DOCUMENTS AND MINUTES OF THE GENERAL FACULTY

REPORT OF THE MEMORIAL RESOLUTION COMMITTEE FOR R. H. BING

The Special Committee of the General Faculty to prepare a Memorial Resolution for R. H. Bing, has filed with the Secretary of the General Faculty the following report.

H. Paul Kelley, Secretary
The General Faculty

IN MEMORIAM
R. H. BING

It was a dark and stormy night when R.H. Bing volunteered to drive some stranded mathematicians from the fogged-in Madison airport to Chicago. Freezing rain pelted the windscreen and iced the roadway as Bing drove on --- concentrating deeply on the mathematical theorem he was explaining. Soon the windshield was fogged from the energetic explanation. The passengers too had beaded brows, but their sweat arose from fear. As the mathematical description got brighter, the visibility got dimmer. Finally, the conferees felt a trace of hope for their survival when Bing reached forward --- apparently to wipe off the moisture from the windshield. Their hope turned to horror when, instead, Bing drew a figure with his finger on the foggy pane and continued his proof --- embellishing the illustration with arrows and helpful labels as needed for the demonstration.

Two of Bing's mathematical colleagues, Armentrout and Burgess, independently told us versions of this memorable evening. Those of us who knew Bing well avoided raising mathematical questions when he was driving.

Bing's love for working on mathematical problems was matched by his success at solving them. He was a mathematician of international renown and was one of the most distinguished UT professors of mathematics in The University's history. His professional vita is impressive --- including authorship of seminal research papers in several branches of topology and honors such as membership in the National Academy of Sciences and presidencies of both the Mathematical Association of America and the American Mathematical Society. But we will remember him most for his zest for life which infected everyone around him with a contagious enthusiasm and good humor.

R.H. Bing started and ended in Texas. He was born on October 10, 1914, in Oakwood, Texas, and there he learned the best of the distinctively Texas outlook and values. What he learned in Oakwood guided him clearly throughout his life. He had a strong Texas drawl which became more pronounced proportionate to his distance from Texas;

and he spoke a little louder than was absolutely necessary for hearing alone. He might be called boisterous with the youthful vigor and playful curiosity that he exuded throughout his life. He was outgoing and friendly and continually found ways to make what he did fun. You could hear him from down the hall laughing with his T.A.'s while grading calculus exams or doing other work that deadens most people. He did not sleep well and when he woke at 4 a.m., he would get up and work. He especially enjoyed working on things requiring loud hammering at that hour on the grounds that if you are going to be up at 4, the family should know about it. He practiced the traditional Texas value of exercising independent judgment, both in general matters and in matters mathematical, and treated people kindly and gently --- unless he knew them, in which case it was more apt to be kindly and boisterously.

Both of Bing's parents were involved in education. His mother was a primary teacher and his father was the superintendent of the Oakwood School District. Bing's father died when R.H. was five, so Bing most remembered his mother's impact on his character and interests. Bing attributed his love for mathematics to his mother's influence. He recalled that she taught him to do mental arithmetic quickly and accurately and to enjoy competition both physical and mental.

After high school, Bing enrolled in Southwest Texas State Teachers College in San Marcos (now Southwest Texas State University) and received his B.A. degree in 1935 after two and a half years there. Later in life, Bing was named as the second Distinguished Alumnus of Southwest Texas State University. The first person so honored was Lyndon Baines Johnson. Bing's college education had prepared him as a high school mathematics teacher. He also was a high jumper on the track team and could jump his own height --- which was over six feet.

Bing's final academic position was as the Mildred Caldwell and Blaine Perkins Kerr Centennial Professor in Mathematics at The University of Texas at Austin, but his first academic appointment was as teacher at Palestine High School in Palestine, Texas. There his duties included coaching the football and track teams, teaching mathematics classes, and teaching a variety of other classes, one of which was typing. His method of touch typing involved anchoring his position over the keys by keeping some constant pressure on his little fingers. This habit was hard to break, apparently, because later he said that when he used an electric typewriter or computer keyboard (neither of which he did often) he tended to produce large numbers of extraneous "a's".

Nowadays one frequently hears complaints about a school system which gives the football coach the added assignment of teaching a mathematics class. One wonders if those football boosters of a bygone day in Palestine complained to the local school board about a real mathematics teacher coaching the football team.

In an effort to improve public school education in the '30's, the Texas Legislature had approved a policy whereby a teacher with a Master's degree would receive more pay than a teacher with a Bachelor's degree. So, many teachers saved (and scrimped) during the nine-month session and went to summer school during the three summer months in an effort to upgrade their talents and their salaries. Bing was among them.

R.H. had begun public school teaching in 1935, and by taking summer school courses at The University of Texas at Austin, he had earned a Master of Education degree in

1938. During one summer, Bing took a course under the late Professor R.L. Moore. Moore was inclined to deprecate the efforts of an older student such as Bing was, so Bing had to prove himself. But he was equal to the task.

Bing's summers in Austin provided him with more than mathematics, however, for during one class Bing met Mary Blanche Hobbs. They took evening drives up to Mt. Bonnell and must have enjoyed them because they married in 1938, and in 1974, they built a home on Mt. Bonnell.

Bing continued to take some summer courses while teaching in the high schools. In 1942 Moore was able to get Bing a teaching position at The University which allowed him to continue graduate study to work towards a doctorate, and to try his hand at research. [This practice of allowing a person of instructor rank or higher to work towards an advanced degree was allowed in those days.]

An unofficial rating scheme sometimes used by R.L. Moore and his colleagues went something like this: You could expect a student with Brown's talents and abilities every year; you could expect a student with Lewis's talents and abilities once every four years; but a student with Smith's talents and abilities came along only once in twelve years. Bing's talents and abilities threw him in the twelve-year class, or in an even higher class, since he is one of the most distinguished mathematicians ever to have received his degree from The University of Texas at Austin. Several of Moore's later graduate students have written that in the days after Bing, Moore used to judge his students by comparing them with Bing --- probably not to their advantage.

Bing received his Ph.D. in 1945 --- writing his dissertation on "Planar Webs." Planar webs are topological objects now relegated to the arcana of historical topological obscurity. The results from his dissertation appeared in one of his earliest papers in the Transactions of the American Mathematical Society. He told us recently that the Transactions had sent him fifty reprints at the time and if we were interested we could have some because he still
had forty-nine or so left.

But Bing did not have long to wait for recognition of his mathematical talent. He received his Ph.D. degree in May 1945, and in June 1945, he proved a famous, long-standing unsolved problem of the day known as the Kline Sphere Characterization Problem. When word spread that an unknown young mathematician had settled this old conjecture, some people were skeptical. Moore had not checked Bing's proof since it was his policy to cease to review the work of his students after they finished their degrees. Moore believed that such review might tend to show a lack of confidence in their ability to check the work themselves. So when a famous professor wired Moore asking whether any first-class mathematician had checked the proof, Moore replied, "Yes, Bing had."

Primarily because of the renown among mathematicians generated by his having solved a famous conjecture, Bing was offered positions at Princeton University and at the University of Wisconsin, Madison. Moore naturally wrote letters of recommendation. One comment he made was that, although the Kline Sphere Characterization Problem was a much better known topic than that of planar webs, Moore felt that it was Bing's work on planar webs that demonstrated that Bing had the mathematical strength to be an outstanding mathematician.

One of the leading topologists of the time was at Princeton, but Bing did not wish to follow in anyone's footsteps, so in 1947 he accepted a position at Wisconsin. He remained at Wisconsin for 26 years except for leaves: one at the University of Virginia (1949-50), three at the Institute for Advanced Study in Princeton (1957-58, 1962-63, 1967), one at The University of Texas at Austin (1971-72), and brief teaching appointments elsewhere. He returned to The University of Texas at Austin in 1973; but it was during his tenure at the University of Wisconsin, Madison that his most important mathematical work was done and his prominent position in the mathematical community established.

Bing's early mathematical work primarily concerned topics in general topology and continua theory, a branch of topology that describes properties of connected compact sets. He proved theorems about continua that are surprising and still central to the field. Among these results is Bing's characterization of the pseudo arc as a homogeneous indecomposable, chainable continuum. This result contradicts most people's intuition about the pseudo arc and directly contradicted a published, but erroneous, "proof" to the contrary. He continued to do some work in continua theory throughout his career; including directing a Ph.D. dissertation in the subject at UT in 1977.

General topology is not really general. Instead it refers to a special branch of topology that considers questions about topological spaces that may lack many of the geometrical aspects of subsets of the Euclidean spaces. Around 1950, one of the great unsolved problems in this field was the problem of giving a topological characterization of the metrizability of spaces. In 1951, Bing gave such a characterization. A Japanese and a Russian mathematician proved similar, independent results at about the same time, so now the result is referred to as the Bing-Nagata-Smirnov Metrization Theorem. That 1951 paper of Bing has probably been referred to in more papers than any other of his papers, even though he later was identified with an altogether different area of topology.

Nowadays if you refer to "Bing-type topology," you are referring to a certain style of geometric analysis of Euclidean 3-space that came to be associated with Bing because of the fundamental work he did in the area and the distinctive style with which he approached it. The first paper Bing wrote in this area appeared in 1952 and contains one of his best-known results. The result in this paper describes a method of shrinking geometric objects in unexpected ways. When Bing first worked on the question considered in this 1952 paper, he naturally did not know whether it was true or false. He claimed that he worked two hours trying to prove it was true, then two hours trying to prove it was false. When he originally worked on this problem, he used collections of rubber bands tangled together in a certain fashion to help him visualize the problem. The mathematics that Bing did is very abstract, but he claimed to get ideas about these abstruse problems from everyday objects. A final note about this problem involves a paper which Bing wrote in 1984 containing one of his last results. If one shrinks the rubber bands in the manner described in Bing's 1952 paper, each rubber band becomes small in diameter, but very long. It became interesting to know whether one could do a similar shrinking without lengthening the bands --- in other words, could you do the same thing with string as Bing had proved could be done with rubber. Bing's original procedure had been studied by numerous graduate students and research mathematicians for more than 30 years, and yet no one had been able to significantly improve Bing's shrinking method. It was left for

Bing himself to prove that “Shrinking without lengthening” (the title of this final paper) is possible.

Bing’s results in topology grew in number and quality. He proved several landmark theorems and then raised lots of related questions. Because of his habit of raising questions, many other mathematicians and students were able to prove good theorems in the area of mathematics which he pioneered. He emphasized the importance of raising questions in one’s papers and encouraged his students and colleagues to do so. He felt that mathematicians who read a paper are often more interested in what remains unknown than they are interested in what has been proved.

The period from 1950 until the mid-60’s was Bing’s most productive period of research. He published about 115 papers in his lifetime --- most during this period at the University of Wisconsin, Madison.

R.H. and his wife, Mary Blanche, had a son, Robert H., by the end of World War II. In Madison the son was joined by their three daughters, Susan Elizabeth Hannah, now of Milwaukee, Virginia Gay Hundley of Princeton, N.J. and Mary Patricia Bing of Union Grove, Wisconsin. There are six grandchildren. The entire family has always been very close and supportive and full of fun. It was traditional in the Bing family to give R.H. toys for Christmas and his birthdays. He felt that part of his job was to give his wife a purpose in life. Under this guiding principle he provided her with many challenges. His granddaughter Beth remembers an occasion when Bing decided that it would be fun to surprise Mary by lining up some hundred toys in a big curving line all over the house. No doubt she was thrilled. R.H. and Mary were also dedicated to their activities with the Presbyterian Church, where R.H. served as an elder. One of the Bing daughters remembers sitting with R.H. in church one Sunday and noticing how absorbed he appeared to be in the sermon. She was not quite so confident in where his thoughts were directed, however, when he reached forward to erase an errant symbol on an imaginary blackboard in the air.

His research success brought him honors, awards, and responsibilities. He was quickly promoted through the ranks at the University of Wisconsin, becoming a Rudoph E. Langer Research Professor there in 1964. He was a Visiting Lecturer of the Mathematical Association of America (1952-53, 1961-62) and the Hedrick Lecturer for the Mathematical Association of America (1961). He was chairman of the Wisconsin Mathematics Department from 1958 to 1960, but administrative work was not his favorite. He was President of the Mathematical Association of America (1963-64). In 1965, he was elected to membership in the National Academy of Sciences. He was Chairman of the Conference Board of Mathematical Sciences (1966-67) and a U.S. Delegate to the International Mathematical Union (1966, 1978). He was on the President's Committee on the National Medal of Science (1966-67, 1974-76), Chairman of the Division of Mathematics of the National Research Council (1967-69), Member of the National Science Board (1968-75), Chairman of the Mathematics Section of the National Academy of Sciences (1970-73), on the Council of the National Academy of Sciences (1977-80), and on the Governing Board of the National Research Council (1977-80). He was a Colloquium Lecturer of the American Mathematical Society in 1970. In 1974 he received the Distinguished Service to Mathematics Award from the Mathematical Association of America. He was President of

the American Mathematical Society in 1977-78. He retired from The University of Texas at Austin in 1985 as the Mildred Caldwell and Blaine Perkins Kerr Centennial Professor in Mathematics. He received many other honors and served in many other responsible positions throughout his career. He lectured in more than 200 colleges and universities in 49 states and in 17 foreign countries.

Bing believed that mathematics should be fun. He was opposed to the idea of forcing students to endure mathematical lectures which they did not understand or enjoy. He liked to work mathematics out for himself and thought that students should be given the opportunity to work problems and prove theorems for themselves. During his years in Wisconsin, Bing directed a very effective training program for future topologists. The first year graduate topology class which he often taught there would sometimes number 40 or more students. He directed the dissertations of 35 students and influenced many others during participation in seminars and research discussions.

Bing enjoyed teaching and felt that experiments in teaching were usually successful --- not because the new method was necessarily better, but because doing an experiment showed an interest in the students which they appreciated and responded to. Here are a couple of the experiments he tried while teaching at UT. Bing thought that a person who could solve a problem quickly deserved more credit than a person who solved it slowly. He would say that an employer would rather have an employee who could solve two problems in as much time as it took for someone else to solve one. So in some of his undergraduate classes he introduced “speed points.” For a fifty minute test, he gave an extra point for each minute before the fifty minutes elapsed that the test was submitted. He noticed that often the people who did the work the quickest also were the most accurate. Speed points were somewhat popular and sometimes he would let the class vote on whether speed points would be used on a test.

Another experiment in test giving was not popular. One day Bing had prepared a calculus test that he realized was too long. Instead of deleting some questions, however, he decided to go ahead and give the test, but as he phrased it, “Let everyone dance to the tune of their own drummer.” That is, each person could do as many, or as few, of the problems as he wished and would be graded on the accuracy of the problems submitted. The class was quite angry when the highest score was obtained by a person who had attempted only one problem.

In the 1971-72 school year, Bing accepted an offer to visit the mathematics department at UT. In 1973, the mathematics department, under Leonard Gillman’s chairmanship, persuaded Bing to accept a permanent position here. When he arrived in 1973, Bing was the highest paid professor in the state of Texas. He soon showed that he was worth the money.

Bing believed that part of the fun of life was to take on a variety of challenges. When he accepted the position at UT, he came with the idea of building UT’s mathematics department into one of the top 10 state university mathematics departments in the country. While he was at Texas from 1973 until his death in 1986, he helped to improve the research standing of the department by recruiting new faculty and by helping to change the attitudes and orientation of the existing faculty. Raising research standards was the watchword of that period and is the guiding principle for the mathematics department

now. Bing was chairman of the department from 1975 to 1977 but used his international prominence in recruiting efforts throughout his stay at UT. Although Bing's goal of putting the UT department in the top ten has not yet been realized, the mathematics department is considered one of the most improved departments over the period of Bing's tenure at UT. The 1983 report of the Conference Board of Associated Research Councils listed Texas as the second most improved mathematics department in research standing during the period 1977-1982, ranking it number 14 among state university mathematics departments at that time.

Bing accomplished much during his life and left us with many ideas, personal and mathematical, to consider and enjoy. He left topologists a treasure-trove of theorems and techniques and left the UT mathematics department with a goal and thirteen years of good progress toward it. He was a man of strong character and integrity who liked to understand things for himself. For example, he never claimed to understand a theorem unless he personally knew a proof of it. He made decisions based on his own experience --- relying on his independent judgment of a person or a cause whenever possible, rather than averaging the opinions of others. He was a kind man and respected people for their own merits rather than measuring them on a single scale.

R.H. Bing died on April 28, 1986. He suffered from cancer and heart troubles during his last years; but he never complained about his health problems nor did he allow discomfort to dampen his enthusiasm and good spirits. He was an exemplary person. His friends, his family, and his students have been enriched beyond bound by his character, his wisdom, and his unfailing good cheer and continue to be enriched by his memory.

William H. Cunningham, President of
The University of Texas at Austin

H. Paul Kelley, Secretary
The General Faculty

This Memorial Resolution was prepared by a special committee consisting of Professors Michael Starbird (Chairman), William T. Eaton, Cameron Gordon, and Robert Greenwood with the assistance of Professor S. Singh, Southwest Texas State University.