. For example, the now correct criterion for dominance of $\hat{\mathbf{b}}$ over $\hat{\boldsymbol{\beta}}$ became $\boldsymbol{\delta}'[\mathbf{R}(\mathbf{X}'\mathbf{X})^{-1}\mathbf{R}']^{-1}\boldsymbol{\delta} \leqslant \sigma^2$. My paper was published in *Communications in Statistics—Theory and Methods* 14 (1985), 2495–2509.

Some years later, I received an invitation to participate in the International Conference on Mathematical Statistics in Kozubnik, Poland. The Solidarity movement had already been founded then with Lech Wałęsa as its leader (becoming later Poland's President). During the conference, I had the opportunity to meet Jerzy for the first time.

I was immediately fascinated by Jerzy's style of presenting and explaining his research results. His transparencies were perfectly prepared in a remarkably beautiful handwriting. I liked his crystal-clear, but nevertheless high-level and original presentations from the very beginning. This was my first experience attending a conference in Poland. After the lectures and after some vodkas, the participants had a chance to get better acquainted with each other at the informal meeting during the evening. Normally, the discussions started with some mathematics and ended up with hot debates over politics.

It was embarrassing for me to notice that the Polish participants expressed their opinion about their government very freely, whereas my colleagues from East Germany would not do the same, obviously fearing that somebody might report them to the Secret Police when they returned to the German Democratic Republic, the official name of East Germany. Jerzy hated communism, and even more its supporters. Having become one of the front leaders of Solidarity in Poznań, he had to spend some days in prison.

About that time our first joint project started. I applied for a scholarship for Jerzy at the Alfried Krupp Foundation of Germany. Ironically, Jerzy's father had worked as a coal miner close to Dortmund after World War I in a pit owned by Alfried Krupp, one of Germany's richest men. Incidentally, Krupp had made a fortune by selling

arms to the German Emperor, Kaiser Wilhelm. When Poland became independent, Jerzy's father went back to Poland.

Jerzy got the support and visited Dortmund for three months in 1988. We had a good time together. Jerzy worked very hard on matrices and statistics, and even on Sundays, after we had had lunch together in our house, he returned to the university to resume his thinking about new theorems. I was very impressed with his intellectual abilities. Equipped with a sharp mind, a photographic memory and a broad imagination, he was able to put forward and solve many problems. My estimate is that he finished over ten papers during his short stay in Dortmund. Occasionally, I suggested some problems to him, and often he came up with some neat counterexamples, mainly by presenting some matrices of low order.

When communism had lost its power in Poland, he became professor at the Tadeusz Kotarbiński Pedagogical University in Zielona Góra, a town close to the German border. In 1990, he took over the rectorship of this University, and, alas, stopped his research activities to devote all his strength to administrative tasks. Fortunately, he came back to science in 2000, and we resumed our collaboration. We wrote a joint paper (together with his son Oskar), and planned to investigate the determinant of modified matrices.

To give an impression of the extent of Jerzy's work, I prepared the following list of topics he has worked on:

- Pre-test estimation
- Experimental design
- Structure of dispersion matrices
- Partial orderings (Löwner, star, minus)
- Estimation in regression under restrictions
- Invariance (rank, trace, eigenvalues, singular values, norms)
- Admissibility
- Variance components estimation
- Estimation in linear models under different dispersion matrix structures
- Equality of the OLSE and the BLUE
- Matrix equations and inequalities
- Aggregation of data
- Covariance adjustment technique
- Symmetrizes of matrices
- Prediction in linear models
- Estimability
- Growth curves
- Euclidian distance between estimators
- Estimation in the presence of nuisance parameters
- Canonical correlation
- Distribution of quadratic forms

- Oblique, orthogonal, generalized, hypergeneralized projectors
- Generalized inverses
- Modified matrices

On the 8th of March, Jerzy died. I am very sad, and I wish to express my deep respect for him by using one of his favourite expressions (in his own pronunciation)

"Jerzy, you were an unbillivable man".

Götz Trenkler
Universität Dortmund

As every day, this morning (Monday, 21 March 2005) I opened my e-mail in my office and there it was. The announcement from ILAS-NET about the sudden death of Jerzy. It is one of those moments that hit you in your face very unexpectedly. There are people in the big world whom even if we do not know very closely in person, their names accompany us over many, many years in our professional life and somehow we are constantly aware of their existence even without special thinking. Jerzy, in my case, was one of them. In an instant moment memories brought back the time when the name Baksalary came up on an almost everyday basis in my work. If I step back in time and think about the period when I was working with Lubomír Kubáček in Bratislava and tried hard to make some progress with my Ph.D. research, dealing a great deal with linear models, subjects like linear projectors in connection with estimability, admissibility, restrictions in linear models, singular models, or nuisance parameters troubled my mind a lot.

That was the time when I started to get familiar with Jerzy Baksalary's work. I remember reading very thoroughly and in detail many of his papers and finding answers in them to many of my questions. Here is a short list of some just as a sample of those that I thought were the most influential [19,25–27,40,41] and then later [59] or [99].

Then came the time when I started to look more closely at topics regarding nuisance parameters in linear models and there were again at least several papers by Jerzy that I found extremely useful. The papers [55,68,99] were considered to contain important information when we were putting together the chapters on nuisance parameters in my joint monograph with Lubomír Kubáček and his late wife Ludmila Kubáčková [*Statistical Models with Linear Structures*, pub. Veda: Publishing House of the Slovak Academy of Sciences, Bratislava, 1995].

Then, several years later, I became fortunate and for the first time I met Jerzy in person at the International Workshop on Matrices and Statistics in Hyderabad, India, December 2000. He was already not in good health but always smiling, very kind, a real gentleman and indeed, very productive and active. Again, here I just mention two of his papers that I looked through not too long ago. They are [145,155].

His insight and active work during that recent time was and still is a very reliable source of information for me. And, it will be for many more years. Jerzy will be never forgotten.

Júlia Volaufová
Louisiana State University Health Sciences Center, New Orleans

Dear Oskar: It was a profound shock to hear of the sudden death of your great father Dr. Jerzy K. Baksalary. Your sorrow will be shared by everyone in the world who knew and loved him. I send my deepest sympathy to you.

As you know, I have a joint paper [114] with your father, and among the many papers written by your father, I was most influenced by the 46 equivalent conditions given in the invited paper [68] entitled "Algebraic characterizations and statistical implications of the commutativity of orthogonal projectors".

I was honoured that your father kindly included two conditions given in my joint paper with C. Radhakrishna Rao [*Journal of Statistical Planning and Inference* 3 (1979), 1–17] among the 46 equivalent conditions in [68], and owing to this paper by your father I have been motivated to work more on projectors, both orthogonal and oblique.

Haruo Yanai
The National Center for University Entrance Examination, Tokyo

Jerzy passed away: the linear algebra community lost an active researcher and we lost a friend. He was a nice man and very fine mathematician. I knew Jerzy from his papers long before I met him in person. His contributions to matrix theory particularly in the area of matrix orderings are of fundamental importance. I met Jerzy only a few times at meetings. He had many interests and a great enthusiasm for mathematics. He will be remembered!

Fuzhen Zhang
Nova Southeastern University, Fort Lauderdale, Florida

Publications by Jerzy K. Baksalary

We present several tables based on the publications by Jerzy K. Baksalary. In Table 2.1 we present an annotated list, which we believe to be complete, of

Jerzy Baksalary's publications in research journals and collections (conference proceedings, Festschriften, and other edited books), proposed problems and solutions to research problems, and edited journal special issues. We also include references to reviews of his publications in *Mathematical Reviews* (MR) and *Zentralblatt MATH* (Zbl); for signed reviews, the reviewer's name is given in parentheses. For reviews in *Mathematical Reviews*, the new style review number (six or seven digits) is given; the old-style number is given (when available) in parentheses.

The 181 entries in Table 2.1 are listed chronologically, and by authorship within year, and may be classified as follows:

> 128 research papers in 32 peer-refereed research journals (with 45 papers published and 1 accepted for publication in *Linear Algebra and its Applications* and 23 in the *Journal of Statistical Planning and Inference*), see Table 2.2.
>
> 12 original research papers in research collections (conference proceedings, Festschriften, and other edited books), see Table 2.3 (which includes 2 collections in which research papers by Jerzy Baksalary have been reprinted).
>
> 31 solutions to research problems (28 in *Image: The Bulletin of the International Linear Algebra Society*, and one each in *Econometric Theory*, *The IMS Bulletin*, and *Statistica Neerlandica*).
>
> 10 other items, being Jerzy Baksalary's Ph.D. dissertation, two journal special issues (one of *Linear Algebra and its Applications* and one of the *Journal of Statistical Planning and Inference*), two research problems (both in *Image*), three papers submitted for publication in research journals, and two papers in preparation.

We have assembled scans (as pdf files) of almost all of these 181 items and plan to make these available (on a CD-ROM) in due course.

Table 2.2 lists the 32 peer-reviewed research journals and Table 2.3 lists the 14 research collections (conference proceedings, Festschriften, and other edited books) in which Jerzy Baksalary published. Included in Table 2.3 are two collections in which research papers by Jerzy Baksalary (originally published in research journals) are reprinted.

Associated with a bibliography by a particular author (with several coauthors), we may define an "authorship matrix" $\mathbf{A} = \{a_{ij}\}$, where $a_{ij} = 1$ if bibliographic entry number i is written with coauthor number j and $a_{ij} = 0$ otherwise. The authorship matrix $\mathbf{A}$ for Jerzy Baksalary based on Table 2.1 is 181×43. The diagonal entries of the 43×43 matrix $\mathbf{A}'\mathbf{A}$ in Table 2.4 represent the numbers of bibliographic entries written with each of the 43 coauthors and these numbers are (also) presented in Table 2.5. In Table 2.6 are listed the 11 coauthors with more than three entries in Table 2.1.

We note that for the 43×43 matrix $\mathbf{A}'\mathbf{A}$ in Table 2.1, there are 12 coauthors for whom the off-diagonal elements are all zero and so whose joint publications are with Jerzy Baksalary alone. These 12 coauthors are identified with a superscript $*$ in Table 2.5: Adrian C. van Eijnsbergen, R. William Farebrother, Roger A. Horn, Anna Kuba, Thomas Mathew, Sujit Kumar Mitra, Anna Molińska, Tarmo Pukkila, P.D. Puri, Kirti R. Shah, Idzi Siatkowski, and Zenon Tabis.

We define the matrix $\mathbf{B}$ to be the 31×31 reduced $\mathbf{A}'\mathbf{A}$ matrix, with "reduced" here meaning that the rows and columns of $\mathbf{A}'\mathbf{A}$ for these 12 coauthors have been removed. We find that the 11 largest eigenvalues of the 43×43 matrix $\mathbf{A}'\mathbf{A}$ in Table 2.4 coincide with the 11 largest eigenvalues of the 31×31 matrix $\mathbf{B}$ and that these are precisely the 11 eigenvalues (of either $\mathbf{A}'\mathbf{A}$ or $\mathbf{B}$) which are larger than 3; these eigenvalues are presented in Table 2.8. The eigenvectors of $\mathbf{B}$ corresponding to these 11 eigenvalues are given in Table 2.8, and for each eigenvector we have identified the coauthor corresponding to the entry that is largest in absolute value (see also Table 2.7). Interestingly, we note that these 11 coauthors are uniquely defined and coincide with the 11 coauthors in Table 2.6 but appear there in a slightly different

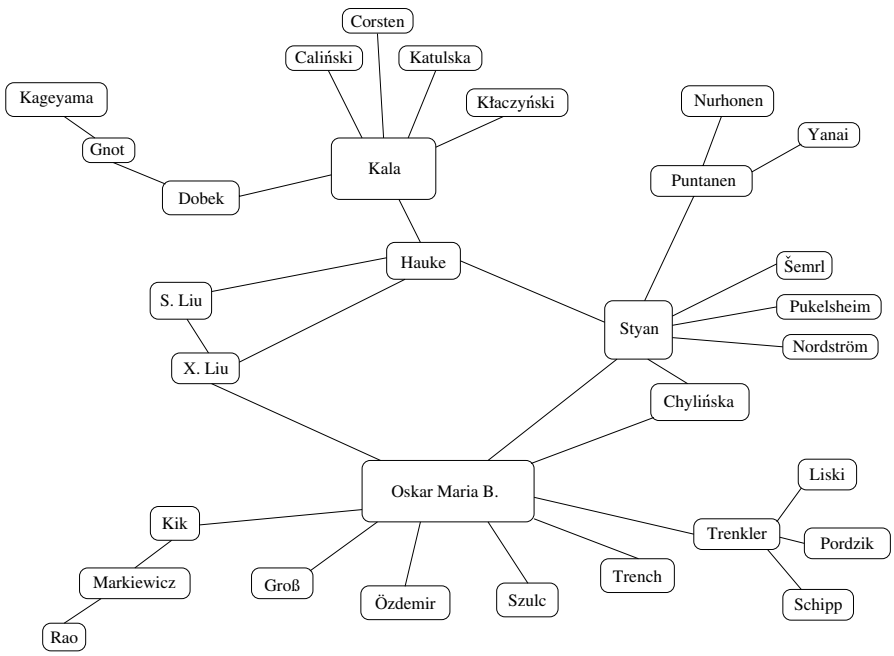

Fig. 4. The connectedness of 31 coauthors of Jerzy K. Baksalary.

order. The first two coauthors and the last two coauthors in Tables 2.6 and 2.7 (or 2.8), however, coincide and appear in the same order.

We find that the 31×31 matrix $\mathbf{B}$ is irreducible and so the associated graph (see Fig. 4) is connected. Moreover, the Perron eigenvector of $\mathbf{B}$, i.e., the eigenvector corresponding to the largest eigenvalue of $\mathbf{B}$, may be computed with all elements strictly positive as given in Table 2.9, where we have scaled the largest entry (corresponding to coauthor Kala) to be +1 and arranged the other entries in nonincreasing order. In Table 2.8 the entries are all correct to 2 decimal places (and arranged in coauthor order), but in Table 2.9 the entries are all correct to 10 decimal places (and arranged in nonincreasing entry order).

Furthermore Jerzy Baksalary published 17 reviews of research papers in *Mathematical Reviews* between 1975 and 1984; five of the articles reviewed are in Polish. References to these reviews are listed in sequence in Table 2.10. Almost all of these reviews are extensive and many identify misprints in the article under review.

Jerzy Baksalary also supervised four Ph.D. dissertations (in Polish) at the Adam Mickiewicz University, Poznań, between 1985 and 1990; these are listed chronologically in Table 2.11. At the time Jerzy Baksalary passed away three students, Katarzyna Chylińska, Paulina Kik, and Anna Kuba (see Fig. 5) at the University of Zielona Góra were working with him on their Ph.D. dissertations.

Fig. 5. Jerzy K. Baksalary with his Ph.D. students (from left to right): Anna Kuba, Paulina Kik, and Katarzyna Chylińska at the 13th International Workshop on Matrices and Statistics: Będlewo, Poland, August 2004. [Photograph: Oskar Maria Baksalary.]

Table 2.1
Annotated complete list of publications by Jerzy K. Baksalary

[1] Jerzy Baksalary, Radosław Kala (1973). Wyznaczanie bazy macierzy. *Roczniki Akademii Rolniczej w Poznaniu: Algorytmy Biometryczne i Statystyczne* 64 (2), 3–9. [Part number refers to the series *Algorytmy Biometryczne i Statystyczne*. Article has # ABS-11 and is in Polish. English translation of article title: "The determination of a basis of a matrix".]

[2] Jerzy Baksalary, Radosław Kala (1974). Metody analizy doświadczeń nieortogonalnych. In *Czwarte Colloquium Metodologiczne z Agro-Biometrii: Referaty (Poznań, 10–15 września 1974)* (Eugeniusz Bilski, Tadeusz Caliński, Witold Klonecki, Wiktor Oktaba, Eds.), Komitet Hodowli i Uprawy Roślin Polskiej Akademii Nauk i Polskie Towarzystwo Biometryczne, Warszawa, 1974, pp. 201–258. [Article in Polish. English translation of article title: "Methods for analysing nonorthogonal experiments".]

[3] Jerzy Baksalary, Radosław Kala (1974). Procedura obliczania uogólnionej odwrotności macierzy. *Roczniki Akademii Rolniczej w Poznaniu: Algorytmy Biometryczne i Statystyczne* 71 (3), 157–165. [Part number refers to the series *Algorytmy Biometryczne i Statystyczne*. Article has # ABS-30 and is in Polish. English translation of article title: "Procedure for calculating a generalized inverse of any matrix".]

[4] Jerzy K. Baksalary (1975). Estymowalność funkcji parametrycznych w modelach liniowych. Ph.D. dissertation, Adam Mickiewicz University, Poznań. [Dissertation in Polish, defended on 29 September 1975. English translation of title: "Estimability of the parametric functions in linear models".]

[5] Jerzy Baksalary, Anita Dobek, Radosław Kala (1975). Rozwiązywanie równań liniowych z nieujemnie określoną symetryczną macierzą układu. *Roczniki Akademii Rolniczej w Poznaniu: Algorytmy Biometryczne i Statystyczne* 80 (4), 243–260. [Part number refers to the series *Algorytmy Biometryczne i Statystyczne*. Article has # ABS-40 and is in Polish. English translation of article title: "Procedure for solving a nonnegative definite symmetric system of equations".]

[6] Jerzy Baksalary, Anita Dobek, Radosław Kala (1976). Wyznaczanie operatorów rzutowania ortogonalnego. *Roczniki Akademii Rolniczej w Poznaniu: Algorytmy Biometryczne i Statystyczne* 86 (5), 187–194. [Part number refers to the series *Algorytmy Biometryczne i Statystyczne*. Article has # ABS-49 and is in Polish. English translation of article title: "Computation of the orthogonal projectors".]

[7] J.K. Baksalary, A. Dobek, R. Kala (1976). A method for computing projectors. *Žurnal Vyčislitel′noĭ Matematiki i Matematičeskoĭ Fiziki* 16, 1038–1040. [Article in English (with abstract and two references in Russian); MR421063 (54 #9068, L.W. Ehrlich); Zbl 0338.65024. Reprinted (with English translation of abstract and two references by J. Berry) in *U.S.S.R. Computational Mathematics and Mathematical Physics* 16 (1976), 216–218 (1977). Zbl 0357.65029.]

[8] Jerzy K. Baksalary, Radosław Kala (1976). Extensions of Milliken's estimability criterion. *The Annals of Statistics* 4, 639–641. [MR415900 (54 #3978, C.R. Rao); Zbl 0336.62058.]

[9] Jerzy K. Baksalary, Radosław Kala (1976). Criteria for estimability in multivariate linear models. *Mathematische Operationsforschung und Statistik* 7, 5–9. [MR413375 (54 #1489, C.G. Khatri); Zbl 0329.62053.]

[10] J.K. Baksalary, A. Dobek, R. Kala (1977). A method of finding bases of a matrix. *Annales Societatis Mathematicae Polonae, Series I: Commentationes Mathematicae* 20, 1–5. [MR453773 (56 #12027); Zbl 0364.65029.]

[11] Jerzy Baksalary, Anita Dobek, Radosław Kala (1977). Wyznaczanie operatorów rzutowania. *Roczniki Akademii Rolniczej w Poznaniu: Algorytmy Biometryczne i Statystyczne* 95 (6), 175–183. [Article has # ABS-60 and is in Polish. English translation of article title: "The computation of projectors".]

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Table 2.1 (*continued*)

[12] Jerzy K. Baksalary, Radosław Kala (1977). An extension of a rank criterion for the least squares estimator to be the best linear unbiased estimator. *Journal of Statistical Planning and Inference* 1, 309–312. [MR518938 (58 #24745, George P.H. Styan); Zbl 0383.62041.]

[13] Jerzy K. Baksalary, Radosław Kala (1977). Sums of squares and products of matrices for a nonfull ranks hypothesis in the model of Potthoff and Roy. *Mathematische Operationsforschung und Statistik, Series Statistics* 8, 459–465. [MR501598 (58 #18914, J.A. John); Zbl 0397.62035.]

[14] Jerzy Baksalary, Radosław Kala, Krystyna Katulska (1977). Analiza wariancji dla klasyfikacji krzyżowych metodą Bocka. *Roczniki Akademii Rolniczej w Poznaniu: Algorytmy Biometryczne i Statystyczne* 95 (6), 3–32. [Part number refers to the series *Algorytmy Biometryczne i Statystyczne*. Article has # ABS-51 and is in Polish. English translation of article title: "Analysis of variance for cross classifications by the method of Bock".]

[15] J.K. Baksalary, L.C.A. Corsten, R. Kala (1978). Reconciliation of two different views on estimation of growth curve parameters. *Biometrika* 65, 662–665. [MR521835 (80g:62034, C.G. Khatri); Zbl 0398.62063.]

[16] Jerzy Baksalary, Anita Dobek, Radosław Kala (1978). Analiza statystyczna w ogólnym modelu liniowym. *Roczniki Akademii Rolniczej w Poznaniu: Algorytmy Biometryczne i Statystyczne* 106 (7), 3–23. [Part number refers to the series *Algorytmy Biometryczne i Statystyczne*. Article has # ABS-61 and is in Polish. English translation of article title: "Statistical analysis in a general linear model".]

[17] Jerzy Baksalary, Anita Dobek, Radosław Kala (1978). Estymacja krzywych wzrostu. *Roczniki Akademii Rolniczej w Poznaniu: Algorytmy Biometryczne i Statystyczne* 106 (7), 81–113. [Part number refers to the series *Algorytmy Biometryczne i Statystyczne*. Article has # ABS-65 and is in Polish. English translation of article title: "Estimation of growth curves".]

[18] Jerzy Baksalary, Anita Dobek, Radosław Kala (1978). Rozkład macierzy rzeczywistej na czynniki pełnych rzędów. *Roczniki Akademii Rolniczej w Poznaniu: Algorytmy Biometryczne i Statystyczne* 106 (7), 179–183. [Part number refers to the series *Algorytmy Biometryczne i Statystyczne*. Article has # ABS-69 and is in Polish. English translation of article title: "Rank factorization of a real matrix".]

[19] Jerzy K. Baksalary, Radosław Kala (1978). A bound for the Euclidean norm of the difference between the least squares and the best linear unbiased estimators. *The Annals of Statistics* 6, 1390–1393. [MR523772 (80f:62065, Lubomír Kubáček); Zbl 0392.62051.]

[20] Jerzy K. Baksalary, Radosław Kala (1978). Estymowalność liniowych funkcji parametrycznych w jednowymiarowym modelu liniowym. *Roczniki Polskiego Towarzystwa Matematycznego, Seria III: Matematyka Stosowana* 12, 133–144. [MR517468 (80d:62046, R. Zmyślony); Zbl 0439.62045. Article in Polish. English translation of article title: "Estimability of linear parametic functions in a one-dimensional linear model".]

[21] Jerzy K. Baksalary, Radosław Kala (1978). Estymowalność liniowych funkcji parametrycznych w jednowymiarowym modelu liniowym z restrykcjami. *Roczniki Polskiego Towarzystwa Matematycznego, Seria III: Matematyka Stosowana* 12, 145–151. [MR517469 (80d:62047, R. Zmyślony); Zbl 0439.62046. Article in Polish. English translation of article title: "Estimability of linear parametric functions in a one-dimensional linear model with restrictions".]

[22] J.K. Baksalary, R. Kala (1978). Relationships between some representations of the best linear unbiased estimator in the general Gauss–Markoff model. *SIAM Journal on Applied Mathematics* 35, 515–520. [MR507953 (80a:62094, Lubomír Kubáček); Zbl 0398.62062.]

[23] J.K. Baksalary, R. Kala (1979). The matrix equation $AX - YB = C$. *Linear Algebra and its Applications* 25, 41–43. [MR528711 (80d:15014, Harald K. Wimmer); Zbl 0403.15010.]

[24] Jerzy K. Baksalary, Radosław Kala (1979). Two relations between oblique and $\mathbf{\Lambda}$-orthogonal projectors. *Linear Algebra and its Applications* 24, 99–103. [MR524829 (80c:15013, M.F. Smiley); Zbl 0401.15004.]

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[26] J.K. Baksalary, R. Kala (1979). On the prediction problem in the seemingly unrelated regression equations model. *Mathematische Operationsforschung und Statistik, Series Statistics* 10, 203–208. [MR544566 (81b:62118, Kenneth N. Berk); Zbl 0417.62053.]

[27] J.K. Baksalary, R. Kala (1979). Covariance adjustment when a vector of parameters is restricted to a given subspace. *SIAM Journal on Applied Mathematics* 37, 20–21. [MR536300 (80m:62063, Federico O'Reilly); Zbl 0411.62033.]

[28] Jerzy K. Baksalary, Tadeusz Caliński, Radosław Kala (1980). Estymacja krzywych wzrostu i jej zastosowanie do oceny odmian gatunków o plonowaniu wielokrotnym. *Biuletyn Oceny Odmian/Cultivar Testing Bulletin (Poznań)* 8, 167–181. [Article in Polish. English translation of article title: "Estimation of growth curves and its application in evaluating varieties of species with repeated yielding".]

[29] Jerzy K. Baksalary, Anita Dobek, Radosław Kala (1980). A necessary condition for balance of a block design. *Biometrical Journal/Biometrische Zeitschrift* 22, 47–50. [MR576961 (81h:62134, K.L. Sharma); Zbl 0457.62059.]

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[31] J.K. Baksalary, A. Dobek, R. Kala (1980). Calculation of projections. *Zastosowania Matematyki/Applicationes Mathematicae (Warsaw)* 17, 209–215. [Zbl 0466.65024. Article in English.]

[32] J.K. Baksalary, J. Hauke, R. Kala (1980). Nonnegative definite solutions to some matrix equations occurring in distribution theory of quadratic forms. *Sankhyā, The Indian Journal of Statistics: Series A* 42, 283–291. [MR656262 (83e:15015, John P. Daughtry); Zbl 0501.62036.]

[33] J.K. Baksalary, R. Kala (1980). A new bound for the Euclidean norm of the difference between the least squares and the best linear unbiased estimators. *The Annals of Statistics* 8, 679–681. [MR568730 (81c:62070, Simon Dahan); Zbl 0464.62055.]

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[35] Jerzy K. Baksalary, Radosław Kala (1980). A note on Ahlers and Lewis' representation of the best linear unbiased estimator in the general Gauss–Markoff model. In *Mathematical Statistics* (Robert Bartoszyński, Jacek Koronacki, Ryszard Zieliński, Eds.), Banach Center Publications 6, PWN–Polish Scientific Publishers, Warsaw, pp. 17–21. [MR599368 (83g:62092, Robert L. Mason); Zbl 0472.62072. Article ends with "Presented to the Semester Mathematical Statistics: September 15–December 18, 1976".]

[36] J.K. Baksalary, R. Kala (1980). On connectedness of ordinary two-way elimination of heterogeneity designs. *Biometrical Journal/Biometrische Zeitschrift* 22, 105–109. [MR583907 (82a:62125, K.G. Russell); Zbl 0462.62063.]

[37] J.K. Baksalary, R. Kala (1980). On estimation problems in a general Gauss–Markov model. In *Data Analysis and Informatics, Proceedings of the Second International Symposium on Data Analysis and Informatics, organised by the Institut de Recherche d'Informatique et d'Automatique, Versailles, October 17–19, 1979* (E. Diday, L. Lebart, J.P. Pagès, R. Tomassone, Eds.), North-Holland, Amsterdam, pp. 163–167. [MR621680 (82f:62004).]

[38] J.K. Baksalary, R. Kala (1980). The matrix equation $AXB + CYD = E$. *Linear Algebra and its Applications* 30, 141–147. [MR568786 (82e:15010); Zbl 0437.15005.]

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[39] J.K. Baksalary, R. Kala (1980). On the difference between two second degree polynomials, each following a chi-square distribution. *Sankhyā, The Indian Journal of Statistics: Series A* 42, 123–127. [MR637997 (82k:62029); Zbl 0487.62043.]

[40] J.K. Baksalary, R. Kala (1981). Linear transformations preserving best linear unbiased estimators in a general Gauss–Markoff model. *The Annals of Statistics* 9, 913–916. [MR619297 (82h:62100, Yasuko Chikuse); Zbl 0471.62067.]

[41] J.K. Baksalary, R. Kala (1981). Simple least squares estimation versus best linear unbiased prediction. *Journal of Statistical Planning and Inference* 5, 147–151. [MR627238 (82k:62122); Zbl 0476.62057.]

[42] J.K. Baksalary, R. Kala (1981). Symmetrizers of matrices. *Linear Algebra and its Applications* 35, 51–62. [MR599845 (82a:15021, Jos M.F. ten Berge); Zbl 0451.15007.]

[43] Jerzy K. Baksalary (1982). The pair of matrix equations $AX = B$ and $A^*Y + CX = D$. *Atti della Accademia Nazionale dei Lincei, Rendiconti della Classe di Scienze Fisiche, Matematiche e Naturali: Serie VIII (Rome)* 73 (5), 81–88. [Article in English (with abstract in Italian). MR726284 (85c:15022); Zbl 0535.15005 (G.P.A. Thijsse). Title page of article gives journal name as *Rendiconti delle sedute della Accademia Nazionale dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, with subheading: "Sezione I (Matematica, meccanica, astronomia, geodesia e geofisica)".]

[44] Jerzy K. Baksalary, Radosław Kala (1982). Admissible estimation by covariance adjustment technique. *Sankhyā, The Indian Journal of Statistics: Series A* 44, 281–285. [MR688807 (84c:62016).]

[45] Jerzy K. Baksalary (1983). An invariance property of Farebrother's procedure for estimation with aggregated data. *Journal of Econometrics* 22, 317–322. [MR714101 (85b:62059).]

[46] J.K. Baksalary, R. Kala (1983). Estimation via linearly combining two given statistics. *The Annals of Statistics* 11, 691–696. [MR696079 (84g:62038, C.R. Rao); Zbl 0515.62053.]

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[50] Jerzy K. Baksalary, Radosław Kala (1983). Range invariance of certain matrix products. *Linear and Multilinear Algebra* 14, 89–96. [MR712827 (86a:15030); Zbl 0523.15006.]

[51] J.K. Baksalary, R. Kala (1983). On the distribution of a nonnegative difference between two χ^2-distributed second degree polynomial statistics. *Zastosowania Matematyki/Applicationes Mathematicae (Warsaw)* 18, 55–59. [MR714320 (85e:62100, Mir Maswood Ali); Zbl 0526.62046.]

[52] J.K. Baksalary, R. Kala, K. Kłaczyński (1983). The matrix inequality $M \geqslant B^*MB$. *Linear Algebra and its Applications* 54, 77–86. [MR714874 (85h:15022, I. Olkin); Zbl 0516.15010 (which incorrectly gives the inequality as $M \leqslant B^*MB$).]

[53] Jerzy K. Baksalary (1984). Comparing stochastically restricted estimators in a linear regression model. *Biometrical Journal/Biometrische Zeitschrift* 26, 555–557. [MR773202 (86e:62041, J. Kleffe).]

[54] Jerzy K. Baksalary (1984). Nonnegative definite and positive definite solutions to the matrix equation $AXA^* = B$. *Linear and Multilinear Algebra* 16, 133–139. [MR769003 (87a:15019); Zbl 0552.15009 (B. Reichstein).]

[55] Jerzy K. Baksalary, Jan Hauke (1984). Inheriting independence and chi-squaredness under certain matrix orderings. *Statistics and Probability Letters* 2, 35–38. [MR729289 (86a:62082, Dennis L. Young); Zbl 0584.62075 (D.N. Shanbhag).]

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[57] Jerzy K. Baksalary, Anna Molińska (1984). Nonnegative unbiased estimability of linear combinations of two variance components. *Journal of Statistical Planning and Inference* 10, 1–8. [MR752448 (86b:62106, Júlia Volaufová); Zbl 0563.62045.]

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[60] Jerzy K. Baksalary, Augustyn Markiewicz (1985). Admissible linear estimators in restricted linear models. *Linear Algebra and its Applications* 70, 9–19. [MR808528 (87m:62205, Khursheed Alam); Zbl 0584.62002.]

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[63] Jerzy K. Baksalary, Zenon Tabis (1985). Existence and constructions of connected block designs with given vectors of treatment replications and block sizes. *Journal of Statistical Planning and Inference* 12, 285–293. [MR818381 (87d:62146, Sanpei Kageyama); Zbl 0586.62118 (P. Avery).]

[64] Jerzy K. Baksalary (1986). A relationship between the star and minus orderings. *Linear Algebra and its Applications* 82, 163–167. [MR858969 (88b:15014b, R. Kala); Zbl 0603.15002 (S.L. Campbell).]

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[81] Jerzy K. Baksalary, Erkki P. Liski, Götz Trenkler (1989). Mean square error matrix improvements and admissibility of linear estimators. *Journal of Statistical Planning and Inference* 23, 313–325. [MR1032688 (90m:62155, Kurt Hoffmann); Zbl 0685.62052.]

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[176] Jerzy K. Baksalary, Oskar Maria Baksalary (2005). An invariance property related to the reverse order law. *Linear Algebra and its Applications* 410, 64–69.

[177] Jerzy K. Baksalary, Oskar Maria Baksalary (submitted for publication). When is a linear combination of two idempotent matrices the group involutory matrix? *Linear and Multilinear Algebra*.

[178] Jerzy K. Baksalary, Oskar Maria Baksalary (in preparation). Particular formulae for the Moore–Penrose inverse of columnwise partitioned matrices. Paper in preparation [based on talk by Oskar Maria Baksalary at the 12th International Linear Algebra Society Conference (Regina, Saskatchewan, Canada, June 2005)].

[179] Jerzy K. Baksalary, Oskar Maria Baksalary, Katarzyna Chylińska, George P.H. Styan (in preparation). A specific form of the generalized inverse of a partitioned matrix useful in econometrics. Paper in preparation [based on talk by Katarzyna Chylińska at the 13th International Workshop on Matrices and Statistics, in celebration of Ingram Olkin's 80th birthday (Będlewo, Poland, August 2004)].

[180] Jerzy K. Baksalary, Oskar Maria Baksalary, Jürgen Groß (submitted for publication). On some linear combinations of hypergeneralized projectors. *Linear Algebra and its Applications*.

[181] Jerzy K. Baksalary, Oskar Maria Baksalary, Paulina Kik (submitted for publication). Generalizations of a property of orthogonal projectors. *Linear Algebra and its Applications*.

Table 2.2
The 32 research journals in which 127 research papers by Jerzy K. Baksalary are published

Aequationes Mathematicae	1
The American Statistician	1
Annales Societatis Mathematicae Polonae, Series I: Commentationes Mathematicae	1
The Annals of Statistics	5
Annals of the Institute of Statistical Mathematics (Tokyo)	1
Atti della Accademia Nazionale dei Lincei, Rendiconti della Classe di Scienze Fisiche, Matematiche e Naturali: Serie VIII (Rome)	1
Biometrical Journal/Biometrische Zeitschrift	3
Biometrika	1
Biuletyn Oceny Odmian/Cultivar Testing Bulletin (Poznań)	2
Bulletin de l'Académie Polonaise des Sciences, Série des Sciences Mathématiques	1
Bulletin of the Polish Academy of Sciences: Mathematics	1

(*continued on next page*)

Table 2.2 (*continued*)

The Canadian Journal of Statistics	4
Communications in Statistics–Theory and Methods	1
Computational Statistics and Data Analysis	1
IEEE Transactions on Automatic Control	1
Journal of Econometrics	1
Journal of Multivariate Analysis	1
Journal of Statistical Computation and Simulation	1
Journal of Statistical Planning and Inference	23
Linear Algebra and its Applications	45
Linear and Multilinear Algebra	2
Mathematische Operationsforschung und Statistik	1
Mathematische Operationsforschung und Statistik, Series Statistics	4
Roczniki Akademii Rolniczej w Poznaniu: Algorytmy Biometryczne i Statystyczne = Annals of the Agricultural University of Poznań: Biometrical and Statistical Algorithms	9
Roczniki Polskiego Towarzystwa Matematycznego, Seria III: Matematyka Stosowana = Annals of the Polish Mathematical Society, Series III: Applied Mathematics (Warsaw)	2
Sankhyā, The Indian Journal of Statistics: Series A	5
Scandinavian Journal of Statistics	1
SIAM Journal on Applied Mathematics	2
Statistica (Bologna)	1
Statistics and Probability Letters	1
Zastosowania Matematyki/Applicationes Mathematicae (Warsaw)	2
Žurnal Vyčislitel′ noĭ Matematiki i Matematičeskoĭ Fiziki translated as *USSR Computational Mathematics and Mathematical Physics*	1

Table 2.3
Annotated list of the 14 research collections in which Jerzy K. Baksalary published

The Collected Papers of T.W. Anderson: 1943–1985, vol. 2 (George P.H. Styan, Ed.), Wiley, New York, pp. i–viii and 827–1681, ISBN 0-471-52786-6 (v. 2), 0-471-62422-5 (2 volume set), 1990: paper [98]. [MR1065815 (91j:01064, C.R. Rao).]

Contributions to the Comparison of Linear Models and to the Löwner-Ordering Antitonicity of Generalized Inverses by Kenneth Nordström, Ph.D. dissertation, University of Helsinki. Tilastotieteellisiä Tutkimuksia (Statistical Studies), vol. 12, Finnish Statistical Society, Helsinki, ISBN 951-95421-6-7 (ISSN 0356-3499), 1990, x + 89 pp.: paper [92] is reprinted here. [MR1211187 (94g:62143).]

Czwarte Colloquium Metodologiczne z Agro-Biometrii: Referaty (Poznań, 10–15 września 1974) (Eugeniusz Bilski, Tadeusz Caliński, Witold Klonecki, Wiktor Oktaba, Eds.), Komitet Hodowli i Uprawy Roślin Polskiej Akademii Nauk i Polskie Towarzystwo Biometryczne, Warszawa, 1974, 410 pp.: paper [2]. [Articles in Polish. English translation of collection title and publisher: *Fourth Colloquium on Methodology in Agricultural Biometry, Written Presentations: Poznań, 10–15 September 1974*, Polish Academy of Sciences and Polish Biometrical Society, Warsaw.]

Data Analysis and Informatics, Proceedings of the Second International Symposium on Data Analysis and Informatics, organised by the Institut de Recherche d'Informatique et d'Automatique, Versailles, October 17–19, 1979 (E. Diday, L. Lebart, J.P. Pagès, R. Tomassone, Eds.), North-Holland, Amsterdam, ISBN 0-444-86005-3, 1980, viii + 790 pp.: paper [.] [MR0621680 (82f:62004), Zbl 0463.00020.]

Table 2.3 (*continued*)

Data Analysis and Statistical Inference: Festschrift in Honour of Prof. Dr. Friedhelm Eicker (Siegfried Schach, Götz Trenkler, Eds.), Verlag Josef Eul, Bergisch Gladbach, ISBN 3-89012-274-4, 1992, viii + 584 pp.: paper [111]. [MR1248829 (94f:62003), Zbl 0771.00052.]

Encyclopedia of Statistical Sciences, Vol. 5: Lindeberg Condition to Multitrait-Multimethod Matrices (Samuel Kotz, Norman L. Johnson, Campbell B. Read, Eds.), Wiley, New York, ISBN 0-471-05552-2 (v. 5), 1985, ix + 741 pp.: paper [58]. [MR0793593 (87a:62001), Zbl 0657.62001.]

Graphs, Matrices, and Designs: Festschrift in Honor of Norman J. Pullman (Rolf S. Rees, Ed.), Lecture Notes in Pure and Applied Mathematics 139, Marcel Dekker, New York, ISBN 0-8247-8790-0 (ISSN 0075-8469), 1993, xv + 314 pp.: paper [120]. [This Festschrift "contains 21 research papers in honor of the sixtieth birthday of Professor Norman J. Pullman on March 31, 1991". Zbl 0771.00051.]

Mathematical Statistics (Robert Bartoszyński, Jacek Koronacki, Ryszard Zieliński, Eds.), Banach Center Publications 6, PWN–Polish Scientific Publishers, Warsaw, ISBN 83-01-01493-8 (ISSN 0137-6934), 1980, 376 pp.: paper [35]. [This collection "contains the proceedings of the VIII semester of the Banach Centre . . . [and] the conference at Wisł a, September 15 to December 18, 1976". MR0599366 (81m:62004), Zbl 0432.00016.]

Multivariate Analysis and Its Applications (T.W. Anderson, K.T. Fang, I. Olkin, Eds.), Institute of Mathematical Statistics Lecture Notes–Monograph Series 24, Institute of Mathematical Statistics, Hayward, Calfornia, ISBN 0-940600-35-8, 1994, xiv + 472 pp.: paper [122]. [Collection comprises selected papers presented at the "International Symposium on Multivariate Analysis and Its Applications, Hong Kong, March 14–18, 1992". MR1479452 (98e:62010), Zbl 0942.00038.]

Multivariate Statistics and Probability: Essays in Memory of Parachuri R. Krishnaiah (C.R. Rao, M.M. Rao, Eds.), Academic Press, Boston, ISBN 0-12-580205-6, 1989, xiii + 567 pp.: paper [78] is reprinted here. [This Festschrift is reprinted from *Journal of Multivariate Analysis* 27 (1–2) (1988) and 28 (2) (1989). MR1056087 (90m:62004), Zbl 0692.00014.]

Probability, Statistics and Design of Experiments (R.R. Bahadur, Ed.), Wiley Eastern Limited, New Delhi, ISBN 81-224-0335-2, 1990, viii + 737 pp.: paper [101]. [This collection "contains papers presented at a Symposium held in Delhi in December 1988 in honour of the late Professor R.C. Bose". Header for each paper reads (in part) "Proceedings of the R.C. Bose Symposium on Probability, Statistics and Design of Experiments, Delhi, 27–30 December 1988".]

Proceedings of the Second International Tampere Conference in Statistics: University of Tampere, Tampere, Finland, 1–4 June 1987 (Tarmo Pukkila, Simo Puntanen, Eds.), Department of Mathematical Sciences/Statistics, University of Tampere, Tampere, Finland, ISBN 951-44-2168-X, 1987, xi + 708 pp.: paper [68]. [Report A 184, Department of Mathematical Sciences, University of Tampere, ISSN 0356-4231.]

A Spectrum of Statistical Thought: Essays in Statistical Theory, Economics and Population Genetics in Honour of Johan Fellman (Gunnar Rosenqvist, Katarina Juselius, Kenneth Nordström, Juni Palmgren, Eds.), Ekonomi och Samhälle: Skrifter utgivna vid Svenska Handelshögskolan, Helsingfors (Swedish School of Economics and Business Administration, Helsinki), ISBN 951-555-351-2, 1991, xii + 276 pp.: paper [105].

Statistical Data Analysis and Inference (Yadolah Dodge, Ed.), North-Holland, Amsterdam, ISBN 0-444-88029-1, 1989, xii + 615 pp.: paper [85]. [This collection "contains invited papers presented at the International Conference on Recent Developments in Statistical Data Analysis and Inference in Honor of C. Radhakrishna Rao, held in Neuchâtel, Switzerland, August 21–24, 1989". MR1089619 (91i:62004), Zbl 0732.00019.]

Table 2.4
The 43×43 matrix $\mathbf{A}'\mathbf{A}$, where $\mathbf{A}$ is the 181×43 authorship matrix

	Oskar Maria B.	Calinski	Chylinska	Corsten	Dobek	van Eijnsbergen	Farebrother	Gnot	Gross	Hauke	Horn	Kegeyama	Kala	Katulska	Kik	Klaczynski	Kuba	Liski	S.Liu	X.Liu	Markiewicz
Oskar Maria B.	38		1						1						1					6	
Calinski		2											2								
Chylinska	1		1																		
Corsten				1									1								
Dobek					12			1					11								
van Eijnsberg						1															
Farebrother							1														
Gnot					1			2				1									
Gross	1								1												
Hauke										11			1						1	1	
Horn											1										
Kageyama								1				1									
Kala		2		1	11					1			50	1		1					
Katulska													1	1							
Kik	1														2						1
Klaczynski													1			1					
Kuba																	1				
Liski																		1			
S.Liu										1									1	1	
X.Liu	6									1									1	9	
Markiewicz															1						9
Mathew																					
Mitra																					
Molinska																					
Nordstrom																					
Nurhonen																					
Ozdemir	1																				
Pordzik																					
Pukelsheim																					
Pukkila																					
Puntanen																					
Puri																					
Rao																					2
Schipp																					
Semrl																					
Shah																					
Siatkowski																					
Styan	2		1							1											
Szulc	2																				
Tabis																					
Trench	1																				
Trenkler	1																	1			
Yanai																					
	54	4	3	2	24	1	1	4	2	15	1	2	67	2	4	2	1	2	3	17	12
	Oskar Maria B.	Calinski	Chylinska	Corsten	Dobek	van Eijnsbergen	Farebrother	Gnot	Gross	Hauke	Horn	Kegeyama	Kala	Katulska	Kik	Klaczynski	Kuba	Liski	S.Liu	X.Liu	Markiewicz

Mathew	Mitra	Molinska	Nordstrom	Nurhonen	Ozdemir	Perdzik	Pukelsheim	Pukkila	Puntanen	Puri	Rao	Schipp	Semrl	Shah	Siatkowski	Styan	Szulc	Tabis	Trenchler	Trenkler	Yanai	
					1											2	2		1	1		Oskar Maria B.
																						Caliński
																1						Chylińska
																						Corsten
																						Dobek
																						van Eijnsbergen
																						Farebrother
																						Gnot
																						Gross
																1						Hauke
																						Horn
																						Kageyama
																						Kala
																						Katulska
																						Kik
																						Klaczynski
																						Kuba
																				1		Liski
																						S.Liu
																						X.Liu
											2											Markiewicz
3																						Mathew
	1																					Mitra
		1																				Molinska
			1													1						Nordstrom
				1					1													Nurhonen
					1																	Ozdemir
						6														1		Perdzik
							4									1						Pukelsheim
								1														Pukkila
				1					11							2					1	Puntanen
										3												Puri
											2											Rao
												1								1		Schipp
													1			1						Semrl
														1								Shah
															1							Siatkowski
			1				1		2				1			12						Styan
																	2					Szulc
																		3				Tabis
																			1			Trench
						1						1								7		Trenkler
									1												1	Yanai
3	1	1	2	2	2	7	5	1	15	3	4	2	2	1	1	21	4	3	2	11	2	
Mathew	Mitra	Molinska	Nordstrom	Nurhonen	Ozdemir	Perdzik	Pukelsheim	Pukkila	Puntanen	Puri	Rao	Schipp	Semrl	Shah	Siatkowski	Styan	Szulc	Tabis	Trenchler	Trenkler	Yanai	

Table 2.5
The 43 coauthors

38	Oskar Maria Baksalary
2	Tadeusz Caliński
1	Katarzyna Chylińska
1	L.C.A. Corsten
12	Anita Dobek
1	Adrian C. van Eijnsbergen*
1	R. William Farebrother*
2	Stanisław Gnot
1	Jürgen Groß
11	Jan Hauke
1	Roger A. Horn*
1	Sanpei Kageyama
50	Radosław Kala
1	Krystyna Katulska
2	Paulina Kik
1	Krzysztof Kłaczyński
1	Anna Kuba*
1	Erkki Liski
1	Sanyang Liu
9	Xiaoji Liu
9	Augustyn Markiewicz
3	Thomas Mathew*
1	Sujit Kumar Mitra*
1	Anna Molińska*
1	Kenneth Nordström
1	Markku Nurhonen
1	Halim Özdemir
6	Paweł R. Pordzik
4	Friedrich Pukelsheim
1	Tarmo Pukkila*
11	Simo Puntanen
3	P.D. Puri*
2	C. Radhakrishna Rao
1	Bernhard Schipp
1	Peter Šemrl
1	Kirti R. Shah*
1	Idzi Siatkowski*
12	George P.H. Styan
2	Tomasz Szulc
3	Zenon Tabis*
1	William F. Trench
7	Götz Trenkler
1	Haruo Yanai

* Publication(s) with no other coauthor(s).

Table 2.6
The 11 coauthors each with more than 3 joint publications

50	Radosław Kala
38	Oskar Maria Baksalary
12	Anita Dobek
12	George P.H. Styan
11	Jan Hauke
11	Simo Puntanen
9	Xiaoji Liu
9	Augustyn Markiewicz
7	Götz Trenkler
6	Paweł R. Pordzik
4	Friedrich Pukelsheim

Table 2.7
The 11 largest eigenvalues of **B** and the associated coauthor identified by the largest entry (in absolute value) in the corresponding eigenvector

53.10	Radosław Kala
39.60	Oskar Maria Baksalary
13.94	George P.H. Styan
11.40	Jan Hauke
9.67	Simo Puntanen
9.65	Augustyn Markiewicz
9.21	Anita Dobek
7.88	Götz Trenkler
7.45	Xiaoji Liu
5.48	Paweł R. Pordzik
3.88	Friedrich Pukelsheim

Table 2.8
The 11 coauthors of Jerzy K. Baksalary, each with more than 3 joint publications, and the eigenvectors of the 31 × 31 matrix **B** associated with its 11 largest eigenvalues

11 coauthors with > 3 publications	Kala	Oskar Maria B.	Styan	Hauke	Puntanen	Dobek	Xiaoji Liu	Markiewicz	Trenkler	Pordzik	Pukelsheim
# of publications > 3	50	38	12	11	11	12	9	9	7	6	4
11 eigenvalues > 3	53.1	39.6	13.94	11.4	9.67	9.21	7.45	9.65	7.88	5.48	3.88
Oskar Maria B.	0.00	**0.98**	0.06	−0.06	0.01	0.02	0.17	0	−0.05	0.02	−0.01
Caliński	0.04	0.00	0.00	0	−0.01	0.07	−0.01	0	0	0	0
Chylińska	0.00	0.03	−0.06	−0.01	0.07	0.01	0	0	0	0	0.04
Corsten	0.02	0.00	0.00	0	0	0.03	0	0	0	0	0
Dobek	0.26	0.00	0.02	−0.1	0.1	**−0.94**	0.04	0.01	−0.02	0	0
Gnot	0.01	0.00	0.00	−0.01	0.01	−0.13	0.01	0	0	0	0
Groß	0.00	0.03	0.00	−0.01	0	0	0.03	0	−0.01	0	0
Hauke	0.02	0.01	−0.26	**0.88**	−0.18	−0.1	0.3	−0.02	−0.15	0.01	−0.02
Kageyama	0.00	0.00	0.00	0	0	−0.02	0	0	0	0	0
Kala	**0.96**	0.00	0.00	0.01	−0.02	0.25	−0.02	0	0.01	0	0
Katulska	0.02	0.00	0.00	0	0	0.03	0	0	0	0	0
Kik	0.00	0.03	0.01	−0.01	0.01	0	0.03	−0.12	−0.01	0.01	0

Kłaczyński	0.02	0.00	0.00	0	0	0.03	0	0	0	0	0
Liski	0.00	0.00	0.00	0	0	0	−0.05	0	−0.12	−0.1	0
Sanyang Liu	0.00	0.01	−0.02	0.11	−0.05	−0.02	−0.08	0	0.03	−0.01	0
Xiaoji Liu	0.00	0.19	0.02	0.27	−0.25	−0.1	**−0.82**	−0.01	0.35	−0.03	0.02
Markiewicz	0.00	0.00	0.00	0	0.06	0	−0.01	**−0.96**	0	0	0
Nordström	0.00	0.00	−0.06	0	0.07	0.01	−0.02	0	0.01	0	0.04
Nurhonen	0.00	0.00	−0.04	−0.03	−0.08	−0.01	0.01	−0.01	−0.01	0	−0.01
Özdemir	0.00	0.03	0.00	−0.01	0	0	0.03	0	−0.01	0	0
Pordzik	0.00	0.00	0.00	0	0	0	−0.22	0	−0.42	**0.88**	0
Pukelsheim	0.00	0.00	−0.08	−0.01	0.1	0.01	−0.05	0.01	0.02	0	**−0.99**
Puntanen	0.00	0.01	−0.55	−0.36	**−0.73**	−0.04	0.08	−0.05	−0.04	0	−0.03
Rao	0.00	0.00	0.00	0	0.02	0	0	−0.25	0	0	0
Schipp	0.00	0.00	0.00	0	0	0	−0.05	0	−0.12	−0.1	0
Šemrl	0.00	0.00	−0.06	0	0.07	0.01	−0.02	0	0.01	0	0.04
Styan	0.00	0.07	**−0.77**	−0.04	0.57	0.04	−0.16	0.04	0.07	−0.01	0.12
Szulc	0.00	0.05	0.01	−0.01	0	0	0.06	0	−0.02	0.01	−0.01
Trench	0.00	0.03	0.00	−0.01	0	0	0.03	0	−0.01	0	0
Trenkler	0.00	0.03	0.01	−0.01	0	0.01	−0.32	0	**−0.8**	−0.46	0
Yanai	0.00	0.00	−0.04	−0.03	−0.08	−0.01	0.01	−0.01	−0.01	0	−0.01

Table 2.9
The Perron eigenvector of the 31×31 matrix $\mathbf{B}$, with entries in nonincreasing order

Kala	1.0000000000
Dobek	0.2677365504
Caliński	0.0391353141
Hauke	0.0237896841
Corsten	0.0191921124
Katulska	0.0191921124
Kłaczyński	0.0191921124
Gnot	0.0052409452
Styan	0.0005969758
Xiaoji Liu	0.0005934943
Sanyang Liu	0.0004679647
Oskar Maria B	0.0003197106
Kageyama	0.0001005848
Puntanen	0.0000283826
Chylińska	0.0000175931
Szulc	0.0000125120
Pukelsheim	0.0000121572
Nordström	0.0000114572
Šemrl	0.0000114572
Trenkler	0.0000069434
Kik	0.0000062588
Groß	0.0000061359
Özdemir	0.0000061359
Trench	0.0000061359
Nurhonen	0.0000005447
Yanai	0.0000005447
Pordzik	0.0000001474
Markiewicz	0.0000001422
Liski	0.0000001333
Schipp	0.0000001333
Rao	0.0000000056

Table 2.10
Reviews by Jerzy K. Baksalary published in *Mathematical Reviews*

MR437554 (55 #10478) Frank J. Hall, Carl D. Meyer, Jr., (1975). Generalized inverses of the fundamental bordered matrix used in linear estimation. *Sankhyā, The Indian Journal of Statistics: Series A* 37, 428–438.

MR442001 (56 #390) George A. Milliken, Fikri Akdeniz (1977). A theorem on the difference of the generalized inverses of two nonnegative matrices. *Communications in Statistics—A, Theory and Methods* 6, 73–79.

MR448720 (56 #7025) A. Bartkowiakowa (1976). Algorithms for regression analysis (in Polish). *Roczniki Polskiego Towarzystwa Matematycznego, Seria III: Matematyka Stosowana* 7, 101–115.

MR448733 (56 #7038) Wiktor Oktaba (1976). Matrix relations in the analysis of variance (in Polish). *Roczniki Polskiego Towarzystwa Matematycznego, Seria III: Matematyka Stosowana* 8, 81–88.

MR455227 (56 #13466) Roman Zmyślony (1976). Quadratically admissible estimators in random models (in Polish). *Roczniki Polskiego Towarzystwa Matematycznego, Seria III: Matematyka Stosowana* 7, 117–122.

MR458732 (56 #16932) Stanisław Gnot, Witold Klonecki, Roman Zmyślony (1977). Uniformly minimum variance unbiased estimation in various classes of estimators, I. *Mathematische Operationsforschung und Statistik, Series Statistics* 8, 199–210.

MR468046 (57 #7885) Johan Fellman (1976). On the effect of "nuisance" parameters in linear models. *Sankhyā, The Indian Journal of Statistics: Series A* 38, 197–200.

MR480556 (58 #715) Ching Hsiang Hung, Thomas L. Markham (1977). The Moore–Penrose inverse of a sum of matrices. *Journal of the Australian Mathematical Society, Series A* 24, 385–392.

MR514647 (80h:62055) David W. Smith, R.R. Hocking (1978). Maximum likelihood analysis of the mixed model: the balanced case. *Communications in Statistics—A, Theory and Methods* 7, 1253–1266.

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Table 2.11
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Zenon Tabis, Adam Mickiewicz University, Poznań (1985). Ph.D. dissertation in Polish: Odporność i minimalność modeli liniowych ze względu na estymowalność funkcji parametryczych. [English translation of title: "Robustness and minimality of linear models with respect to estimability of parametric functions".]

Augustyn Markiewicz, Adam Mickiewicz University, Poznań (1988). Ph.D. dissertation in Polish: Dopuszczalne estymatory liniowe w modelach liniowych. [English translation of title: "Admissible linear estimators in linear models".]

Idzi Siatkowski, Adam Mickiewicz University, Poznań (1990). Ph.D. dissertation in Polish: Modele liniowe z dwiema grupami parametrów wtrąconych. [English translation of title: "Linear models with two groups of nuisance parameters".]

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