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In memoriam

Joseph L. Ullman (1923–1995)

Joseph L. Ullman, Professor Emeritus of Mathematics, died on September 11, 1995, in Chelsea, Michigan, at the age of 72, due to complications arising from Alzheimer's disease. He is survived by his wife, Barbara; four daughters, Esther Ullman of Ann Arbor, Ruth Michelson of California, Sara Cumming of Chelsea, and Katie Ullman of Salt Lake City, Utah; nine grandchildren; and his sister, Judith Chernoff of Massachusetts.

Born in Buffalo, New York, on January 30, 1923, Joe was happy to share this date of birth with Franklin Delano Roosevelt, his favorite president. He received his B.A. degree from the University of Buffalo in 1942. His graduate study was interrupted by his service in the US Army during World War II, where he was injured, and received a purple heart. Because of this injury, Joe was taken out of active duty and put into training classes. This is how he met Gábor Szegő who would later become his thesis advisor. Joe later served as an instructor of mathematics at army schools in Czechoslovakia and at Biarritz, France. Joe received his Ph.D. degree from Stanford University in 1949, for a thesis entitled "Studies on Faber Polynomials" under the direction of Szegő.

Joe joined the University of Michigan as Instructor of Mathematics in 1949, was promoted to Assistant Professor in 1954, Associate Professor in 1962 and Professor in 1966. During 1970–71, he served as Associate Chairman for Graduate Students, and for many years he was the Chair of the Master's Committee in the Department of Mathematics.

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During his tenure at the University of Michigan he was thesis advisor to eleven Ph.D. students: Rogers Newman (1961), Hassoon Al-Amiri (1962), Daniel Maki (1966), James McCall, Jr. (1972), Jimmie Jones (1972), Kenneth Day (1973), Raymond Chu (1974), Gerald Myerson (1977), Lynn Ziegler (1977), Matthew Wyneken (1985), and Sungki Chun (1990). After forty-four years of dedicated service, he was named Professor Emeritus by the Board of Regents.

Joe Ullman is known for his work in logarithmic potential theory and orthogonal polynomials, and he has made important contributions to the theory of orthogonal polynomials on the infinite interval and Chebyshev, i.e., equal-weight, quadrature. Altogether he published forty-three research papers and directed eleven doctoral theses. Professor Ullman was valued most by his colleagues for his love of mathematical inquiry, his encyclopedic knowledge of classical analysis, and his willingness to share his knowledge.

Ullman established a criterion for regular asymptotic behavior of orthogonal polynomials and regular zero behavior [3]. Ullman's criterion for orthogonal polynomials with respect to a positive measure μ on $[-1, 1]$ is that the minimal carrier capacity of μ is equal to the capacity of the support of μ, which is $1/2$ if the support is $[-1, 1]$. The asymptotic distribution of the contracted zeros of Freud-type orthogonal polynomials with weight $w(x) = \exp(-|x|^\alpha)$ on $\mathbf{R}$ is given by the measure with density

$$v_\alpha(x) = \frac{1}{\pi}\int_{|x|}^{1} \frac{1}{\sqrt{t^2 - x^2}}\, \mathrm{d}t^\alpha, \quad -1 \le x \le 1,$$

which has become known as the Ullman measure in view of results in [4]. He also showed that equal-weight quadrature (Chebyshev quadrature) is possible on an infinite interval [2], which is a rather surprising result.

Most of us will remember him for his love of classical analysis and his interesting research, as can be judged from the following quote from the book by Stahl and Totik [1, Preface]: "*It was especially J. L. Ullman who systematically studied different bounds and asymptotics on orthogonal polynomials with respect to arbitrary measures μ on* $[-1, 1]$, *and we owe a lot to his research and personally to him for initiating and keeping alive the subject*".

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Recollections

Submitted by James Ward Brown. Some years ago, my good friend and colleague Michael Lachance and I teamed up with Joe Ullman and a few others to run a seminar in Ann Arbor ranging over topics of interest to us in approximation theory, special functions, etc. We occasionally finished our business with social hours in which we talked about how we got into mathematics. It was fun to learn from Joe how Professor Gábor Szegő turned him towards mathematics when he was mustering out of the army in Europe. Professor Szegő had been brought in to keep the soldiers busy until their return home. I recall one story that Joe told. I believe that he was somewhere in France when his commanding officer needed someone to cross a street in order to draw enemy fire and asked Joe to volunteer, which he did. I remember Joe telling us that it is pretty depressing being fired at. Joe enjoyed telling such stories almost as much as he enjoyed our seminars. We did realize, of course, that he enjoyed telling such stories more than the experiences themselves.

I was doing my graduate work at Michigan during the early 1960s and knew Joe as my professor. But to know him as a colleague and human being was just as satisfying. I consider myself fortunate to have known him.

Submitted by Michael Lachance. I first arrived in Michigan in 1979, and spent what seemed like every Thursday afternoon for the next five years in the company of Joe Ullman in his Approximation Theory seminar. In good years the seminar would swell with attendees–his students, folks from local universities, and others on sabbatical leave–and sometimes it would be just Joe and me.

When it was just the two of us, we would take turns presenting to one another about what we were currently working on. Joe would invariably begin at the beginning, reviewing fundamentals, going slowly over the material at hand. He would explain if not apologize that this was necessary for him if not for me. Because of the informality of our sessions, our conversations would sometimes roam. He would share stories of his experiences in the Second World War, of how he met Gábor Szegő, of his and Barbara's sheep farm in Chelsea, and of his daughters.

In private and in small groups he spoke softly, chose his words carefully, and waited to see if they had the desired effect. It was in these moments that Joe's sense of humor revealed itself. My favorite illustration of Joe's humor is when he was paid a compliment. He would lean forward just a tad, and with a twinkle in his eye say "Excuse me?" so that he could hear the compliment repeated.

In spite of all of our time together, Joe and I never collaborated on a paper. Joe would remark about this from time to time, and mention it as a failing on his part as my mentor. Nothing could be further from the truth. Mentors impart all sorts of qualities, the greatest of which may not be related to a specialized subject area at all.

Submitted by Doron Lubinsky. I first met Joe Ullman at a conference in Lille, France. Some years later, I drove up from Columbus, Ohio, to Ann Arbor to visit him. I got lost in Ann Arbor, it was very late, and I had to phone Joe — as always, he was friendly, and gave directions. I stayed overnight at his little farm, and his wife showed me her spinning wheel where she spun woolen garments from their own sheep. I heard about his World War II service, and his daughter's musical interests.

It was also the first time I had visited Ann Arbor, and it was freezing, so much so that the cold penetrated to my spine, though I was wearing all the clothes I'd brought from Florida with me!

I met several of the classical complex analysts at Ann Arbor, and Joe's student Matt Wyneken. Joe gave me some of his papers, and I learned from them that he was one of the very first (perhaps the first) to systematically use potential theory in investigating asymptotics of orthogonal polynomials. Joe played a role in introducing potential theory to several of those who would later apply it to exponential weights — for example, Hrushikesh Mhaskar.

Submitted by Hrushikesh Mhaskar. Although I had been in the US for five years when I met Joe, it was first through him that I got a glimpse of a real live American family. Of course, he helped me quite a bit as a mathematician. He invited me to the University of Michigan in 1981–82, taught me potential theory, and wrote letters on my behalf. In particular, the discussions with him on connections between potential theory and orthogonal polynomials played a strong motivational role in my 1984 paper with Ed Saff (Extremal problems associated with polynomials with exponential weights, Trans. Amer. Math. Soc., **285** (1984), 223–234), dedicated to Joe on the occasion of his 60th birthday. In that paper Saff and I showed (using ideas from previous works on incomplete polynomials) that the "Ullman distribution" for the normalized zeros of orthogonal polynomials with respect to Freud weights was indeed valid without Ullman's assumption of the truth of Freud's conjecture. (Ed and I were so appreciative of his inspiring influence and his mentoring that we invited Joe to be a co-author on that paper, but he graciously declined our offer.) He introduced me also to discrepancy theorems, which I worked on later with Hans-Peter Blatt and Vladimir Andrievsky. I remember him even more fondly for his kindness and love.

In my original home state of Maharashtra, India, the traditional new year starts when the sun is in Pisces while aligned with the moon at the new moon point, rather than on the astronomically arbitrary date of January 1. Therefore, December 31 and January 1 are just ordinary days of my life with no special meaning. On Dec. 31, 1981, though, Joe started thinking that I must be missing the company of my family on New Year's Eve, and therefore, asked me to come to his home to spend the day. With no experience of driving in the snow, and with an unpaved road leading to his house, I got stuck in a ditch. He had anticipated this, and was waiting for me nearby. He then helped to get the car out and brought me home. Barbara had gone through a lot of trouble to make a very delicious vegetarian meal, without touching it with utensils used for cooking meat dishes! Joe and Barbara told me many amusing anecdotes about the many animals on his farm. It was a wonderful day, and I have remembered both Joe and Barbara on every December 31 since then.

Joe was also the first American guest to stay with me, in spite of my having warned him in advance that I had no furniture in the apartment. Apparently, he did not expect it to be true with mathematical precision. I think he was very uncomfortable, and finally, collected the courage to ask me if he could bring in some alcoholic beverage to drink by himself. Together, we enjoyed the AMS meeting and the trip to the Queen Mary, a ship on which he had traveled earlier as a soldier during the Second World War. Over the years, as I became settled in a house (this time, with furniture), I have often wished he could visit and stay with me again.

Submitted by Vilmos Totik. Around 1992 I came across a paper of Joe Ullman (Orthogonal polynomials for general measures, Orthogonal polynomials and their applications (Laredo, 1987), 95–99, *Lecture Notes in Pure and Appl. Math.*, **117**, Dekker, New York, 1989), in which he mentioned the following open problem: if a measure μ is supported on $[-1, 1]$, and $\mu' > 0$ almost everywhere on a subinterval $[a, b]$, then the asymptotic density of the zeros in $[a, b]$ is at least as large as the arcsine distribution $(\pi\sqrt{1-x^2})^{-1}$. Since I had been working on related questions with Herbert Stahl in connection with orthogonal polynomials with respect to general measures, I became interested in the problem. When I succeeded in solving it, I sent the solution to Joe. To my surprise, the reply was a letter that accompanied a handwritten manuscript. The letter asked if my result was related to the manuscript, and explained that the manuscript was written around the time of the Helsinki IMU congress (or for that congress, I do not remember). The manuscript's result also solved the problem from 1987. Now the Helsinki congress was in 1978, so Joe had proposed in 1987 a problem that he had solved in 1978 or before. Apparently he had forgotten his manuscript from 1978, but somehow he remembered it when he received my letter.

It has turned out that Joe's solution was more elegant than mine, but my approach was more general, so in the end we wrote the paper: Local asymptotic distribution of zeros of orthogonal polynomials, *Trans. Amer. Math. Soc.*, **341** (1994), 881–894. This is one of his last papers, if not the very last one.

Submitted by Richard Varga. Joe Ullman was a great guy. He was a student of Gábor Szegő, and Joe's research was always interesting. Ed Saff and I wrote a paper with Joe some years back, before potential theory was, let us say, "well-known." I stayed at his farm on one occasion, and he was a wonderful host. I always thought that he was not given the credit he deserved, for he had written some very deep papers in his career.

Submitted by Matt Wyneken. My first course at the University of Michigan was advanced calculus. The instructor had a curious style, speaking very loudly, sometimes rolling his eyes to the ceiling. This was my first introduction to Joe. Several years later, I found myself attending Joe's classical analysis seminar. Joe made me feel welcome. Eventually I asked him if he would be my thesis advisor. Joe was a wonderful advisor.

One day Joe spoke to me about his curious classroom style. He had been shell-shocked in WWII and it had a lasting effect on him. One must be very brave and strong to survive such an experience.

I was always treated with real warmth, and on several occasions was invited to his home. Joe used to describe himself as a "gentleman farmer". His wife, Barbara, ran the sheep farm, and she used the wool to do her own weaving. I remember his collection of small wind up toys that he kept to entertain young children.

Joe was a master mathematician, a master teacher of the subject, and my mentor. I will be forever grateful for this.

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