

Great things continue to happen in our department. We cannot succeed without alumni and friends. Your gifts, information, linkages, hiring of graduates and interns, and even simple things like cheerleading and spreading the word about the strengths of our department, its students, and faculty, are all important. You are always welcome to stop and visit with the math faculty and students.



FORT HAYS STATE
UNIVERSITY

Forward thinking. World ready.

FHSU MATH NEWSLETTER

Volume 42

Spring 2015

MACS DIVIDED

The Department of Mathematics & Computer Science was divided into two individual departments at the beginning of 2014 – 2015 academic year.

The Math program and the Math Education program now form the Department of Mathematics. The Computer Science program and the Information Systems Engineering program now form a brand new department; the Department of Computer Science & System Information Engineering. Two Computer Science faculty, Dr. Jeffery Solheim and Dr. Hongbiao Zeng, joined the new department.

The administrators believe that the formation of the new departments will establish and develop engineering programs at FHSU.

The “big MACS;”, the Department of Mathematics & Computer Science, was established in 1987 under the leadership of Dr. Ron Sandstrom, former Chair of the Department of Mathematics, by adding the computer science program to the Department of Mathematics. Dr. Sandstrom had served as the Chair of Department of Mathematics & Computer Science since 1987 until his retirement in 2010. The current chair of the Department of Mathematics is Dr. Mohammad Riazi.

After 27 years of cooperation, math and computer science pro-

grams formally separated. Fortunately, due to the strong bond between these two disciplines, the Department of Mathematics and The Department of Computer Science & Information Systems Engineering will continue to cooperate together in various areas such as Math Relays, Student Seminar, and MACS club.



MATH Faculty and new students at the Freshman Orientation in August.



Judy Brummer, Lanee Young, Mohammad Riazi, Jeff Sadler, Keith Dreiling, Bill Weber, Soumya Bhoumik, Sarbari Mitra, Michelle Zeng



Dorothy Knoll, 2014 Alumni Achievement Award Recipient.

Math Major Receives 2014 Alumni Achievement Award

Dr. Dorothy (Gross) Knoll received a B.S. in mathematics in 1968 and an M.S. in counseling and guidance in 1976, both from FHSU, as well as her Ph.D. in counseling and student personnel administration from Kansas State University, Manhattan. Now a Licensed Professional Counselor/Life Coach/Qualified Mediator, Knoll spent a vast portion of her career with the University of Kansas Medical Center in Kansas City as Dean of Student Services until her retirement in 2011.

Before that, she served FHSU in several capacities, including associ-

ate dean of students and foreign student advisor and assistant vice president for student affairs. She is a recipient of the Distinguished Service Award, granted by the National Association of Student Personnel Administrators Region IV-West; the KU Women of Distinction Award; and James J. Rhatigan Outstanding Dean Award.

Knoll and her husband, Joseph Beasley, live in Dallas, Texas. She has two children, a daughter, Dr. Victoria Knoll, and a son, Corbin, a 1996 FHSU graduate, and two grandchildren.

A reception was held for Dr. Knoll by the MACS Department on October 9.



NOYCE SCHOLAR — AMANDA BARNUM

As we all know, going to college is a great way to better ourselves and deepen our learning and understanding. But that education comes at a cost—literally! And so, like every other student, I have applied for scholarship after scholarship, in hopes of easing this expense. Financial help was all I was looking for when I applied for the Noyce Scholarship. When I was accepted, I had no idea that this scholarship would give me the keys to open many doors!

For most scholarships, a check is sent to help with expenses, but the help ends there. The Noyce Scholarship is different. Of course a check is sent to the school, but then we Noyce Scholars are given special training to better prepare us to enter the teaching world. As there is a shortage nationwide of secondary math and science teachers, the Noyce Scholarship program works hard to seek out the best secondary pre-service math and science teachers. This national program is then focused on better preparing Noyce Scholars so that we will love and stay in the field. The program gives training during our pre-service years, and continues to provide any help and support we will need in our beginning teaching years.

Every week, we would meet with the advisors and discuss all topic and aspects of being a teacher! Most discussions covered topics that were not discussed in any other education course, but were very relevant to being a teacher! We looked at some of the legal aspects, worked with the new NGSS and CCS standards, and even practiced writing grants. The Noyce Scholarship program takes Scholars to a variety of education conferences, hosts seminars with NASA representatives, and also places each Scholar in a rural school for a week of observation and extra interaction with students and teachers.

All of these experiences are meant to help me feel better prepared to take control of my own classroom. But that's not all—they helped me secure my first job as well! I was given extra help to prepare for my interview and, because of a suggestion from a Noyce Advisor, I was even offered financial help with moving expenses from the school (which was not something they usually offered)! In my interview, the school was very interested and impressed with the training I had received as a Noyce Scholar. They were impressed with my



Math Education First Year Noyce Scholars: Luke Abbott, Amanda Barnum, Sydney Lower, Nik Boyle.

diverse observations (due to the rural Noyce experience), loved the technology training I received from Noyce, and their jaws dropped when I gave the list of Google training Noyce Scholars had received. When building resumes, we are always told to make our resume "POP", to make ourselves stand out compared to the other resumes. Making mine "POP" was a piece of Pi with all the Noyce training!

Financial help through college is great, but what the Noyce Scholarship Program gives is priceless! To each and every one of my math and science teacher friends, I highly recommend applying for this program! There are many doors which are opened only to Noyce Scholars! Due to the experiences, networking, multiple perspectives on teaching and training I gained, I feel confident as I prepare to step into the world of teaching. Thanks to the Noyce Scholarship Program, I am *Forward Thinking. World Ready.*
Editors Note: Amanda is currently student teaching at Thomas More Prep in Hays Kansas. She has accepted a teaching position at Meade High School beginning Fall 2015.

FHSU Awards Six Math Majors

During the 2014-15 academic year, six FHSU math majors received scholarship dollars totaling \$72,000 as part of a National Science Foundation (NSF) grant aimed at recruiting the most talented math and science students to become teachers after graduation. The Noyce Teacher-Leaders for Western Kansas grant is currently in year three of its five year cycle, and will continue to award scholarship dollars over the next two years.

Luke Abbott (Great Bend senior), Amanda Barnum (Colby senior), Sydney Lower (Hutchinson senior), Nicole Maurer (Udall junior via Cowley CCC), Will Pingsherhaus (Cimarron junior via Dodge City CC), and Lakin Werth (Hays junior) were the 2014-15 awardees. All are pursuing the teaching emphasis, and upon completion of their undergraduate degrees, have agreed to teach math for two years in a high-needs district as their form of "repayment" to the NSF. All are progressing through their coursework, and we look forward to their graduation, so that we will have 6 excellent new math teachers in the field!

In addition to receiving scholarship money, these students also participated in courses to help prepare them for teaching in a rural setting. In the seminar course taken with the other awardees, topics included specialized classroom

management, personal and professional isolationism, and grant writing. Students also participated in a week-long rural field experience in early January to immerse themselves within rural schools in southwestern Kansas. The students were very excited after this experience, and must have made quite a positive impression on their mentor teachers,

as some of them have been invited back to southwestern Kansas to complete their student teaching experience! Finally, in addition to the scholarship money and specialized coursework, three of the awardees traveled to Omaha, NE with Dr. Weber to attend the regional Noyce conference last fall. At the conference, they were able to watch presentations done by some of the most talented math and science teachers in the entire country.

The second major component of the grant is focused on recruiting more students to consider math or science teaching as a career. FHSU is actively searching for freshman and sophomore level students to help with the various



Noyce Scholars: Front Row: Alysia Schwarz, Nicole Maurer, Lakin Werth, Sydney Lower. Back Row: Luke Abbott, Will Pingsterhaus, Nathan Purrdue Not Pictured: Amanda Barnum.

science and math camps we currently offer each summer. If any readers know of potential candidates from FHSU or elsewhere who might consider math or science teaching as a career, please encourage them to apply for next summer's awards.

Congratulations to all the awardees, and again, if you know of any students who might be excellent future math or science teachers, please contact Bill Weber (bweber@fhsu.edu).... he'd be happy to visit with them about these scholarship opportunities!

KME/MACS CLUB UPDATE

This past year we tried to do the old with a new twist. The annual KME Initiation Ceremony was held on April 24 in lieu of seminar. We hoped to have more students attend in order to raise awareness about KME., the mathematics honor society. Luke Abbott (Great Bend), Amanda Barnum (Colby), Seonyeong Ha (Korea), Sydney Lower (Hutchinson), Tanner Reece (Topeka), Cinthia Rodriguez (Kansas City), Shan Zhong (China) and Dr. Soumya Bhoumik (India) were among the inductees. Kaitlyn Paul,

Aidan Winblad and various faculty helped with the initiation ceremony. Everyone enjoyed cake and punch after the formalities had taken place.

On August 15 (the Friday before classes), the MATH Faculty had the opportunity to meet all of the incoming math majors and start learning names and faces. Per tradition, all math and computer science majors were invited to enjoy a variety of ice cream flavors in the hallway after the first seminar. A pizza party was held a couple weeks later and according to

tradition, the faculty ended up eating most of the pizza. Several students came and roasted marshmallows and made s'mores at Judy Brummer's house early in the fall. Due to scheduling conflicts we were unable to play the annual Faculty vs Student Softball Game but the point is moot as faculty would have won anyway.

As always, we hope to encourage more involvement in various activities in and out of the classroom.



Sydney Lower and Jamie Spoonmore enjoying their mathematics.



Sydney Lower, Keith Dreiling, and Amanda Barnum take proctoring Math Relays tests very seriously.

Last November, the FHSU Math Department hosted the largest Math Relays we've had since the recent renovations at the Memorial Union. We hosted 723 students from 53 schools on that day, and despite the large numbers, had a very successful day.

MATH RELAYS — 2014

In class 1A, the overall team winner was St. John's Catholic (Beloit), followed by Skyline (Pratt) and Rock Hills (Mankato). In the 2A/3A category, Decatur Community (Oberlin) won top honors, with Trinity Catholic (Hutchinson) and Minneapolis placing 2nd and 3rd. Within the 4A-6A category, Salina Central was the winner, with McPherson and TMP-Marian (Hays) also placing in the top three. For a complete listing of team placing and individual winners, please check our website <http://www.fhsu.edu/mac/s/Math-Relays/Past-Winners/>

The only "problem" with last year's Relays was that we came very close to approaching the maximum number of students we can host. At this time, our thoughts are to

decrease the number of individuals each school can bring by one per event, thus allowing a little extra room for any schools above the 53 from last year to attend.

The 37th Math Relays will be held on Thursday, November 12, 2015. We look forward to another fun day of hosting the best and brightest math students from our area on the FHSU campus!



FACULTY ACTIVITIES — 2014

The Mathematics & Computer Science Faculty are actively involved in original research, publication, problem solving, and proposing. The following is a partial list of scholarly activities by the faculty in 2014.

"Graceful Labeling of Pendant Edge Extension of Complete Bipartite Graph." *International Journal of Mathematical Analysis*, Vol. 8(58), pp. 2885-2897, (2014).

"A Group-based Deterministic Key Pre-distribution Scheme for Wireless Sensor Network." *International Journal of Wireless and Mobile Communication*, Vol. 7(5), pp. 435-447 (2014).

"Unconditionally-Secure Key Pre-Distribution for Triangular Grid Based Wireless Sensor Network." *Journal of Applied Mathematics and Computing*, Vol. 44(1-2), pp. 229-249 Springer (2014).

"Key Pre-Distribution in a Non-Uniform Network Using Combinatorial Design." *Qshine, LNICST (Springer)*, Vol. 115, pp. 155-170, (2014).

Paper reviewed for the *International Journal of Trust Management in Computing and Communications (IJTMCC)*.

"On The Automorphism Groups of Almost All Circulant Graphs and Digraphs",

Paper reviewed for the *Journal of the Australian Mathematical Sciences (JAMS)*

Presented numerous seminars. Advised seminar students. Advised KAMS students in research.

Revisiting the M-GUDS-S: Teacher candidates' awareness and acceptance of diversity. Submitted to *The Kansas Advocate*.

Mechanical Solutions to the Three Construction Problems from Antiquity, presentation at the Mathematical Association of America MathFest, Portland, OR, August 9, 2014

Presented at RCML Conference and MATHFEST concerning research on College Algebra

Submitted article to Kansas Association of Teachers of Mathematics for February Bulletin

Continued work on awarded grant from NSF for the Noyce Scholarship Program.

Co-Developed new courses for the Noyce awardees (STEM Leadership, Rural Field Experience, Distance Learning, Noyce Seminar)

Presented "Value Added Experiences for Noyce Scholars at FHSU" at National Noyce Scholarship Conference in Washington DC, and the regional Noyce Conference in Omaha, NE.

Writing an Open Educational Resources text in College Algebra with possible implementation in Fall 2015 College Algebra courses.

Researched, developed, and initiated implementation (as part of a team) the Fort Hays TK20 data collection system in relation to the FHSU College of Education accreditation.

Led Standard 5 team in development and implementation of two data retreat sessions relative to COE new CAEP accreditation;

Assisted in analysis of instruction in introductory statistics courses (in development phase for possible grant submission tied to analysis

Assisted in continuing development of online entry and upgraded grading/reporting software for Math Relays

Credit for correct solution to problem# 1896 *Mathematics Magazine*, vol.86, No.3, Mathematical Association of America.



Judy Brummer, Sarbari Mitra, Soumya Bhoumik, Bill Weber, Jeff Sadler, Keith Dreiling, Lanee Young,

ROLLER COASTER MATH CAMP

The summer of 2014 brought with it the second annual FHSU math camp for 5th through 7th grade students. Sixteen students from surrounding Kansas communities attended the camp June 2 – 5. Three faculty members, Dr. Lanee Young, Dr. Keith Dreiling and Judy Brummer supervised the camp with the assistance of six Noyce Summer Scholars.

Campers were challenged with the task of designing a roller coaster. Working in groups of 3 or 4, topics such as

force, friction, potential and kinetic energy, centripetal force, slope and speed were discussed. By the end of the camp, each group had designed a roller coaster out of foam tubing and demonstrated their roller coasters for family and friends.

The student scholars that assisted with the camp gained some valuable experience working with the campers; and the campers developed improved mathematical skills. But, let's not forget the fun! Campers participated in team building activities and were treated to fun outside games on the last day of camp.



SUMMER MATH CAMP is
JUNE 15-18, 2015.
We will
explore the mathematics of
Geometry and Golf!!!

SCIENCE OLYMPIAD

Science Olympiad is a national, non-profit organization dedicated to improving the quality of K-12 science education through participation in Science Olympiad Tournaments and incorporation of the Science Olympiad into classroom curriculum.

Science Olympiad competitions are like track meets, consisting of 23 individual and team events. Each year, events are updated to reflect the ever-changing nature of biology, earth science, chemistry, physics, computers, astronomy, engineering, and technology. By combining events from all disciplines, Science Olympiad encourages a wide cross-section of students to participate. Students who participate in Science

Olympiad are taught advanced science through active, hands-on participation. All events involve team work, group planning, and cooperation. There are now over 5,500 middle schools and high schools from all 50 states who participate in Science Olympiad.

The Department of Mathematics & Computer Science at Fort Hays State University has been actively involved in coordinating, organizing, and judging events for the past several years. Members of the MACS faculty were involved in the 2014 Regional Olympiad held on February 3 and 10. Jeff Solheim and Jeff Sad-

ler judged Mission Possible for the high school students. Bill Weber and Jeff Sadler judged It's About Time also for the high school. Write It Do It, for middle and high school students, was designed and judged by Sarbari Mitra and Soumya Bhoomik. If you ever want to help with or observe a Science Olympiad competition, contact Lanee Young. You will enjoy the experience of watching these young minds at work.



Retired Faculty News

Elton Beougher

By the time most of you read this, I will have reached another milestone in my life. I will be $\frac{3}{4}$ of a century old, a geezer, a sage, a nuisance around the house, a dodo, full of wisdom, still in the 20th Century, not a millennial, and several other descriptions, depending on the describer's viewpoint or age. Where do I get my wisdom? Mostly from my grandchildren, especially my computer, smart TV, and smart phone wisdom. If you want how to learn how to do something with any of those new-dangled gadgets, ask a pre-teenager. Only one problem with that. Mine say "first you do this, and this, and then this and then that,...." Whoa, I'm still on the first "this." So, if I really want to find out, I need to find another geezer whose mind is as cluttered as mine. My Mom used to say our minds are like a closet. We open the door and just toss stuff in. Over the years there is a lot of stuff piled in there. Then when we need to remember something we have to search through all the clutter to find it. I have 75 years of clutter in mine. Also, I have the "hereafter" problem. There's the story about the old man who was visiting with his minister. The minister said "Elton, do you ever think of the hereafter." Elton says, "Yes I think of the hereafter all the time. When I am doing a honey-do around the house I go down to my shop in the basement to get a tool. I stop and think 'what am I here after?' I go back upstairs to my task and I think 'what am I here after?' After several trips up and down the stairs, I'm still wondering 'what am I here after?' You see, I think of the hereafter all the time."

Speaking of my grandchildren (which I like to do) my wife and I have 12 and one more on the way. We are also expecting our first great-grandchild. That makes me feel old. But what really makes me feel old is my SON WILL BE A GRANDDAD! That brings me up short. Our grandchildren's ages are 25, 23, 23, 20, 13, 12, 12, 11, 9, 9, 7, and 6. There are a lot of teen-age years for their parents to live through, God bless them. They are scattered from Seattle, Washington to DeSoto, Kansas. We don't get to spend near enough time with them.

Charles Votaw

We've made it through the past year with no catastrophic incidents but no great adventures either. I learned that I have developed atrial fibrillation, and I had a pacemaker implanted to get my heart rate up from its previous normal of about 45. It seems to be an improvement.

Ellen Veed

No big trips this year. I spent the summer out at my cabin in Colorado. I also spent several weeks in Colorado helping out my nephews and niece. My nephews have been busy at the cabin and dragging it into the 20th century (NOT the 21st century yet)! So, running water in the cabin may be in the near future? I am also spending a month or so with my brother in Alamogordo, NM to assist him after the passing of his wife. This past year I had my application approved to become a member of the Daughters of the American Revolution!

Rosalie Nichols

Weeden and I are enjoying New Mexico.

Ron Sandstrom

Hello fellow mathematicians and friends. Relative to last year, this year has been un-eventful. NOT. Last spring found us spending lots of time in Derby helping get Erik's house ready for sale. He and his family moved to Havre, MT where he is now an emergency Doc. Our oldest grandson graduated from high school and is now in Army Special Services. Jess is still in Hutchinson teaching Mathematics and Spanish in the High School, and changes are a coming. Cathy's highlight besides having cataract surgery was our photo safari to Kenya Africa. We spent 12 days in 6 different national parks. We have lots of photos of the big seven as they are called. Other than keeping up with the above events, my life has not changed. NOT. I have gotten so bored this winter that I have started substituting in our local middle/high school. I'm anxiously waiting for the weather to warm up so I can be out in my garden.

Ruth Pruitt

No trips or anything else very exciting. I am the registrar for my Daughters of the American Revolution chapter which means I help prospective members with their genealogy and application papers. Bev Unruh is an active member, having joined after seeing in a former newsletter that I am involved in DAR. Ellen Veed has recently joined my chapter also.

Mary Kay Schippers

“Sunrise, Sunset”. Remember that song from *Fiddler on the Roof*? Since retirement, that’s how I measure my days. I missed the awe and wonder of too many I think as I was rushing to get ready for work in the mornings and grading papers late into the night. So now I appreciate them. I can’t believe there have been almost 2300 sunrises since we moved to the country, and over 1000 sunsets since I’ve retired. (Go ahead, whip out your pocket calculators.)

Good news and bad news on the grandbaby front. Good – no GREAT – news is that Jared and Marli will present us with grandbaby #5 in late May. They already know it’s a girl – Vivian Marie. Bad news is that Brent and Sasha moved with their four from Lawrence to west St. Louis. Brent got a job offer that he realistically could not turn down. We are so very proud of him yet so very sad at the same time. But you can bet I will become VERY familiar with both Rapid City, South Dakota and Wildwood, Missouri.

Since I last wrote, we have traveled to New Orleans with my sisters and brothers-in-law, where the highlight for me was holding a baby gator during a swamp trip. (Granted it was January, and the little fella was pretty cold, but still!) We are planning our next “sister” trip to Charleston in October.

Last, but not least, I have finished my second book, a sequel to *A Year on the Family Farm*. It is titled, appropriately enough, *Another Year on the Family Farm*. It is set in 1970, five years later, and I have written it in such a way that it will, without a doubt, be my last. I refuse to be another Laura Ingalls Wilder. The book should be available in a couple of months. Other than that, my farm chores keep me busy and my farm companions keep me happy. Sunrise, Sunset.

Erv Eltze

Ervin M. Eltze, 76, of Olathe, Kansas passed away Friday, February 6, 2015, surrounded by his family.

Ervin was born May 9, 1938 in rural Crete, Nebraska to Ervin F. and Irma Lubben Eltze. Erv attended a one-room schoolhouse, graduating from Crete High School. He received his bachelor's degree from Doane College and a Master's degree in mathematics with a minor in physics from the University of South Dakota. There, he was part of the honorary Sigma Xi Fraternity, Pi Mu Epsilon and Kappa Mu Epsilon.



While working on his master's degree, Erv married LeAnn Hagena on August 9, 1963. They moved to Omaha where Erv taught mathematics at Creighton University, until they moved to Ames, Iowa in 1965. He earned his PhD in mathematics from Iowa State University. Erv was a member of the honorary fraternity Phi Kappa Phi. While living in Ames, their two sons, Michael and Robert were born.

Erv and LeAnn moved to Hays, Kansas where he taught at Fort Hays State University for 33 years. Their daughter Michelle was born soon after moving to Hays. At Fort Hays, Erv served as President of Faculty Association, and President of Phi Kappa Phi. Erv was also active in the Hays United Methodist Church, singing in the choir and holding leadership positions. He served on the Finance Committee, and Council of Ministries.

In 2011, Erv and LeAnn moved to Olathe, Kansas. Erv was an active member of Lion's Club. He also volunteered for many years with the Boy Scouts of America, serving as Webelo Leader, Cub-master, and Camp Visitation Team. They honored him with the prestigious Silver Beaver Award for his outstanding service to youth in Boy Scouts.

In 2011, Erv and LeAnn moved to Olathe, Kansas where he lived his remaining years.

Erv loved woodworking, playing the cello in the Hays Symphony, playing card games, photography, fishing and traveling, especially to the Rocky Mountains. He also loved spending time with his family.

Ervin and LeAnn shared 51 years together. Grateful for having shared his life are son Michael Eltze, his wife Angela of Cedar Rapids, Iowa, son Robert Eltze of Manhattan, Kansas, his daughter Michelle Danner and her husband Robert of Olathe, Kansas. They have five grandchildren Matthew, Samantha and Emma Eltze and Chloe and Ethan Danner. His brother Ronald Eltze and his wife Elaine of Crete, Nebraska and his sister-in-law Eunice Peters and husband Alfred of Lennox, South Dakota.

He is preceded in death by his parents, Ervin F. Eltze and Irma (Lubben) Eltze.

Funeral services were held 2pm, Tuesday, February 10th, at Church of the Resurrection – Wesley Covenant Chapel, 13720 Roe Ave. Leawood, Kansas. Internment was in Riverside Cemetery, Crete, Nebraska. Memorial contributions may be made to Fort Hays State University, Church of the Resurrection or Olathe Hospice House.

2014-2015 Scholarship Awardees

Significant financial support in awarded scholarships worth over \$100,000 was given to FHSU students pursuing a degree in mathematics or computer science this current academic year. The scholarship dollars came from five areas of funding: named scholarships, departmental scholarships, Academic Opportunity Awards, grant funding, and special funds donated to the department. These funding areas are primarily supported by the generous contributions of alumni and friends of the MACS Department.

Six MACS department students received scholarships from the Noyce Scholarship Program (co-directed by the MACS Department's Dr. Bill Weber), and the SEMI-Steffen Scholarships (directed by Dr. Paul Adams through the FHSU Science and Mathematics Education Institute.) One may wish to examine the 2013-2014 MACS Newsletter cover story detailing the Noyce Scholarship Program to find more information about these unique NSF grant funded scholarships. After going through a rigorous application process, these MACS students received \$62,400 in scholarships:

Luke Abbott (Great Bend)—\$12,000 Noyce Scholarship
 Sydney Lower (Hutchinson)—\$12,000 Noyce Scholarship
 Nicole Maurer (Udall)—\$12,000 Noyce Scholarship
 Will Pingsterhaus (Cimarron)—\$12,000 Noyce Scholarship
 Lakin Werth (Hays)—\$12,000 Noyce Scholarship
 Bailey Pfortmiller (Natoma)—\$2,400 SEMI-Steffen Scholarship

Now in its eighth year, the Academic Opportunity Awards (AOA) continued to be a valued scholarship for incoming freshmen to the MACS department. Since replacing the 20-year old Award of Excellence program in 2007, the AOA has provided a two-tier structure with award amounts of either \$900 or \$500. The awarding and amount was based upon a student's interest in pursuing a degree within mathematics or computer science as well as upon the student's high school academic achievement and ACT/SAT scores. Twenty-five AOA scholarships worth \$19,300 were offered to students interested in beginning a degree program in mathematics or computer science at FHSU. From this group of prospective students, eight began classes in Fall 2014 for a total of \$5,600 in paid scholarships. Those students included:

Zach Glass (Scott City)
 Kenton Lindsey (Goddard)
 Danielle Nay (Bennington)
 Clinton Petrie (Topeka)
 Victoria Rall (Colby)
 Lucas Scott (Collyer)
 Austin Wellbrock (Oakley)
 Landry Wilson (Garden Plain)

Thanks to annual TigerCall Telethon supporters, the department was able to award twelve scholarships, either of \$650 or of \$500, in the MACS Departmental Scholarships category. The 2014-2015 awards totaling \$7,200 were given to:

Chad Befort (Hays)
 Avery Burns (Cimarron)
 Hailey Davey (Evergreen, CO)
 William Goodrow (Hays)
 Elaina Haberer (Luray)
 Tyler Hardwick (Hays)
 Dylan Hogan (Winfield)
 Tyler Hardwick (Hays)
 Carlos Linares (Aurora, CO)
 Tyler Masters (Natoma)
 Robert Mayor (Broken Bow, NE)
 Jared Mick (Ellis)
 Melvin Williams (Russell)

Nineteen dedicated students were awarded \$20,500 in prestigious named scholarships from the MACS Department third area of funding. These scholarships are financed through both endowed dollars and newly received designated contributions, some also coming from the TigerCall Telethon. The following FHSU students received both the deserved recognition and related awards:

Kellen Griffin (Hays)—Denio \$1500 Scholarship
 Aiden Winblad (Goessel)—O.E. and P. Etter \$1500 Scholarship
 Erin Deenihan (Hill City)—Tebo Family \$1500 Scholarship
 Royall Yonkers (Amherst, NE)—Toalson \$1500 Scholarship
 Blake Michaud (Salina)—Ron and Cathy Sandstrom \$1,200 Scholarship
 Cinthia Rodriguez (Kansas City)—P. Miller Math/Physics \$1,000 Scholarship
 Erin Deenihan (Hill City)—Moore Family \$1,000 Scholarship
 Kellen Griffin (Hays)—Moore Family \$1,000 Scholarship
 Alysia Schwarz (Grinnell)—Moore Family \$1,000 Scholarship
 Brianna Wooldridge (Hays)—Moore Family \$1,000 Scholarship
 Rilee Krier (Strasburg, CO)—Ruth and Roger Pruitt \$1000 Scholarship
 Samuel Devore (Lyons)—Frances E Shockley \$1000 Scholarship
 Cinthia Rodriguez (Kansas City)—E. Veed \$1000 Scholarship
 Thao Tran (Salina)—Baxter \$800 Scholarship
 Mallory Diederich (Topeka)—E.E. and L. Colyer Memorial \$800 Scholarship
 Charlee Samuelson (Morganville)—Dr. Carolyn Ehr \$800 Scholarship
 Tyler Hinkle (Omaha, NE)—Jimmy Rice Memorial \$800 Scholarship
 Shauna Guyle (Concordia)—C.W. Lowry \$750 Scholarship
 Cheyanne Toler (Colorado Springs, CO)—Ogle \$750 Scholarship
 Jamie Spoonemore (Hillsboro) —Marshall \$600 Scholarship

The departments remaining scholarships were funded by a generous contribution to the department by Kerry and Dorothy Bahl. Although no specific restriction or direction on the expenditure of these dollars was given by the Bahl's, the department faculty continued to direct \$5,000 toward student scholarships. Several of these scholarships were designated toward deserving transfer students. The following MACS students were awarded scholarships from these contributions:

Steffy Thottasseril (Liberal)—\$2,000 Scholarship
 Bailey Pfortmiller (Natoma)—\$750 Scholarship
 Brianna Wooldridge (Hays)—\$750 Scholarship
 Cody Forell (Alva, OK)—\$750 Scholarship
 Houston Hilton (Goddard)—\$750 Scholarship

On behalf of these students, the Mathematics and Computer Science Department expresses deep appreciation for the financial assistance given, especially to the MACS department friends who continue to contribute their personal funds to our department. If interested in contributing either new or continued funds to any MACS scholarships area, please do so by sending a check to the MACS department payable to the FHSU Endowment Association—specify the mathematics scholarship fund of interest on the memo line.

The Mathematics Department continues to ask alum and other friends for assistance in encouraging ALL local high school students with an interest or talent in mathematics education or mathematics toward higher education at FHSU. The department has a goal to consistently have at least twenty well-prepared high school seniors begin higher education in mathematics at FHSU during the fall semester after their high school graduation. To have any hope of reaching this goal, the department needs the help of its friends in various communities to connect with such students. Anyone with questions about departmental scholarships or with the ability to assist in identifying and/or recruiting possible MATH students can do so by contacting Jeff Sadler at jsadler@fhsu.edu or (785)-628-4416.

ALUMNI UPDATES

Aimee Overmiller ('13) is teaching 6-8th grade math at Pike Valley .

Alison (Chretien) Sommers ('11) had her 2nd child (a boy). Alison is teaching Physics and Math in Victoria, and is also working on a Special Ed Masters.

Roger Schuster ('88) is a programmer/ analyst at Texas Tech University.

James Beard ('13) is teaching at Garden City High School.

Antoinette Leiker ('09) is working for Sprint in the Kansas City area as a Statistician.

Tanner Hageman ('14) is teaching math and coaching football at Hutchinson High School.

Jayne Hansen ('14) is teaching at Ellsworth High School.

An Nguyen ('14) is a GTA at Wichita State University pursuing her masters in mathematics.

Kaitlyn Paul ('14) is teaching at Dodge City Middle School.

Joshua Richards ('14) is attending Kansas State University to study engineering.

Margo Voth ('14) is substitute teaching in Lawrence, Kansas.

Jocelyn Serna ('14) is teaching in Cimarron Kansas and also gave birth to a baby boy this past year.

Gene Zimmer ('66) died on Wednesday February 12, 2014. Gene graduated from Schoenchen High School in 1961, Fort Hays State University in 1966 with a BS in Mathematics before earning his MS in Mathematics at Seton Hall University. Gene began his teaching career at Tescott for two years, moving on to LaCrosse High School for nine years, and then accepted a teaching position at Kennedy Middle School where he spent twenty three years teaching 8th grade math and algebra. During the spring of 2000, Gene accepted a position to teach Algebra II and College Algebra at Thomas More Prep-Marian High School, where he went on to teach for twelve years. He was a member of the National Association of Teachers of Mathematics (NATM) and the Kansas Association of Teachers of Mathematics (KATM). Gene led TMP-Marian at the Fort Hays Math Relays and garnered more first place finishes than second and third combined, throughout the course of his leadership.

Nikolaus Boyle ('14) died August 7, 2014. He was born Apr. 23, 1992 at McPherson, KS, the son of William Bruce and Loree M. (Loreg) Boyle. A 2010 graduate of St. John High School receiving Valedictorian honors. He received a B.S. Degree in Education and a B.A. Degree in Mathematics from Fort Hays State Univ., he was a student teacher. FHSU Colligate honors include, National Colligate Honor Society, Noyce Scholarship recipient, worked in the Science and Mathematics Institute, managed the Old School House on campus, various campus campaigns and admissions counselor.



Chelsey Weber ('09) visited campus this fall. Since my graduation, I entered The Sisters of the Immaculate Heart of Mary of Wichita in 2010. In my initial formation with the sisters, I took classes over Scripture, Theology, Philosophy, and Religious Life. My Math degree helped me make sense of all the information I have learned. Many topics in Theology and Philosophy are complex and involve recognizing patterns and understanding how many things work to together. I noticed that I could often apply Math theorems and concepts to the material to help me understand. In 2013 I professed my first vows and went back to college to receive my elementary teaching license. In fall of 2015, I will be student teaching and look forward to teaching in Catholic Elementary Schools in the Wichita area. I will profess my final vows in February of 2016. - Chelsey "Sr. Rose Marie" Weber, IHM

SUMMER CLASSES 2015

ONLINE: MATH 010 Intermediate Algebra,, MATH 110 College Algebra, MATH 250 Elements of Statistics, MATH 331 Calculus Methods

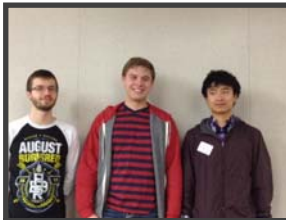
TWO TEAMS PLACE AT PROBLEM SOLVING COMPETITION

Every year the Kansas Section of the Mathematical Association of America meets at a place of higher education for faculty and students to share research, teaching ideas, renew old friendships and make new ones. A problem solving competition is also held for undergraduate students at the conference.

On March 28, while faculty members presented their research on the campus of Fort Scott Community College, teams of students worked together to solve ten problems in three hours. Problems ranged in difficulty and content but were designed to be accessible using skills from statistics and calculus.

The Fort Hays contingency fared well this year as the team of Cinthia Rodriguez, Seonyeong Ha, and Evan Shanelec placed 4th while Aidan Winblad, Luke Abbot, and Xingling Lie placed 6th in the competition. Congratulations on a job well done.

The KMAA Conference will be held at Fort Hays State University on April 8-9, 2016.



Aidan Winblad, Luke Abbot, and Xining Li placed 6th at the problem solving competition



Cinthia Rodriguez, Seonyeong Ha, and Evan Shanelec placed 4th at the problem solving competition



Six faculty (Bill Weber, Keith Dreiling, Sarbari Mitra, Lane Young, Mohammad Riazi, Soumya Bhoumik) and six students attend the KMAA Conference in Fort Scott, KS.

THANK YOU FOR YOUR SUPPORT

The Department of Mathematics enjoys this opportunity each year to list the donors who have given so generously to our department. Without your contributions it would not be possible for us to award scholarships to our deserving majors.

Please check out the list of students receiving scholarships on pages 8 and 9 of this newsletter. We wish to thank each of you who have shared your financial resources with the University, and especially wish to thank those of you who designated the Mathematics Department as recipient. We also appreciate the employers who matched your contributions. Individuals or companies contributing to the Spring 2014 campus drive or Fall 2014 Tiger Call are:

Joan Albers, Jeralyn Allen, Charles and Cathryn Allphin, Steve Alston, Lavern and Cari Andrews, Kerry and Dorothy Bahl, Gary and Bernice Bell, Eton and Wendy Beougher, Rex and Beverly Blanding, Stacy Boyd, Susan Boeman, Stephen and Judy Brummer, Darren Brungardt, Larry Carter, Kent and Lisa Colwell, Willis and Alma Crabtree, Mary Cunningham, Emily Decker, Danny and Connie Dibble, David Dille, Kyndra Dobson, Keith and Pam Dreiling, Kay and Mildred Dundas, Dennis Echard, Carolyn Ehr, Leslie and Karen Freeman, Kathryn Fritz, Rhonda Gardner, Kent and Karla Gross, Chad Heckman, Cheryl Helget, Al Herren, Troy and Tina Herrman, Jerrod and Jess Hofaker, Kent Huffman, Amy Johnson, James and Barbara Johnson, James and Judy Johnson, John and Regina Johnson, Brad Kearn, Vernon Kisner, Norwin Kohls, Richard Kratzer, Mike and Carmen LaBarge, Darrell and Sheila Latham, Clint and Carol Ledbetter, Larry and Donna Leitner, Don and Linda Lesovsky, Aaron Lessor, Max and Thelma Ligget, Pat Luea, Lois Lutz, Larry and Connie Masters, Ronald and Debbie Miller, Bob and Anel Minneman, James Morford, Troy and Laura Munsch, Patrick and Donna Myers, Weeden and Rosalie Nichols, Adam North, Marvin and Katrina Penka, Robert Plomondon, Darlene Plymell, Roger and Ruth Pruit, Mohammad and Seddigheh Riazi-Kermani, Shayne Riley, Richard and Sharon Ruder, Jeff and Lori Sadler, Ron and Cathy Sandstrom, Robert and Christine Sauber, Dan and Mary Kay Schippers, Kim Schmidtberger, Janet Schuetz, Dennis and Gaylene Shank, Loren Shannon, James and Lida Sharp, Joyce Buckles, Pat and Kathy Spicer, J Gail Stanley, Todd Stanton, Debbie Stelter, Betty Taylor, Textron, Inc, Ken Trimmer, Blake and Crystal Vacura, Ellen Veed, Charles and Reta Votaw, Charlene Weber, Bill and Tiffany Weber, Donald Werner, Westar Energy Foundation, Joe Whitley, Rex and Margaret Wilson, Marilyn Wilson, Leroy and Sharon Winklepleck, Wilbur and Shirley Wood, Lane Young, Hongbiao and Michelle Zeng, Eugene Zimmer.

Apologies are extended if someone's name was inadvertently left off the list. We appreciate each and every donation received! These contributions are so important in allowing us to attract and retain mathematics and computer science majors; which then gives these students the opportunity to become successful citizens such as yourself. If you know of any potential mathematics majors, please let us know by sending us their names.

Graceful Labeling — Intro to Research by Soumya Bhoumik

Paul Erdos expressed his sense of mathematical beauty in these words: *"Why are numbers beautiful? It's like asking why is Beethoven's Ninth Symphony beautiful. If you don't see why, someone can't tell you. I know numbers are beautiful. If they aren't beautiful, nothing is."* One who sees the beauty of Mathematics, can't live without it. When I was a kid, I realized, Mathematics is the subject, I want to know more about. I was fascinated by the beauty of Mathematics, and it was very obvious that I will opt for higher studies over corporate job. During my Masters' I was introduced to the area of Graph Theory and I was completely mesmerized by the charisma of the subject. The love of the subject didn't fade away over the time, instead thickened and now it became a part of my daily life today. It might sound weird, but today when I feel exhausted after the regular daily stuffs, I relax myself by spending some time on problems on Graph Theory.

Why Graph Theory? - Probably the answer would be it is very addictive and it doesn't require any prior knowledge, or, you don't need to remember a lot of things (Theorems or results). This particular branch of Mathematics which has become quite rich and interesting for several reasons. In last few decades hundreds of research articles have been published in Graph Theory. Let me give an example: Many of the most arduous problems of graph theory are the easiest to state compared to other branches of Mathematics. One of the famous one of them is *the four-color problem*, which is that a planar map can be colored using at most four colors in such a way that no two bordering regions have the same color. This problem, originally hypothesized in the early 1850's, remained unsolved until the 1980's, and its proof relies on the use of computer software to check a large number of cases. Subsequent, more elegant proofs have arisen, but the problem was unsolved for almost hundred and eighty years.

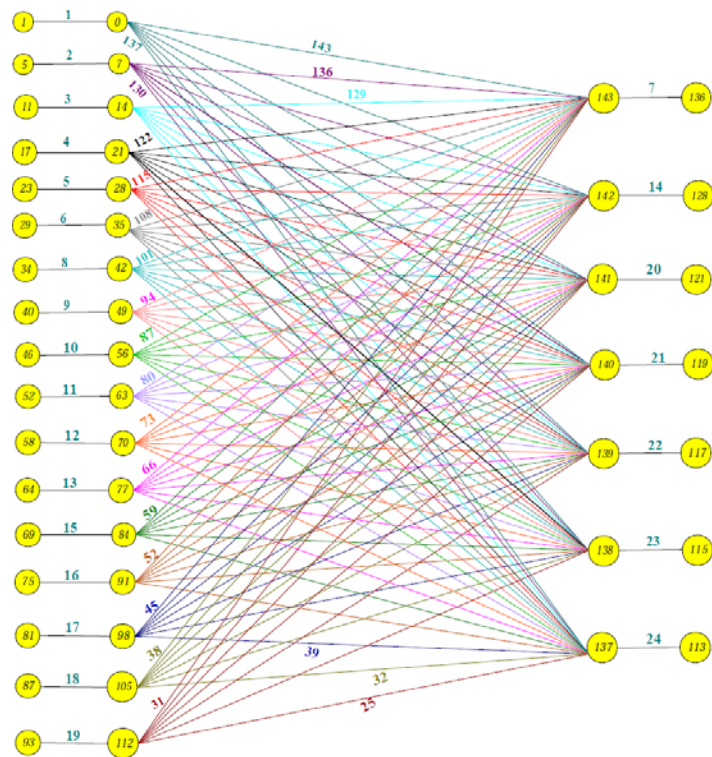
There are several other areas of Graph Theory which have received good attention from mathematicians. Some of these areas are Coloring of Graphs, Matching Theory, Domination Theory, Labeling of Graphs and areas related to Algebraic Graph Theory. Me and my wife Dr. Sarbari Mitra found that the Labeling of Graphs deserves further attention. Thus, we explored this area for our research work. Very often, the problems from this area draw attention due to their application to real life situations or, in some cases, their history. Here, we investigate another somewhat longstanding problem in graph labelings, which is called Graceful Labeling in graphs.

Graceful Labeling was first introduced by A. Rosa as β -valuation in 1967. A graceful labeling of a graph with m edges is a labeling of its vertices with some subset of $\{1, 2, \dots, m\}$, such that no two vertices share a label, and such that each edge is uniquely identified by the absolute difference between its endpoints. A graph which admits a graceful labeling is called a **graceful graph**. Graph theorist primarily used this type of labeling as an efficient tool for decomposing a complete graph into isomorphic subgraphs. Even though very soon (1980) Graham and Sloane claimed that most graphs are not graceful, it is still an interesting problem to identify which graphs are graceful. However, as per the rigorous survey by Gallian, it is obvious that a lot of work has been devoted in seeking the answers to this problem for different family of graphs, and substantial progress in this area has been made in last few decades, but there are still numerous number of families of graphs of important structures for which the answer must be found for future reference. See the graceful labeling of few well-known graphs below.

Consequently an obvious question arises which is: *If we produce a new graph from two known graceful graphs using some graph operations, then is that new graph is also graceful?* In the literature of graph labelling it is interesting to observe that many mathematicians have constructed larger graceful graphs from standard ones by using various operations. Joint and product operations are used on graphs such as paths, cycles, stars, complete graphs, complete bipartite graphs etc., to get larger graphs. On the other hand, many copies of certain standard types of graphs such as complete graphs, complete bipartite graphs, cycles, etc. joined at one common vertex have been proved to be graceful. It is already known $K_{m,n}$ (Complete Bipartite Graph), and K_p (Complete Graph) is graceful for (for p less than 5). So we investigate that whether the **corona product** (or simply **corona**), denoted by \odot , of these two families of graphs are also graceful. The corona $G_1 \odot G_2$ two graphs G_1 and G_2 can be obtained in this following way. First corresponding to each vertex of G_1 , put a copy of G_2 , and then put every edge between the i^{th} vertex of G_1 to the G_1 corresponding i^{th} copy of G_2 . We basically investigated to find an answer this following questions: *Is $K_{m,n} \odot K_p$ graceful for p less than 5?*

In 2001, Sethuraman and Elumalai have shown that pendant edge extension of a complete bipartite graph, i.e. $K_{m,n} \odot K_1$ is graceful when n even, $n \leq m \leq 2n+4$; and $n \leq m \leq 2n-1$; when n odd. In 2014, we showed that $K_{m,n} \odot K_1$ is graceful for $n \leq m \leq n^2 + n$. In short, Sethuraman and Elumalai have shown that for any positive integer n , the corona product $K_{m,n} \odot K_1$ is

graceful as long as $m = O(n)$. In our work we provided a completely different graceful labeling which induced a remarkable improvement on m , i.e. $m = O(n^2)$.

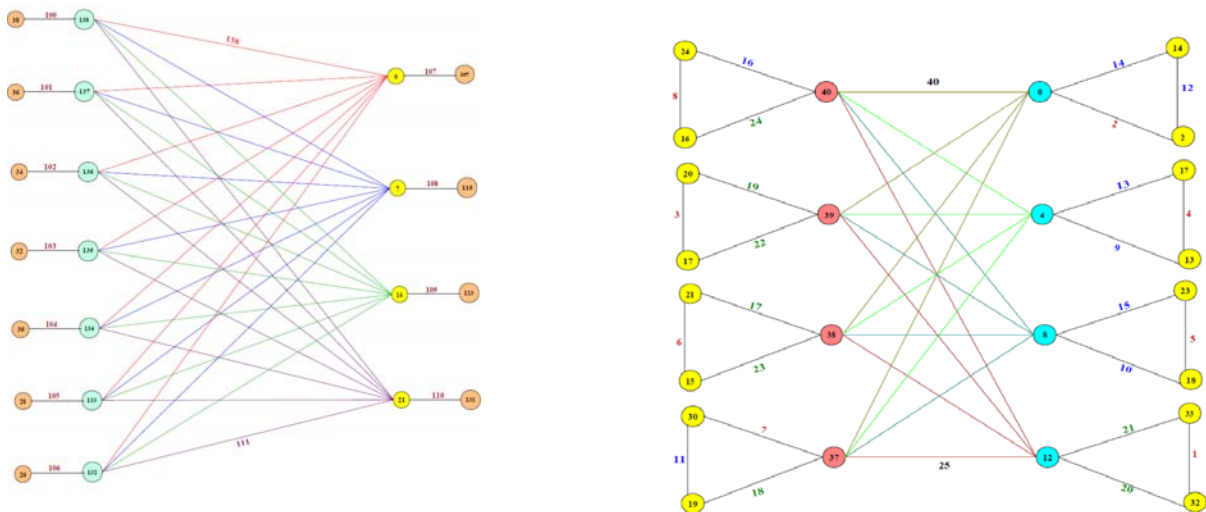


On the other hand, the k -graceful graphs, which is a natural generalization of graceful graphs was introduced independently by Slater in 1982 and by Maheo and Thuillier in 1982. A graph G is k -graceful, if there exists a mapping $f: V(G) \rightarrow \{0, 1, 2, \dots, |E(G)| + k - 1\}$ such that $f(x) \neq f(y)$ for distinct $x, y \in V(G)$ and an induced mapping is defined as

$f^*: E(G) \rightarrow \{k, k + 1, \dots, |E(G)| + k - 1\}$, where $f^*(uv) = |f(u) - f(v)|$ is a bijection for all edges $uv \in E(G)$. If a graph is k -graceful for any integer k , then it also called arbitrarily graceful. Obviously G is graceful when $k=1$. In 2011, Li, Li, and Yan proved that $K_{m,n}$ is k -graceful. In 1991 Ma ke-jie proposed the following conjecture which kind of triggered our interest,

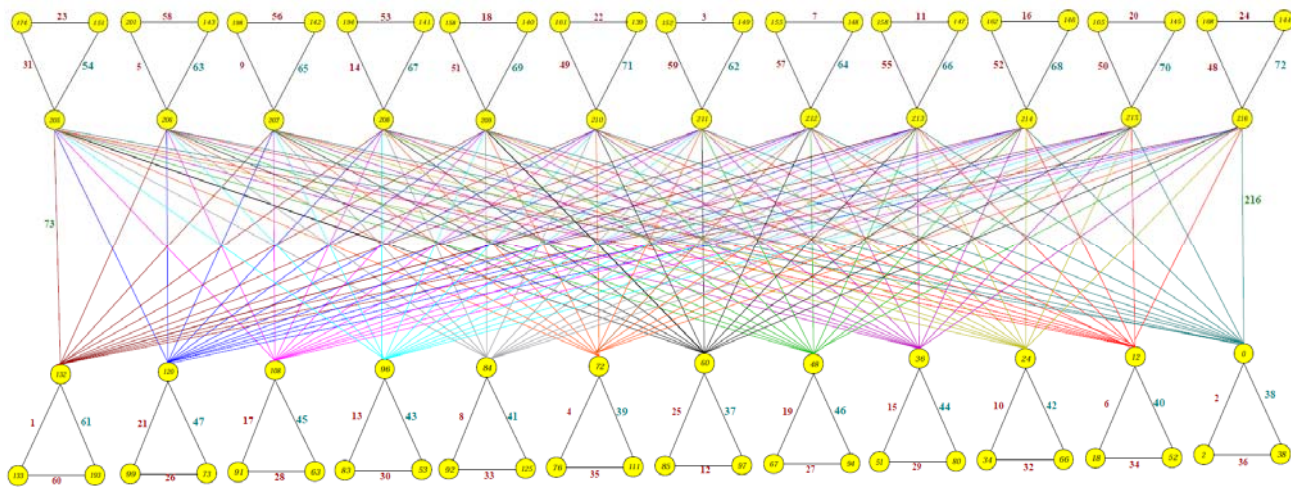
1 -crown (pendant edge extension) of complete bipartite graph $K_{m,n}$ ($m < n$) is k -graceful graph for $k \geq 2$. This conjecture has not been proved or disproved till date. Jirimutu has showed that this conjecture is true when $m=1$. In 2001, Sethuraman and Elumalai showed that pendant edge extension of a complete bipartite graph, i.e $K_n \circ K_1$ is 1 -graceful. We started working on this, and very soon showed that $K_n \circ K_1$ is k -graceful, if $k \geq mn + m + n$. But when $k < mn + m + n$ it was not that easy to make it work. So finally we proved that it would be graceful with some exceptions. Below we have an example that shows that $K_n \circ K_1$ is 100 -graceful.

Next we investigated the gracefulfulness of the next member of the family of graphs $K_{m,n} \odot K_p$, which was $p = 2$. To start we consider first $m = n$, and they are even. If n is a smaller enough then just by trial-and-error we might come up with the graceful labeling of that graph. For example the graceful labeling of the graph $K_{11} \odot K_2$ is given below.



But when n is large enough, we need some kind of functions that will label the vertices gracefully. Finally we come up with such function, and instead of providing the function here, let's see one example of action of such function on the graph

$$K_{12,12} \odot K_2$$



For future project, we have plan to extend our own work on the graphs $K_{m,x} \odot K_p$, where $3 \leq p \leq 4$. We are also spending some time on other problems of graceful labeling and other areas of graph theory as well.