Extremal Mathematicians

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Synopsis

We report on the top ten mathematicians with the highest number of articles, citations, and students, based on data from MathSciNet and the Mathematics Genealogy Project.

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When I was an undergraduate student, I used to hear that Paul Erdös was the most prolific mathematician, that is, the mathematician with more published papers than any other mathematician alive. Recently, my curiosity led me to explore the existing tools of the Mathematics Genealogy Project [8] and MathSciNet [7] in order to find out the current status. What I found is that Ravi P. Agarwal, professor of mathematics at Texas A&M University-Kingsville, is now the mathematician with the highest number of publications on the MathSciNet database. To satisfy my curiosity completely, I then computed Tables 1, 2, and 3, where the top ten mathematicians with the highest number of published papers, citations, and Ph.D. students, respectively, are listed.[2]

My approach was based on the tools of the Mathematics Genealogy Project and MathSciNet, so it is possible that my results differ from those one might obtain using other tools such as Google Scholar [6] or ResearchGate [9].

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[1] Carlos A. Alfaro has been working at Banco de México for the last seven years. Recently he began teaching classes at Universidad La Salle México.

[2] Data used in all three tables were collected on January 15th, 2020, and can be found at `https://alfaromontufar.github.io/MathSciNet.csv`.

# Publications	# Citations	# Students	Name
1605	15147	1	Ravi P. Agarwal
1445	19170	4	Paul Erdös
1369	11196	1	Daniel J. O'Regan
1300	1159	1	Edoardo Ballico
1258	10023	3	Hari Mohan Srivastava
1247	5318	18	Josip Pecaric
1110	3847	7	Silvestru Sever Dragomir
1077	8935	10	Saharon Shelah
1071	1770	2	Ioannis Konstantinos Argyros
966	6145	29	Jaume Llibre

Table 1: Top ten most prolific mathematicians (data from 1/15/2020, see Footnote 2).

The Mathematics Genealogy Project [8] is an initiative of North Dakota State University and the American Mathematical Society aiming to compile a record of mathematical genealogy, that is, a comprehensive database of advisor-advisee relationships among mathematicians with doctoral degrees. Information about the graph encoding this database can be found at `https://www.genealogy.math.ndsu.nodak.edu/extrema.php`. There, we learn that in 2016, Cosmin Ionita and Pat Quillen used MATLAB to analyze this graph, which, at that time, had 200,037 vertices. In 2018, a contest was held, as part of the Graph Drawing 2018 conference, to draw creatively a subgraph of the Mathematics Genealogy project, which only contained the 2,277 mathematicians who had received doctoral degrees before the year 1900.[3]At that time, there were 222,360 mathematicians on the database. Today, as of January 14, 2022, the Project boasts 275,169 records!

MathSciNet [7] is an electronic publication of the American Mathematical Society that is the continuation of the paper-based *Mathematical Reviews*, which dates back to 1940s. The first public beta version of MathSciNet database went live in 1995. Today MathSciNet is a rich database containing reviews, abstracts, and bibliographic information of the mathematical sciences literature [1]. It is important to note that the data in this database are constantly updated as new literature appears. In January 2020, as I was collecting my data, MathSciNet had a record of 982,875 authors, an average

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[3] See the contest project description at `http://mozart.diei.unipg.it/gdcontest/contest2018/topics.html` and check out [2] for a report on the conference. The project of the winning team can be consulted on the page `https://mathematics-genealogy.de`.

# Publications	# Citations	# Students	Name
380	27128	17	Pierre-Louis Lions
480	24017	46	Jacques-Louis Lions
230	22984	52	Elias Menachem Stein
397	20289	30	Barry Martin Simon
299	19896	58	Haim Brezis
369	19888	51	Chi-Wang Shu
1445	19170	4	Paul Erdös
479	18556	123	Roger Meyer Temam
255	18076	4	Thomas J. R. Hughes
287	16765	57	Stanley Joel Osher

Table 2: Top ten mathematicians with the highest number of citations (data from 1/15/2020, see Footnote 2).

of 6.66 publications per author, and the average of citations 28.52. Today, as of January 14, 2022, there are 1,097,213 authors indexed in the database according to the front page [7]. See [3, 4, 5] to learn more about this database.

These two databases offer us different snapshots of extremal mathematicians, that is, those mathematicians that perform at the extremes with respect to various measures and metrics of academic performance. Readers can update these snapshots if they desire. My tables here were all based on data from the first half of 2020. Today in the first month of 2022, the numbers are of course different, but some basic outlines remain the same. For example, it is easy to see that the folks with the highest number of publications are not the same as the folks who have the highest number of citations, who in turn are not the same as the folks who have had the most number of doctoral students. Only two names, Paul Erdős and Roger Meyer Temam show up in two out of three tables — Erdős in Tables 1-2, and Temam in Tables 2-3 — but they seem to be the exceptions. These types of observations raise interesting questions about what it means to be a top mathematician.

More broadly, we should keep in mind that the contributions and the legacy of a mathematician are dispersed between doing research, teaching, directing theses, writing articles, disseminating mathematics, and reviewing articles, as well as participating in a wide range of other scholarly activities. It is very important that each mathematician, especially young students, should construct their own criteria on the values and impact of mathematical work and think carefully about how they can themselves impact society through their mathematics.

# Publications	# Citations	# Students	Name
39	72	151	C.-C. Jay Kuo
479	18556	123	Roger Meyer Temam
205	1410	108	Pekka Neittaanmäki
45	38	107	Andrew Bernard Whinston
4	0	105	Shlomo Noach Sawilowsky
92	1520	101	Willi Jäger
24	13	100	Ronold Wyeth Percival King
213	1600	100	Alexander Vasil'evich Mikhalëv
69	118	95	Erol Gelenbe
2	0	95	Leonard Salomon Ornstein

Table 3: Top ten mathematicians with the highest number of doctoral students (data from 1/15/2020, see Footnote 2).

References

[1] American Mathematical Society, "About MathSciNet", available at https://mathscinet.ams.org/mathscinet/help/about.html?version=2, last accessed on January 14, 2022.

[2] W. Devanny, P. Kindermann, M. Lóffler, I. Rutter, "Graph drawing contest report," pages 609–617 in *GD 2018: Graph Drawing and Network Visualization – 26th International Symposium, GD 2018, Proceedings*, edited by T. Biedl and A. Kerren (Lecture Notes in Computer Science, volume **11282** (2018).

[3] E. Dunne, "Looking at the mathematics literature," *Notices of the American Mathematical Society*, Volume **66** Number 2 (2019), pages 227–230.

[4] E. Dunne, "Everything in its right place: An expert guide to searching with MathSciNet," *Notices of the American Mathematical Society*, Volume **66** Number 8 (2019), pages 1320–1324.

[5] E. Dunne, "Everything in its right place: Part II: An expert guide to searching with MathSciNet," *Notices of the American Mathematical Society*, Volume **66** Number 9 (2019), pages 1501–1506.

[6] Google Scholar, free web-based search engine for scholarly literature, available at https://scholar.google.com/, last accessed on January 14, 2022.

[7] MathSciNet, subscription-based electronic research review database, available at http://mathscinet.ams.org/, last accessed on January 14, 2022.

[8] Mathematics Genealogy Project, *Mathematics Genealogy Project, A service of the NDSU Department of Mathematics, in association with the American Mathematical Society*, available at https://www.genealogy.math.ndsu.nodak.edu/index.php, last accessed on January 14, 2022.

[9] ResearchGate, commercial social networking site for scientists and researchers, available at http://www.researchgate.net, last accessed on January 14, 2022.