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Editor:

The Problem Corner: Pat Costello Chip Curtis Department of Mathematics Department of Mathematics and Statis-Missouri Southern State University tics 3950 E Newman Road Eastern Kentucky University Joplin, MO 64801-1595 521 Lancaster Avenue curtis-c@mssu.edu Richmond, KY 40475-3102 pat.costello@eku.edu **Business Manager:** Don Tosh Kappa Mu Epsilon News: Peter Skoner Department of Science and Technology Department of Mathematics Saint Francis University Evangel University 1111 N. Glenstone Ave. Loretto, PA 15940 Springfield, MO 65802-2191 pskoner@francis.edu toshd@evangel.edu

Associate Editors:

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A Comparative Analysis of Some Population Models Using Census Data

Nicole Hatzispirou and Jennifer Kinsella, students

NY Omicron

St. Joseph's College Patchogue, NY 11772

Abstract

The real world problem that we were faced with was that of estimating the size of a population at some future time, t. In order to begin solving this problem we first needed to collect data from the actual population in order to analyze how the population has changed with respect to time. The relationship between population and time can be represented by the Malthusian model $\frac{dP}{dt} = kP$, $P(0) = P_0$, where the rate of change of population with respect to time is directly proportional to the size of the population. Here, the constant of proportionality, k, is called the growth rate. To begin our mathematical analysis, we used this equation as our starting point to analyze the relationship between the size of the population and how quickly it grows. We then continued to analyze the data and apply various mathematical analysis techniques until we came to a model that closely resembled that of the actual population from which we collected our data. Finally, we applied these mathematical results to re-analyze our original problem and to come to some conclusion.

1. Introduction

Have you ever thought about all the people within the world, taken the time to consider the rate at which the population grows, or wondered when the world would reach its maximum capacity? After having posed these questions, we decided that we would analyze population growth and try to estimate the population at some future time. When performing our calculations, we did so for three different geographical areas. In order to solve this problem, we started with a general analysis of the world population,

and then decided to take a look at the United States. We then focused on New York State to make the analysis more specific and personal.

When creating a mathematical model there are a number of different models to choose from such as discrete versus continuous and stochastic versus deterministic [7]. First, let's take a look at discrete models versus continuous models. Both discrete and continuous models change over the course of time. However, in discrete models the variables within are also discrete which means they have distinct values, whereas in a continuous model the variables are also continuous meaning they can take on more than one value. Now, let's look at stochastic models versus deterministic models. A stochastic model involves randomness and variables can be represented by probability distributions, whereas in a deterministic model variables can be represented by unique values that can be determined by certain parameters that are set within the model.

2. Malthusian Law

In order to examine the population, we had to first gather all the actual data that has been recorded to date. This data was made possible through the records of the U.S. Census that is taken every 10 years. "The official U.S. Census is described in Article 1, Section 2 of the Constitution of the United States. It calls for an actual enumeration of the people every ten years, to be used for apportionment of seats in the House of Representatives among the States" [4]. For the United States as well as for New York, we were able to trace the actual data records back to the first census, which was taken in 1790. The world population was a little bit more difficult to trace that far back, since an actual count of the population was not possible. The first record for the world that we were able to obtain was that of 1950. We were able to collect yearly data from that point forward. The actual population data that we collected is shown in the following tables [4]. Table 1 shows the data that was collected for the World population while Table 2 and Table 3 show the United States and New York respectively.

We began to analyze our data and realized that the easiest model to start with was that of exponential growth. We stated before that the relationship between population and time could be represented by $\frac{dP}{dt} = kP$, $P(0) = P_0$, [2]. Separating variables in the differential equation and integrating yields $\ln P = kt + C$. Applying the initial condition then gives

$$P\left(t\right) = P_0 e^{kt}$$

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| World Population (in billions) | | | | | |
|--------------------------------|---------------|--|------|---------------|--|
| Ycar | Population | | Year | Population | |
| 1950 | 2,555,974,605 | | 1976 | 4,160,126,123 | |
| 1951 | 2,593,780,614 | | 1977 | 4,231,780,688 | |
| 1952 | 2,635,880,316 | | 1978 | 4,303,286,722 | |
| 1953 | 2,681,233,385 | | 1979 | 4,377,519,906 | |
| 1954 | 2,729,328,845 | | 1980 | 4,452,451,405 | |
| 1955 | 2,780,922,284 | | 1981 | 4,528,687,972 | |
| 1956 | 2,834,077,239 | | 1982 | 4,608,415,507 | |
| 1957 | 2,890,110,490 | | 1983 | 4,689,947,648 | |
| 1958 | 2,946,837,071 | | 1984 | 4,770,060,862 | |
| 1959 | 2,999,388,662 | | 1985 | 4,851,527,647 | |
| 1960 | 3,041,695,967 | | 1986 | 4,935,195,956 | |
| 1961 | 3,082,699,160 | | 1987 | 5,021,161,729 | |
| 1962 | 3,138,919,797 | | 1988 | 5,107,795,874 | |
| 1963 | 3,208,674,455 | | 1989 | 5,194,436,716 | |
| 1964 | 3,280,047,437 | | 1990 | 5,282,213,440 | |
| 1965 | 3,349,284,271 | | 1991 | 5,365,510,011 | |
| 1966 | 3,419,724,865 | | 1992 | 5,449,733,223 | |
| 1967 | 3,489,675,788 | | 1993 | 5,531,904,448 | |
| 1968 | 3,561,725,235 | | 1994 | 5,612,766,764 | |
| 1969 | 3,636,562,333 | | 1995 | 5,693,771,068 | |
| 1970 | 3,711,956,979 | | 1996 | 5,774,308,279 | |
| 1971 | 3,789,615,854 | | 1997 | 5,853,889,792 | |
| 1972 | 3,865,965,428 | | 1998 | 5,932,329,190 | |
| 1973 | 3,941,800,091 | | 1999 | 6,009,653,180 | |
| 1974 | 1,016,420,950 | | 2000 | 6,085,976,743 | |
| 1975 | 4,089,019,750 | | | | |

| United States Population (in millions) | | | | | | |
|--|--|------|--|--|--|--|
| Year | Population | | Year | Population | | |
| 1790 | 3,928,214 | | 1900 | 75,994,575 | | |
| 1800 | 5,308,483 | | 1910 | 91,972,266 | | |
| 1810 | 7,239,881 | | 1920 | 105,710,620 | | |
| 1820 | 9,633,822 | 14 | 1930 | 122,776,046 | | |
| 1830 | 12,866,020 | | 1940 | 131,669,275 | | |
| 1840 | 17,069,453 | - 10 | 1950 | 150,697,361 | | |
| 1850 | 23,191,876 | | 1960 | 179,323,175 | | |
| 1860 | 31,443,321 | | 1970 | 203,302,031 | | |
| 1870 | 38,558,371 | | 1980 | 226,542,199 | | |
| 1880 | 50,155,783 | 1 | 1990 | 248,709,873 | | |
| 1890 | 63,947,714 | | 2000 | 281,421,906 | | |
| | Та | bl | e 2 | | | |
| Ne | w York Popu | ilat | tion (in | millions) | | |
| Year | Population | | Year | Population | | |
| 1790 | 340,120 | | 1900 | 7,268,894 | | |
| 1800 | 589,051 | | 1910 | 9 113 614 | | |
| 1810 | | | | 2,112,014 | | |
| | 959,049 | | 1920 | 10,385,227 | | |
| 1820 | 959,049 1,372,812 | | 1920 1930 | 10,385,227 | | |
| 1820 1830 | 959,049 1,372,812 1,918,008 | | 1920 1930 1940 | 10,385,227 12,588,066 13,479,142 | | |
| 1820 1830 1840 | 959,049 1,372,812 1,918,008 2,428,921 | | 1920 1930 1940 1950 | 10,385,227 12,588,066 13,479,142 14,830,192 | | |
| 1820 1830 1840 1850 | 959,049 1,372,812 1,918,008 2,428,921 3,097,394 | | 1920 1930 1940 1950 1960 | 10,385,227 12,588,066 13,479,142 14,830,192 16,782,304 | | |
| 1820 1830 1840 1850 1860 | 959,049 1,372,812 1,918,008 2,428,921 3,097,394 3,880,735 | | 1920 1930 1940 1950 1960 1970 | 10,385,227 12,588,066 13,479,142 14,830,192 16,782,304 18,242,584 | | |
| 1820 1830 1840 1850 1860 1860 | 959,049 1,372,812 1,918,008 2,428,921 3,097,394 3,880,735 4,382,759 | | 1920 1930 1940 1950 1960 1970 1980 | 10,385,227 12,588,066 13,479,142 14,830,192 16,782,304 18,242,584 17,558,165 | | |
| 1820 1830 1840 1850 1860 1870 1880 | 959,049 1,372,812 1,918,008 2,428,921 3,097,394 3,880,735 4,382,759 5,082,871 | | 1920 1930 1940 1950 1960 1970 1980 1990 | 10,385,227 12,588,066 13,479,142 14,830,192 16,782,304 18,242,584 17,558,165 17,990,455 | | |

Table 3

In the Malthusian model, we assumed that the supplies are unlimited. Supplies include but are not limited to food, resources, and land. The growth rate is the difference between the birth rate and death rate. The birth rate and the death rate of the population would remain constant within this model.

2.1 World Data

Once we arrived at the equation $P(t) = P_0 e^{kt}$, we began our analysis for each of the regions that we would be studying. To begin, we analyzed the world data under this mathematical approach. With this equation, and our collected data, we were able to solve for a value of P_0 (starting population) and that of k (growth rate).

Letting P(t) represent the world population in billions, Table 1 gives $P_0 = 2.556$, with t = 0 corresponding to the year 1950. Using the value P(3) = 2.681 from Table 1 gives the equation $2.681 = 2.556e^{3k}$. Solving for k gives a growth rate of k = 0.01592. With this data we evaluated our equation for various times (t) in order to have data to plot. We then graphed

the solutions and compared this graph to that of the original which you will see in Figure 1. We noticed that since we didn't limit our resources, the graph had a larger growth rate than that of our actual data.



2.2 U.S. Data

Next we analyzed the United States using the same procedure, this time with P(t) representing the population in millions. The population data for the years 1790 and 1800 from Table 2 give the equation $5.308 = 3.928e^{10k}$, and a growth rate of k = 0.0301. The graph resembled the actual population curve for small t. However, since limitations to supplies were not considered, we knew that we would have to make adjustments to this model for large t. The Malthusian model had a much larger growth rate, which we had expected.

2.3 New York Data

Finally, we repeated this process one last time for New York. With population in millions, the data from Table 3 for the years 1790 and 1800 give the equation $0.589 = 0.340e^{10k}$, corresponding to a growth rate of k = 0.0549. The values predicted by the Malthusian model and shown in Figure 3 were so much larger than the actual values that the actual data weren't displayed in the graph.







Figure 3

3. Logistic Law

Our next approach was to slightly adjust the model that we were currently using in hopes of getting closer to the actual data that we had gathered [5]. The logistic model was our second approach to the problem. Specifically, our model is

$$\frac{dP}{dt} = \left[\beta\left(t\right) - \delta_{0}\right]P\left(t\right).$$

Here, $\beta(t)$ represents the birth rate, which is the rate of increase for the unit of time of population growth, and $\delta(t) = \delta_0$ represents the death rate, which will remain constant. Setting $\beta(t) = \beta_0 - kP(t)$, we obtain

$$\frac{dP}{dt} = [\beta_0 - \delta_0 - kP(t)] P(t)$$
$$= k \left[\frac{\beta_0 - \delta_0}{k} - P(t) \right] P(t)$$
$$= k (M - P) P,$$

where k is the growth rate and M is the maximum capacity. As before, we solve the differntial equation by separating variables and integrating, this time obtaining

$$\frac{1}{M}\left[\ln P - \ln\left(M - P\right)\right] = kt + C.$$

We combine the logarithms and exponentiate to rewrite the equation in the form

$$\frac{P}{M-P} = \beta e^{kMt}$$

and then solve for P:

$$P\left(t\right) = \frac{M\beta e^{kMt}}{1 + \beta e^{kMt}}$$

Applying the initial condition P(0) = Pl0, produces $P_0 = \frac{M\beta}{1+\beta}$, which we can rewrite as $\beta = \frac{P_0}{M-P_0}$. Substituting this in the equation for P(t), we arrive at a final equation with two parameters, M and k:

$$P(t) = \frac{MP_0}{P_0 + (M - P_0) e^{-kMt}}$$

,

3.1 World Data

For the analysis of the world population under the logistic approach, we apply the data from Table 1 corresponding to the years 1950, 1975, and 2000. We let P(t) represent the population in billions and let t = 0 represent the year 1950. Then $P_0 = 2.556$, and we have the system

$$4.089 = \frac{2.556M}{2.556 + (M - 2.556)x}$$
$$6.086 = \frac{2.556M}{2.556 + (M - 2.556)x^2}$$

with

$$x = e^{-25kM}.$$

The solution to the system is M = 14.842 and x = 0.5471, so that $e^{-25(14.842)k} = 0.5471$, and k = 0.001625. Figure 4 shows the result compared to the original data.



3.2 U.S. Data

For the United States population data, using the values from Table 2 for the population in the years 1790, 1820, and 1850, the same analysis yields M = 444, x = 0.402, and k = 0.0000683. The resulting graph is shown in Figure 5.



3.3 New York Data

For New York, the populations from Table 3 for the years 1820, 1870, and 1920 give M = 20.37, x = 0.264, and k = 0.00131. Figure 6 shows the result.



4. Least Squares Logistic Model

With our last approach we realized that although our assumption under the logistic model was fairly close to that of our original data, we were still not satisfied. We decided to apply the method of least squares to our data [1]. This method is used to find the curve that most nearly fits the data. It minimizes the sum of the squares of the differences between the actual and the predicted values [6]. To implement least squares for the logistic model of population growth, we set a = kM and b = -k in the differential equation, obtaining

$$\frac{dP}{dt} = aP + bP^2,$$
$$\frac{P'}{P} = a + bP.$$

which we rewrite as

This is the equation of a straight line with independent variable
$$P$$
 and dependent variable $\frac{P'}{P}$. Letting t_i , $i = 1, 2, ...$, be the times at which we have population data, and P_i the populations at these times, we approximate the $P'(t_i)$ as a difference quotient:

$$P'(t_i) \approx \frac{P(t_{i+1}) - P(t_{i-1})}{t_{i+1} - t_{i-1}}.$$

We define

$$Q_{i} = \left[\frac{P(t_{i+1}) - P(t_{i-1})}{t_{i+1} - t_{i-1}}\right] / P_{i},$$

$$d_{i} = Q_{i} - (a + bP_{i}),$$

and

$$f(a,b) = \sum_{i=1}^{n} [Q_i - (a+bP_i)]^2.$$

We set equal to zero the partial derivatives of f(a, b) with respect to a and b. We then solve the resulting system for a and b to get

$$a = \frac{\sum_{i=1}^{n} P_i^2 \sum_{i=1}^{n} Q_i - \sum_{i=1}^{n} P_i \sum_{i=1}^{n} P_i Q_i}{n \sum_{i=1}^{n} P_i^2 - \left(\sum_{i=1}^{n} P_i\right)^2}$$

and

$$b = \frac{n \sum_{i=1}^{n} P_i Q_i - \sum_{i=1}^{n} P_i \sum_{i=1}^{n} Q_i}{n \sum_{i=1}^{n} P_i^2 - \left(\sum_{i=1}^{n} P_i\right)^2}.$$

We use these values to determine M and k. The resulting values for the population of the world, the U.S., and New York are shown in the table and in the graphs that follow.

| | a | k = -b | M |
|----------|------------|---------------|----------|
| World | 0.0228895 | 0.00130327 | 17.5631 |
| U.S. | 0.02860469 | 0.00009130542 | 313.2858 |
| New York | 0.02759970 | 0.001320828 | 20.8958 |





5. Comparison of Models

After applying the three different methods to our data, we realized that the model that appeared to be the closest to that of our actual data was the Gauss least squares method that we applied to the logistic model.

5.1 World Data

With the legend as clarification of which graph represents the given model in Figure 10, we can clearly notice that the logistic model is fairly close to that of our original data which is represented with the asterisk. However, the application of the least squares method to the logistic model is an even closer representation of our data. Since the graphs seemed to be fairly close, we decided to perform a correlation analysis of our data to see exactly how much better our models were getting. Using the correlation function in Excel, we came up with the following correlations. Under the Malthusian model for the world we had a correlation of 0.99851366. Under the logistic model we had a correlation of 0.99974441, and finally under the application of the least square method to our logistic model we arrived at a correlation of 0.99979674. Although it was not as evident in our graphical comparison, the correlations reassured us that as we progressed through our models we were able to get a more accurate representation of the world population. Next we will examine the graphs for the United States.



Figure 10

5.2 U.S. Data

By looking at these graphs in Figure 11 we can clearly notice that the logistic model which is represented by, the circle points, is fairly close to that of our original data, which is represented with the asterisk. However, the application of the least squares method to the logistic model, the square points, is a much closer representation of our data. The curve is based on a best-fit approach to match our data and it does so accordingly. Looking at the graphical comparisons of methods applied to the United States data, the differences are much clearer as to which model best represents our actual data. We once again entered our results into the Excel program to analyze the correlation of each model. Under the Malthusian model for the United States we had a correlation of 0.92172903; under the logistic model we had a correlation of 0.99489831; and finally under the application of 0.99511813. Although the correlations are fairly close, we can still see improvement as we progressed through our models.



Figure 11

5.3 New York Data

For New York, since our Malthusian model was so far off, we wouldn't be able to see our other approaches if graphed on the same set of axes. For this reason we decided to leave that graph out of our comparison in order to be able to view our other models. Our logistic approach is a very similar curve to that of our actual data. However, once again the application of the least squares method to the logistic approach results in a much more accurate representation. It is quite evident in the New York comparison graph shown in Figure 12 which model is best suited to that of our data, but once again we took a look at the correlation between our actual data and that of our models. For the Malthusian model of New York, our correlation was 0.65726132. It made sense that the correlation was much lower than our other Malthusian models since the graph wouldn't even compare to that of our actual data. As we got more specific in population area the differences in our models became clearer. Under the logistic model our correlation was 0.98030253, and finally for the application of the least square method to our logistic approach we had a correlation of 0.99681346. As we had expected, our correlations improved as we progressed through our models.



6. Prediction of Carrying Capacity

After analyzing all of our graphs and their comparative correlations, it is evident that the application of the Gauss least square method to solving the logistic model resulted in the closest representation of the actual data. Therefore, it is with this approach that we revisited the original problem. Under this method we try to predict the future population at some given time t and try to discover the carrying capacity of these geographical areas. The carrying capacity can be defined as the limiting population where $\lim_{t\to\infty} P(t) = \frac{a}{b}.$

6.1 World Data

We evaluate our least squares logistic model of world population (in billions) at 100 year intervals. The results are shown in the table. The values of t represent years elapsed since 1950.

| t | 100 | 200 | 300 | 400 | 500 |
|-------------------|-------|-------|-------|-------|-------|
| $P\left(t\right)$ | 11.01 | 16.56 | 17.46 | 17.55 | 17.56 |

The model predicts a carrying capacity of M = 17.56 billion; from the table, we estimate that the world population will be close to that value by the year 2450.

6.2 U.S. Data

The least squares logistic model of U. S. population (in millions) predicts the values shown in the table below. The values of t represent years elapsed since 1790.

| t | 300 | 400 | 500 | 600 |
|------|-------|-------|-------|-------|
| P(t) | 308.7 | 313.0 | 313.3 | 313.3 |

The model predicts a carrying capacity of M = 313.3 million; the table suggests the population will be near capacity by 2390.

6.3 New York Data

The least squares logistic model for the population of New York (in millions) predicts the values shown below, with t measuring years elapsed since 1790.

| t | 200 | 300 | 400 | 500 | 600 |
|------|------|------|------|------|------|
| P(t) | 19.8 | 20.8 | 20.9 | 20.9 | 20.9 |

The model predicts a carrying capacity of M = 20.9 million; the table suggests the population will be close to capacity by 2190.

7. Conclusion

We believe that we were successful in determining a method to analyze population growth in order to make predictions. After applying multiple calculations and taking into consideration various variables, we were able to arrive at an equation that closely represented the actual population data that we had collected. Having accomplished the task of finding an equation, we were able to then look back at our original problem and predict the population at some future time. We then decided to take it a step further and see when the population would approach some limit that we could assume to be maximum capacity. Knowing that an area will eventually reach a maximum capacity, we evaluated until our predictions approached a value where the growth rate became minimal and would soon decrease. For future analysis, we would like to analyze our resources and explore their availability in comparison to our growing population.

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Where Math Meets Music

Tamela (Bolen) Lake, student

KS Delta

Washburn University Topeka, KS 66621

Presented at the 2008 North Central Regional Convention

Abstract

Most people know that there are many connections between math and music but do not know what these connections are. In this paper we will discuss basic music theory, application of this theory, graphs of sound waves, and Fourier theory in music. The culmination of these connections will be seen in the reconstruction of sound waves using a discrete set of data points.

1. Introduction

Walking down the street, riding in a car, shopping in a store, or sitting in a room, one will most likely hear music; music is almost everywhere. Most people simply enjoy music for its sound, but some begin to wonder, what is it that makes music? What makes notes sound good together? What makes a sound? The answer to each of these questions is rooted in mathematics. Mathematics is the foundation of basic music theory and can be used to describe the sound made by musical instruments.

2. Sequences and Series in Music

Before a person can delve into the vast mathematics involved in music, one must first understand a few basic connections between math and music theory. Musical notes come from a certain pitch that depends on frequency measured in Hertz (Hz) [4, p. 28]. A higher frequency indicates a shorter wave length and thus a higher pitch [4, p. 29]. But, a musical sound is usually more than a single frequency. Musical sounds come from many different frequencies; in particular frequencies called *harmonics* [4, p. 32].

To understand the harmonics involved in music, we consider a string with fixed ends [4, p. 46]. If the string is plucked in the middle, the sound made by the vibration is called the fundamental pitch. If we divide the length of the string into two equal parts by fixing it in the center and then plucking it in the middle of a section (see Figure 1), the sound that is made by that vibration is the second harmonic of the fundamental pitch [2, p. 22].



Figure 1: Vibrating String

We can continue this process by dividing the string into thirds, fourths, and so on to produce the corresponding harmonics in the *harmonic series*. This is similar to the mathematical harmonic series, which is given by $\sum_{i=1}^{\infty} 1$

 $\sum_{k=1}^{\infty} \frac{1}{k}$, since the notes in the musical harmonic series are produced by di-

viding the string into k equal pieces, each one-kth the length of the original string.

Every fundamental pitch produces a unique harmonic series. However, there is a consistent pattern in the frequencies of each harmonic series. To create the second harmonic, we divided the length of the string in half. This produces a sound that has twice the frequency of the fundamental pitch. The third harmonic has a frequency three times that of the fundamental pitch. This process continues for the entire harmonic series. Thus, the frequencies of the notes in a harmonic series form a mathematical *arithmetic sequence*; yet another connection between math and music. That is, if the frequency of the fundamental pitch is f, the frequencies of the harmonics of that pitch are given by the terms of the sequence $\{kf\}_{k=1}^{\infty} = \{f, 2f, 3f, \ldots\}.$

The second harmonic of any pitch will produce a sound with a frequency twice that of the first pitch. In ratio format this is commonly written as 2:1 [4, p. 40]. In music theory, a pitch that has twice the frequency of the fundamental is said to be one *octave* higher than the first pitch. No matter what pitch is used as the fundamental, pitches that are an octave apart always have a 2:1 ratio of frequencies. Thus, the fourth harmonic of a pitch is two octaves above the fundamental pitch and one octave above the second harmonic. Similarly, the eighth harmonic is an octave above the fourth harmonic. In general, a pitch k octaves above a pitch with frequency f will have frequency $f \cdot 2^k$ [5, p. 31]. This means that we have yet another mathematical sequence occurring in music theory, namely the geometric sequence $\{2^k\}_{k=0}^{\infty} = \{1, 2, 4, 8, ...\}$.

3. Tuning

The harmonic series is the basis of what makes notes sound good or bad together. In music this is called *consonance* and *dissonance* [4, p. 35]. Consider the pitch A with a frequency of 440 Hz. The third harmonic of the pitch has frequency 3(440)=1320 Hz. Since these pitches are in the same harmonic series, when played together, they would sound consonant or "good" together [4, p. 48][4, 48]. But, if pitches with frequencies 440 Hz and 1290 Hz were played together, this would sound dissonant or "bad" since they are not in the same harmonic series.

The concepts of consonance and dissonance lead us to tuning, which is the basis of scales in music. In modern day Western music we use a chromatic scale, which is a scale with twelve pitches [5, p. 32]. The chromatic scale can be represented with a geometric model called the circle of fifths shown in Figure 2 [2, p. 164].

Notes that are a *fifth* apart have frequencies whose ratios are 2:3. For example, since the second harmonic has twice the frequency of the fundamental pitch, and the third harmonic has three times the frequency of the fundamental, the ratio of the frequencies between these two pitches is 2:3 and therefore the second and third harmonics are a fifth apart.



Figure 2: Circle of Fifths

To create the circle of fifths as shown in Figure 2, begin with a pitch and ascend by a fifth at each stage. Since a fifth is a ratio of 2:3, to find the fifth, we take the starting frequency and multiply by 1.5. Say, for example the first pitch is A with a frequency 440 Hz. Then the next perfect fifth has frequency of 440(1.5) = 660 Hz which is E. Continuing in this manner, we find the note a fifth above E is B, followed by F# (also called Gb), C#/Db, G#/Ab, D#/Eb, A#/Bb, F, C, G, D, and back to A [4, p. 61]. Hence, the circle of fifths produces every pitch within the chromatic scale. Since it is circular, one can start at any note and go around the circle forwards or backwards.

In light of this discussion, it seems that a reasonable way to tune a piano would be to start with a pitch and tune each fifth perfectly until you to obtain a pitch an octave above the original. However, tuning in intervals of fifths has been a problem in music since the time of Pythagoras [2, p. 163]. To see why, consider again the pitch A with a frequency of 440 Hz. The next perfect fifth is E with a frequency of 440(1.5) = 660Hz. Continuing in this manner, the next perfect fifth (B) would have frequency 660(1.5) = 990 Hz. However, we wish to obtain all the pitches in the octave from 440 Hz to 880 Hz; but, 990 Hz is out of this range. To compensate for this, we divide the frequency by two to lower the pitch an octave, which gives a frequency of 495 Hz. In general the frequency of the next fifth is found by multiplying the previous frequency by 1.5 and then lowering an octave if necessary. Table 1 demonstrates this process for the entire circle of fifths.

| Note | Frequency | Mathematics | | | |
|------------|-----------|--|--|--|--|
| A | 440 | Multiply by 1.5 = 660 | | | |
| E | 660 | Multiply by 1.5 and divide by 2 = 495 | | | |
| В | 495 | Multiply by 1.5 = 742.5 | | | |
| F# | 742.5 | Multiply by 1.5 and divide by 2 = 556.875 | | | |
| C# | 556.875 | Multiply by 1.5 = 835.3125 | | | |
| G# | 835.3125 | Multiply by 1.5 and divide by 2 = 626.4844 | | | |
| E-flat | 626.4844 | Multiply by 1.5 and divide by 2 = 469.8633 | | | |
| B-flat | 469.8633 | Multiply by 1.5 = 704.7949 | | | |
| F | 704.7949 | Multiply by 1.5 and divide by 2 = 528.5962 | | | |
| С | 528.5962 | Multiply by 1.5 = 792.8943 | | | |
| G | 792.8943 | Multiply by 1.5 and divide by 2 = 594.6707 | | | |
| D | 594.6707 | Multiply by 1.5 = 892.0061 | | | |
| A (octave) | 892.0061 | | | | |

Table 1: Circle of Fifths Chart

At the thirteenth stage of the circle of fifths we should obtain a frequency that is twice that of the fundamental pitch since we have completed an octave. However, as shown in Table 1, the final frequency is approximately 892 Hz rather than the desired 880 Hz. This discrepancy occurs because we multiply by 1.5 twelve times and divide by 2 six times to keep the pitches in the desired octave. This is equivalent to multiplying the starting frequency by what is known as the Pythagorean comma, namely $\frac{(1.5)^{12}}{26} \approx 2.0273 \ [2, p. 163].$

With this problem in mind, a tuner must choose between perfectly tuning the fifths or the octaves. The most common solution to this problem is to tune the octaves and use a process called equal-tempering to tune the fifths [5, p. 29]. With equal-tempering, notes within the octave are tuned so that the ratio of the frequencies of two successive notes is constant. Since the chromatic scale has 12 notes, this ratio of frequencies is then $\sqrt[12]{2}$. This results in the fifths having frequencies in ratios of $\left(\frac{\sqrt{2}}{2}\right)^5 \approx 1.335$ rather than 1.5.

As previously discussed, we have already seen a harmonic series and both an arithmetic and geometric sequence involved in music. The equaltempering process leads us to yet another geometric sequence. Namely, the notes on a piano are arranged in a geometric sequence based on their frequencies [4, p. 43]. The first frequency on a piano is 27.5 Hz corresponding to the pitch of A. The next pitch, A#, has a frequency $\sqrt[12]{2}(27.5) \approx$ 29.125 Hz. In general, to obtain the next pitch on the keyboard, one takes the previous pitch and multiplies its frequency by $\sqrt[12]{2}$. Thus, to get the frequency of the *k*th note on the piano, one multiplies the frequency of 27.5 Hz by $(\sqrt[12]{2})^{k-1}$.

4. Graphs of Sounds Waves and the Classroom Based Learning System

To really understand how music works, we need to explore sound waves. Sound waves are longitudinal waves, meaning that the particles vibrate parallel to the way the wave is traveling [4, p. 23]. The sound wave moves through the air creating periods of pressure variations in a periodic motion [8, p. 12]. This motion can be represented with sine curves [8, p. 17].

Simple sine curves represent pure tones. Pure tones are tones that have a constant single frequency with no harmonics [4, p. 29]. Tuning forks vibrate with close to a pure tone, and thus can be used for tuning [8, p. 18]. More complex sounds in music, such as those made by musical instruments, can be broken down into a combination of simple pure tones and their respective sine curves [8, p. 9]. Combining these simple pure tones into complex sounds is what makes the music we hear every day. A characteristic of musical tones is the frequency or number of sound wave cycles that are completed in a given amount of time. The Hertz unit associated with frequency is equivalent to one vibration per second. The human ear can hear a range of 20 to 20,000 Hz [2, p. 13].

Using the Texas Instrument Classroom Based Learning System (CBL), a program was implemented on the TI-84+ Graphing Calculator to create sound waves from actual sound sources [12, p. 103]. A tuning fork was used for the first experiments because it produces a sound close to the pure tone. The data that is recorded by the CBL is a graph of pressure versus time with time along the independent axis and pressure along the dependent axis. The graph shown in Figure 3 is the result of the researcher playing a 512 Hz tuning fork into the CBL system.



Figure 3: Graph of 512 Hz on tuning fork

Notice that the horizontal line at the top designates the amplitude of the pitch. Using the data recorded from the tuning fork, we used the distance on the x-axis between two peaks on the graph to calculate the time to complete one cycle, thus finding the frequency. The amplitude can be found by finding the maximum y-value. These numbers can then be used with the equation $P = a \sin (2\pi \cdot f \cdot t)$ to obtain a sine curve modeling the sound wave. The graph obtained in this manner might not exactly duplicate the sound wave because of a phase shift. The CBL cannot collect data immediately, and thus the graph it produces may be a shift of the graph of the actual sound wave. The phase shift is based on where the graph crosses the time axis.

The graph of a pure sound wave can be modeled by $P = a \sin (2\pi \cdot f \cdot t)$, where P is pressure, a is amplitude, f is frequency, and t is time [12, p. 103]. A pitch with frequency 440 Hz produced by most musical instruments would not be a pure tone, but would incorporate the frequencies of the pure tone and one or more of the pure tone's harmonics. Note that the second harmonic has the equation $P = a_2 \sin (2 \cdot 2\pi \cdot 440 \cdot t)$, the third harmonic has the equation $P = a_3 \sin (3 \cdot 2\pi \cdot 440 \cdot t)$, and so on. To look at the graph of the overall sound wave produced by the instrument, we take the summation of all the harmonics that are involved in the sound. Thus, a non-pure tone, such as the one produced by mu-

sical instruments, can be written as $P = \sum_{n=1}^{k} a_n \sin(n \cdot 2\pi \cdot 440 \cdot t)$. As

with pure tones, when recording a non-pure tone the sound wave recorded may include a phase shift from the actual sound wave. To account for this we use a sinusoidal graph. The equation of a pitch with frequency $\frac{1}{2}$

f is then given as
$$P = \sum_{n=1}^{k} a_n \sin(n \cdot 2\pi \cdot f \cdot t + \phi_n)$$
 or equivalently

$$P = \sum_{n=1}^{k} [a_n \sin(n \cdot 2\pi \cdot f \cdot t) + b_n \cos(n \cdot 2\pi \cdot f \cdot t)].$$

We now have that a sound wave is a trigonometric series [11, p. 395]. Although trigonometric series are infinite, we can model the sound wave series with a finite series because, as previously noted, a human ear can only hear a finite range of frequencies. Thus, we will only need to include a finite number of harmonics. Since we have a trigonometric series, all we need to do is find the coefficients in order to have the graph of a non-pure sound. These coefficients can be found by using Fourier Analysis.

5. Fourier Theory

Now, we must briefly discuss how Fourier Analysis works. If we look at the set $\left\{1, \cos\left(\frac{2\pi nx}{L}\right), \sin\left(\frac{2\pi nx}{L}\right)\right\}_{n \in \mathbb{N}}$ on [0, L], where L is the length of one cycle, we can show that the set is orthogonal, meaning that the integral from zero to L of the product of any two distinct functions from the set will equal zero. Namely,

$$\int_{0}^{L} \sin\left(\frac{2\pi mx}{L}\right) \cdot \sin\left(\frac{2\pi nx}{L}\right) dx = 0 \ (m \neq n),$$

$$\int_{0}^{L} \cos\left(\frac{2\pi mx}{L}\right) \cdot \cos\left(\frac{2\pi nx}{L}\right) dx = 0 \ (m \neq n),$$

$$\int_{0}^{L} \sin\left(\frac{2\pi mx}{L}\right) \cdot \cos\left(\frac{2\pi nx}{L}\right) dx = 0,$$

$$\int_{0}^{L} 1 \cdot \sin\left(\frac{2\pi nx}{L}\right) dx = 0,$$

and

$$\int_0^L 1 \cdot \sin\left(\frac{2\pi nx}{L}\right) \, dx = 0$$

[11, p. 395]. Note that the last two equations can be justified by using a u substitution. The other three integrals all use a similar trigonometric substitution; thus we will only demonstrate one. In what follows we use the identity $\cos A \cos B = \frac{1}{2} [\cos (A - B) + \cos (A + B)].$

$$\int_{0}^{L} \cos\left(\frac{2\pi mx}{L}\right) \cos\left(\frac{2\pi nx}{L}\right) dx$$
$$= \int_{0}^{L} \frac{1}{2} \left[\cos\left(\left(\frac{2\pi mx}{L}\right) - \left(\frac{2\pi nx}{L}\right)\right) + \cos\left(\left(\frac{2\pi mx}{L}\right) + \left(\frac{2\pi nx}{L}\right)\right) \right] dx$$
(1)

$$= \frac{1}{2} \int_{0}^{L} \left(\cos\left(\frac{2\pi (m-n)x}{L}\right) + \cos\left(\frac{2\pi (m+n)x}{L}\right) \right) dx$$

$$= \frac{1}{2} \int_{0}^{L} \cos\left(\frac{2\pi (m-n)x}{L}\right) dx + \frac{1}{2} \int_{0}^{L} \cos\left(\frac{2\pi (m+n)x}{L}\right) dx$$

$$= \frac{L}{\pi (m-n)} \int_{0}^{2\pi (m-n)} \cos u \, du + \frac{L}{\pi (m+n)} \int_{0}^{2\pi (m+n)} \cos v \, dv$$

$$= \frac{L}{\pi (m-n)} \left[\sin (2\pi (m-n)) - \sin 0 \right]$$

$$+ \frac{L}{\pi (m+n)} \left[\sin (2\pi (m+n)) - \sin 0 \right]$$

$$= \frac{L}{\pi (m-n)} (0-0) + \frac{L}{\pi (m+n)} (0-0)$$

$$= 0.$$

Since the set is orthogonal, we can now look at the definition of the Fourier coefficients of a periodic function f(x) with period L. The Fourier coefficients of the function f(x) with respect to the orthogonal system $\left\{1, \cos\left(\frac{2\pi nx}{L}\right), \sin\left(\frac{2\pi nx}{L}\right)\right\}_{n \in \mathbb{N}}$ are given as

$$(L) \quad (L) \quad f_{n \in \mathbb{N}}$$

$$a_0 = \frac{2}{L} \int_0^L f(x) \, dx$$

$$a_n = \frac{2}{L} \int_0^L f(x) \sin\left(\frac{2\pi nx}{L}\right) \, dx,$$

and

$$b_n = \frac{2}{L} \int_0^L f(x) \cos\left(\frac{2\pi nx}{L}\right) dx.$$

In this case, the corresponding Fourier series is

$$\frac{1}{2}a_0 + \sum_{n=1}^{\infty} \left[a_n \sin\left(\frac{2\pi nx}{L}\right) + b_n \cos\left(\frac{2\pi nx}{L}\right) \right]$$

[7, p. 431]. Remember that in music, the series can be modeled with a finite series because of the limitations of the human ear.

Since the sound wave is a periodic trigonometric series as previously discussed, Lebesgue showed that the coefficients of the sine and cosine functions in the sound wave are exactly the corresponding Fourier coefficients [11, p. 400]. This means that if we can find the Fourier coefficients of the sound wave, then we will be able to know the entire function for the

sound wave. Using the data points from the previous section, we can get a basic idea of how Fourier Theory is used. The result is not exact because the CBL system used is only able to obtain six to seven data points per cycle. In order to really use Fourier Theory, many more data points would be needed.

6. Reproducing Sound Waves from a Clarinet

The researcher then chose to move beyond the tuning fork and record the sound wave of a clarinet. Interestingly, the shape of instruments affects the harmonics that are produced. In particular, cylindrical instruments, such as the clarinet family, play only the odd harmonics [3, p. 463]. When recording the clarinet sound wave, it was assumed that the fundamental frequency was exactly 440 Hz. If the clarinet was a little out of tune, the frequency would be minutely off, thus causing the Fourier series to be slightly different than what was found.

Another problem in using data points is that we do not know the entire function. We are trying to obtain the function by finding its Fourier coefficients, but from the definition of the Fourier coefficients in (1), we need to first know the function in order to find the coefficients. Because of this, the integrals in (1) must be approximated. This was done using Reimann sums.

Using Maple code adapted from [6], we were able to quickly approximate the integrals and graph the Fourier series as compared to the original data points. The following graphs (Figures 4 and 5) show the data points and corresponding Fourier series of the note C with frequency 512 Hz produced by a tuning fork and the note A with a frequency 440 Hz as played by a music professor on his clarinet. The second set of graphs (Figures 6 and 7) extend the data and Fourier series to see how well the approximation fits beyond the first cycle. The coordinates of the data points within the respective first cycles are found in Tables 2 and 3. As is shown, the series is not exactly correct, but with more data points, the approximation would be improved.



tuning fork

Table 3: A-440 Hz on clarinet

Data points for first cycle

7. Conclusion

As can be seen from this paper, music and math tend to go hand in hand, but many musicians do not think about the mathematics of sounds, and many mathematicians do not think about music when working with sequences and series. The researcher was able to learn fascinating information about the connection between math and music. There are many more areas of mathematics in music that could be explored with more time and more resources, and hopefully the researcher will have the opportunity to examine these areas in the future.

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The Problem Corner

Edited by Pat Costello

The Problem Corner invites questions of interest to undergraduate students. As a rule, the solution should not demand any tools beyond calculus and linear algebra. Although new problems are preferred, old ones of particular interest or charm are welcome, provided the source is given. Solutions should accompany problems submitted for publication. Solutions of the following new problems should be submitted on separate sheets before September 1, 2011. Solutions received after this will be considered up to the time when copy is prepared for publication. The solutions received will be published in the Fall 2011 issue of *The Pentagon*. Preference will be given to correct student solutions. Affirmation of student status and school should be included with solutions. New problems and solutions to problems in this issue should be sent to Pat Costello, Department of Mathematics and Statistics, Eastern Kentucky University, 521 Lancaster Avenue, Richmond, KY 40475-3102 (e-mail: pat.costello@eku.edu, fax: (859)-622-3051)

NEW PROBLEMS 669-678

Problem 669. *Proposed by Mohammad Azarian, University of Evansville, Evansville, IN.*

Show that

$$\int_{-1}^{1} \frac{1}{1+e^{2x}} \, dx = 1.$$

Problem 670. *Proposed by Mohammad Azarian, University of Evansville, Evansville, IN.*

Show that for any natural number n,

$$\sum_{k=0}^{n} \frac{1}{\left[k! \, (n-k)!\right]^2} < \left(\frac{2^n}{n!}\right)^2.$$

Problem 671. *Proposed by Jose Luis Diaz-Barrero, Universitat Politecnica de Catalunya, Barcelona, Spain.*

Let ABCD be a trapezoid, with CD parallel to AB, side CD fixed, and AB a segment of constant length. Assume that AD + BC is constant. Describe the locus of the point M at which sides AD and BC meet and the locus of the point O at which the diagonals of the trapezoid meet.

Problem 672. *Proposed by Jose Luis Diaz-Barrero, Universitat Politecnica de Catalunya, Barcelona, Spain.*

Find all positive solutions of the following system of equations:

 $\begin{cases} x_1 + x_2 + x_3 = x_4^2 \\ x_2 + x_3 + x_4 = x_5^2 \\ x_3 + x_4 + x_5 = x_6^2 \\ x_4 + x_5 + x_6 = x_1^2 \\ x_5 + x_6 + x_1 = x_2^2 \\ x_6 + x_1 + x_2 = x_3^2 \end{cases}$

Problem 673. Proposed by Pedro H.O. Pantojz, Natal-RN, Brazil.

Let n, p, x be positive integers. Let $S_{n,p}$ be the set of all possible remainders on division of $x^{10\cdot 2^n}$ by p. Prove that there exists p so that $|S_{1,p}| = |S_{2,p}| = |S_{3,p}| = \cdots$, where |S| represents the number of elements in S.

Problem 674. Proposed by Ovidiu Furdui, Campia Turzii, Cluj, Romania.

Let [x] be the integer part of x and $\{x\}$ the fractional part of x. Find the value of

$$\int_0^1 x \left\{ \frac{1}{x} \right\} \left[\frac{1}{x} \right] dx$$

Problem 675. Proposed by Ovidiu Furdui, Campia Turzii, Cluj, Romania.

Let k be a real number with k > -1. Calculate the double integral

$$\int_0^1 \int_0^1 \frac{x^{k+1}y^k}{x+y} \, dx \, dy$$

Problem 676. *Proposed by Ed Wilson, Eastern Kentucky University, Richmond, KY.*

Triangle ABC is circumscribed by a triangle. The midpoints of the sides of the circumscribing triangle are (5, 10), (1, 2), and (8, 1). Determine the equation of the circle that circumscribes triangle ABC.

Problem 677. Proposed by the editor.

Let $\{a_n\}$ be an integer sequence defined by

 $a_1 = 0, a_2 = 2, a_3 = 5$, and $a_n = a_{n-1} + a_{n-2} - a_{n-3}$ for $n \ge 4$.

Find (with proof) a positive rational number Q so that $a_n \ge Qn - 3$ for all $n \ge 1$ and Q is the largest such rational number.

Problem 678. Proposed by the editor.

An alphametic is a mathematical puzzle in which a set of words is written in the form of an ordinary addition sum and requires that the letters in the puzzle be replaced with decimal digits so that the result is a valid arithmetic sum. Solve the following alphametic in base 14:

| | | W | Ι | L | S | 0 | Ν |
|---|---|---|---|---|---|---|---|
| + | Т | Η | Е | 0 | R | Е | Μ |
| L | А | G | R | А | Ν | G | Е |

SOLUTIONS 649-658

Problem 649. *Proposed by Tuan Le, Fairmont High School, Anaheim, CA.*

Suppose x, y, z are positive real numbers such that $xyz \ge 10 + 6\sqrt{3}$. Prove that

$$\frac{y}{x+y^3+z^2} + \frac{z}{x^2+y+z^3} + \frac{x}{x^3+y^2+z} \le \frac{1}{2}.$$

Solution by the proposer.

Applying the Cauchy-Schwarz inequality to the denominator of the first fraction above, we have

$$(x+y^3+z^2)\left(x+\frac{1}{y}+1\right) \ge (x+y+z)^2$$

After dividing both sides by $x + \frac{1}{y} + 1$, taking reciprocals of both sides, and multiplying both sides by y, we get

$$\frac{y}{x+y^3+z^2} \le \frac{xy+y+1}{(x+y+z)^2}$$

Similarly, $\frac{z}{x^2 + y + z^3} \le \frac{yz + z + 1}{(x + y + z)^2}$ and $\frac{x}{x^3 + y^2 + z} \le \frac{xz + x + 1}{(x + y + z)^2}$. Summing these, we get

$$\frac{y}{x+y^3+z^2} + \frac{z}{x^2+y+z^3} + \frac{x}{x^3+y^2+z} \\ \leq \frac{xy+yz+xz+x+y+z+3}{(x+y+z)^2}.$$

Now it is sufficient to show that the right side is less than 1/2. Setting it less than 1/2 and clearing the denominator, we have

$$2(xy + xz + yz + x + y + z + 3) \le (x + y + z)^{2}.$$

Expanding the right side and cancelling, we get

$$2x + 2y + 2z + 6 \le x^2 + y^2 + z^2,$$

which is equivalent to

$$x^{2} + y^{2} + z^{2} - 2(x + y + z) - 6 \ge 0.$$
 (2)

By the Cauchy-Schwarz inequality, we have $x^2 + y^2 + z^2 \ge \frac{1}{3} (x + y + z)^2$.
Subtracting 2(x + y + z) + 6 from both sides of this, we get

$$x^{2} + y^{2} + z^{2} - 2(x + y + z) - 6 \ge \frac{1}{3}(x + y + z)^{2} - 2(x + y + z) - 6.$$

If we can show that the right side is greater than or equal to 0, then (1) will be true. setting it nonnegative and multiplying by 3, we need to prove $(x + y + z)^2 - 6(x + y + z) - 18 \ge 0$. Factoring, we need to prove $(x + y + z - 3)^2 - 27 \ge 0$. This is equivalent to showing that

$$\left(x+y+z-3-3\sqrt{3}\right)\left(x+y+z-3+3\sqrt{3}\right) \ge 0.$$
 (3)

Applying the arithmetic-geometric mean inequality, we have $x + y + z \ge 3 (xyz)^{1/3} \ge 3 (1 + \sqrt{3})$, with the last inequality following from the assumption that $xyz \ge (1 + \sqrt{3})^3 = 10 + 6\sqrt{3}$. Hence, both factors $(x + y + z - 3 - 3\sqrt{3})$ and $(x + y + z - 3 + 3\sqrt{3})$ are nonnegative in (2). Therefore, we can conclude the original inequality is true. [Editor's note: The inequality is true for x = y = z = 2 which causes xyz = 8. In fact, x = y = z = 1.8 still gives a true inequality and xyz < 6. Thus the bound on xyz can be improved. To what?]

Problem 650. *Proposed by Tuan Le, Fairmont High School, Anaheim, CA.*

Suppose a, b, c are positive real numbers. Prove that

$$\frac{a^2b + b^2c + c^2a}{3(a^3 + b^3 + c^3)} + \frac{a^2 + b^2 + c^2}{ab + bc + ca} \ge \frac{4}{3}.$$

Solution by the proposer (with adjustment by the editor).

We will use the following identities:

$$\frac{a^{2}b + b^{2}c + c^{2}a}{3(a^{3} + b^{3} + c^{3})} - \frac{1}{3} = -\frac{(a-b)^{2}(a+b) + (a-c)(b-c)(b+c)}{3(a^{3} + b^{3} + c^{3})}$$
$$\frac{a^{2} + b^{2} + c^{2}}{ab + bc + ca} - 1 = \frac{(a-b)^{2} + (a-c)(b-c)}{ab + bc + ac}.$$

Without loss of generality, we may assume that $c = \min \{a, b, c\}$. Then $(c-a)(c-b) \ge 0$. Subtracting 4/3 from both sides of the inequality to prove and using the identities above, we need to prove that

$$(a-b)^{2} \left(\frac{1}{ab+bc+ac} - \frac{a+b}{3(a^{3}+b^{3}+c^{3})}\right) + (c-a)(c-b)\left(\frac{1}{ab+bc+ac} - \frac{b+c}{3(a^{3}+b^{3}+c^{3})}\right) \ge 0.$$

It is sufficient to show that

$$\frac{1}{ab+bc+ac} - \frac{a+b}{3(a^3+b^3+c^3)} \ge 0$$

and

$$\frac{1}{ab+bc+ac} - \frac{b+c}{3\left(a^3+b^3+c^3\right)} \geq 0.$$

Clearing the denominators, these inequalities are equivalent to

$$3(a^{3} + b^{3} + c^{3}) - (a+b)(ab+bc+ac) \ge 0$$

and

$$3(a^{3} + b^{3} + c^{3}) - (b + c)(ab + bc + ac) \ge 0.$$

Since $(x - y)^{2} \ge 0$, we have $x^{2} - xy + y^{2} \ge xy$, and thus

$$a^{3} + b^{3} = (a+b) (a^{2} - ab + b^{2}) \ge ab (a+b),$$

$$b^{3} + c^{3} = (b+c) (b^{2} - bc + c^{2}) \ge bc (b+c),$$

and

$$c^{3} + a^{3} = (a+c)\left(a^{2} - ac + c^{2}\right) \ge ac\left(a+c\right).$$

Adding these three inequalities, we get

$$2(a^{3} + b^{3} + c^{3}) - [ab(a + b) + bc(b + c) + ac(a + c)] \ge 0.$$
(1)

But applying the arithmetic-geometric mean inequality to the sum of cubes, we get

$$a^{3} + b^{3} + c^{3} \ge 3abc > 2abc \text{ or } a^{3} + b^{3} + c^{3} - 2abc > 0.$$
 (2)

Adding (1) and (2) gives

$$3(a^{3} + b^{3} + c^{3}) - [(a+b)(ab+bc+ac) + (a+b)c^{2}] \ge 0,$$

nce $(a+b)c^{2} > 0$ we must have

Since
$$(a+b) c^2 > 0$$
, we must have

$$3(a^{3} + b^{3} + c^{3}) - (a + b)(ab + bc + ac) \ge 0.$$

Similarly,

$$3(a^{3} + b^{3} + c^{3}) - (b + c)(ab + bc + ac) \ge 0,$$

and so the original inequality is true.

Problem 651. *Proposed by Jose Luis Diaz-Barrero, Universitat Politecnica de Catalunya, Barcelona, Spain.*

Find all triplets (x, y, z) of real numbers for which

$$\int \frac{4x-y^2-2}{\sqrt{4y-z^2-2}} \sqrt{\frac{4y-z^2-2}{\sqrt{41x+43y+44z}}}$$

is a positive integer, and determine the values.

Solution *by the proposer.*

Since $4x - y^2 - 2$, $4y - z^2 - 2$, and $4z - x^2 - 2$ are indices of roots, then $4x - y^2 - 2 \ge 2$, $4y - z^2 - 2 \ge 2$, and $4z - x^2 - 2$. Adding these yields

$$x^{3} + y^{3} + z^{3} - 4(x + y + z) + 12 \le 0$$

or

$$(x-2)^{2} + (y-2)^{2} + (x-2)^{2} \le 0,$$

which has only x = y = z = 2 as a solution. Substituting these values in the expression, we get

$$\int_{4x-y^2-2}^{4x-y^2-2} \sqrt{\frac{4y-z^2-2}{\sqrt{4z-x^2-2}\sqrt{41x+43y+44z}}} = \sqrt{\sqrt{\sqrt{256}}} = 2,$$

and we are done.

Problem 652. *Proposed by Jose Luis Diaz-Barrero, Universitat Politecnica de Catalunya, Barcelona, Spain.*

Let a, b, c be the lengths of the sides of triangle ABC. Prove that

$$\left(\frac{\sqrt{bc}}{a}\right)\sin A + \left(\frac{\sqrt{ca}}{b}\right)\sin B + \left(\frac{\sqrt{ab}}{c}\right)\sin C \le \frac{3\sqrt{3}}{2}.$$

B)

Solution by Pedro H. O. Pantoja, Natal-RN, Brazil.

By the arithmetic-geometric mean inequality,

$$\left(\frac{2\sqrt{bc}}{a}\right)\sin A \le \left(\frac{b+c}{a}\right)\sin A.$$

Similarly,

$$\left(\frac{2\sqrt{ca}}{b}\right)\sin B \le \left(\frac{c+a}{b}\right)\sin B$$

and

$$\left(\frac{2\sqrt{ab}}{c}\right)\sin C \le \left(\frac{a+b}{c}\right)\sin C.$$

Summing, we get

$$\sum_{\text{cyclic}} \left(\frac{2\sqrt{bc}}{a}\right) \sin A \le \sum_{\text{cyclic}} \left(\frac{b+c}{a}\right) \sin A.$$

By the extended Law of Sines, we have

$$\frac{b+c}{a} = \frac{\sin B + \sin C}{\sin A},$$
$$\frac{c+a}{b} = \frac{\sin C + \sin A}{\sin B},$$

and

$$\frac{a+b}{c} = \frac{\sin A + \sin B}{\sin C}$$

Thus

$$\sum_{\text{cyclic}} \left(\frac{2\sqrt{bc}}{a}\right) \sin A$$

$$\leq (\sin B + \sin C) + (\sin C + \sin A) + (\sin A + \sin A)$$

$$= 2(\sin A + \sin B + \sin C)$$

$$\leq 2 \cdot 3 \sin ((A + B + C) / 3) \text{ by Jensen's inequality}$$

$$= 2 \cdot 3 \sin (60^{\circ})$$

$$= 3\sqrt{3}.$$

Dividing both sides by 2 gives the desired inequality.

Also solved by Scott Brown, Auburn University, Montgomery, AL; and the proposer.

Problem 653. Proposed by Mohammad K. Azarian, University of Evansville, Evansville, IN.

Find the general solution of the recurrence relation

$$\sum_{k=0}^{2010} (2010)^{2011-k} x_{n-k} = 0, n \ge 2010.$$

Solution by the proposer.

First we note that the given recurrence relation in expanded form is $2010^{2011}x_n + 2010^{2010}x_{n-1} + 2010^{2009}x_{n-2} + \dots + 2010x_{n-2010} = 0,$ and the characteristic equation of this recurrence is $2010^{2011}r^{2010} + 2010^{2010}r^{2009} + 2010^{2009}r^{2008} + \dots + 2010^2r + 2010 = 0.$ (1)

Next we divide this equation by 2010, and then we let t = 2010r to obtain

$$t^{2010} + t^{2009} + t^{2008} + \dots + t + 1 = 0.$$
 (2)
Using the fact that

$$t^{2011} - 1 = (t - 1) (t^{2010} + t^{2009} + t^{2008} + \dots + t + 1)$$

the roots of equation (2) will be the 2010 distinct 2011^{th} complex roots of unity other than 1; namely

 $t_k = \cos(2k\pi/2011) + i\sin(2k\pi/2011), k = 1, 2, 3, ..., 2010,$

Then the complex values $r_k = t_k/2010$ are the roots of the characteristic equation (1). Therefore, the general solution of the given recurrence will be

$$x_n = \sum_{k=1}^{2010} C_k (r_k)^n = \sum_{k=1}^{2010} C_k \left(\frac{t_k}{2010}\right)^{y_n}$$
$$= \frac{1}{2010^n} \sum_{k=1}^{2010} C_k (\cos(n\theta_k)) + \sin(n\theta_k)$$

by Demoivre's Theorem, where $\theta_k = 2k\pi/2011$ and C_k are constants that can be determined if the values for $x_0, x_1, ..., x_{2009}$ are given.

Problem 654. *Proposed by Mohammad K. Azarian, University of Evansville, Evansville, IN.*

Find all real roots of the exponential equation

 $e^{9x} - 2e^{8x} + e^{7x} - 29e^{6x} + 87e^{5x} - 87e^{4x} + 29e^{3x} - e^{2x} + 2e^x - 1 = 0.$

Solution by Amanda Goodrick, Slippery Rock University, Slippery Rock, PA.

Clearly x = 0 is a solution, so $(e^x - 1)$ is a factor. After factoring and repeating this argument two more times, we arrive at the factorization

 $(e^{x}-1)^{3} \left(e^{6x}+e^{5x}+e^{4x}-28e^{3x}+e^{2x}+e^{x}+1\right).$

Using the Rational Root Theorem and the fact that e^x is always positive, we find that there are no more rational factors. By Descartes Rule of Signs, there are two or zero remaining factors. We assume the factorization

$$(e^{2x} + Ae^{x} + 1) (e^{4x} + Be^{3x} + Ce^{2x} + De^{x} + 1)$$

= $e^{6x} + e^{5x} + e^{4x} - 28e^{3x} + e^{2x} + e^{x} + 1,$

expand, and match coefficients of like powers of e^x to obtain

$$(e^{2x} - 3e^x + 1) (e^{4x} + 4e^{3x} + 12e^{2x} + 4e^x + 1).$$

Since there are no more sign changes, the expression cannot be factored further. Using the quadratic formula, we arrive at the two remaining real solutions, namely, $\ln\left(\frac{3+\sqrt{5}}{2}\right)$ and $\ln\left(\frac{3-\sqrt{5}}{2}\right)$.

Also solved by G. C. Greubel, Newport News, VA; Oklahoma Alpha, Northeastern State University, Tahlequah, OK; Pedro H. O. Pantoja, Natal-RN, Brazil; and the proposer. Problem 655. Proposed by Ovidiu Furdui, Campia Turzii, Cluj, Romania.

Let f(n) be the function defined by $f(n) = \frac{\ln 2}{2^{k-1}}$ if $2^{k-1} \le n < 2^k$. Prove that

$$\sum_{n=1}^{\infty} \left(\frac{1}{n} - f(n) \right) = \gamma,$$

where γ denotes the Euler-Mascheroni constant.

Solution by the proposer.

We have

$$\sum_{n=1}^{\infty} \left(\frac{1}{n} - f(n)\right) = \sum_{k=1}^{\infty} \left(\sum_{2^{k-1} \le n < 2^k} \left(\frac{1}{n} - f(n)\right)\right)$$
$$= \sum_{k=1}^{\infty} \left(\sum_{2^{k-1} \le n < 2^k} \frac{1}{n} - \sum_{2^{k-1} \le n < 2^k} f(n)\right)$$
$$= \sum_{k=1}^{\infty} \left(\sum_{2^{k-1} \le n < 2^k} \frac{1}{n} - \ln 2\right)$$
$$= \sum_{k=1}^{\infty} \left(\frac{1}{2^{k-1}} + \frac{1}{2^{k-1} + 1} + \dots + \frac{1}{2^k - 1} - \ln 2\right)$$
$$= \gamma,$$

where the last equality follows by calculating the nth partical sum of the preceding series and then using the limit definition of the Euler Mascheroni constant.

Problem 656. Proposed by Ovidiu Furdui, Campia Turzii, Cluj, Romania.

Let $k\geq 2$ be a natural number. Find the sum

$$\sum_{n_1,\dots,n_k \ge 1} (-1)^{n_1 + \dots + n_k} \left(\zeta \left(n_1 + \dots + n_k \right) - 1 \right),$$

where ζ denotes the Riemann zeta function.

Solution by G. C. Greubel, Newport News, VA.

We have

$$\sum_{n_1,\dots,n_k \ge 1} (-1)^{n_1 + \dots + n_k} \left(\zeta \left(n_1 + \dots + n_k \right) - 1 \right)$$

$$= \sum_{n_1,\dots,n_k \ge 1} (-1)^{n_1 + \dots + n_k} \left[\sum_{r=1}^{\infty} \frac{1}{r^{n_1 + \dots + n_k}} - 1 \right]$$

$$= \sum_{n_1,\dots,n_k \ge 1} (-1)^{n_1 + \dots + n_k} \sum_{r=2}^{\infty} \frac{1}{r^{n_1 + \dots + n_k}}$$

$$= \sum_{r=2}^{\infty} \prod_{s=1}^k \left(\sum_{n_s=1}^{\infty} \frac{(-1)^{n_s}}{r^{n_s}} \right)$$

$$= \sum_{r=2}^{\infty} \left(-1 + \frac{1}{1 + 1/r} \right)^k$$

$$= \sum_{r=2}^{\infty} \left(\frac{-1}{r+1} \right)^k$$

$$= (-1)^k \sum_{r=3}^{\infty} \frac{1}{r^k}$$

$$= (-1)^k \left[\zeta \left(k \right) - 1 - \frac{1}{2^k} \right].$$

Also solved by the proposer.

Problem 657. *Proposed by Panagiote Ligouras, Leonardo Da Vinci High School, Noci, Italy.*

Let a, b, c be positive real numbers. Prove that

$$\frac{5c^2 + 11ab}{(a+b)^2} + \frac{5a^2 + 11bc}{(b+c)^2} + \frac{5b^2 + 11ca}{(c+a)^2} \ge 12.$$

Solution *by the proposer.*

The claimed inequality is successively equivalent to

$$\sum_{\text{cyclic}} \frac{(c^2 + ab) + (4c^2 + 10ab)}{(a + b)^2} \ge \frac{24}{2}$$

$$\sum_{\text{cyclic}} \frac{c^2 + ab}{(a + b)^2} + 2\sum_{\text{cyclic}} \frac{2c^2 + 5ab}{(a + b)^2} \ge \frac{3}{2} + 2 \cdot \frac{21}{4}.$$
(1)
We have
$$\sum_{\text{cyclic}} \frac{(a - b)(a - c)}{(b + c)^2} \ge 0, \text{ and Nesbitt's inequality says } \sum_{\text{cyclic}} \frac{a}{b + c} \ge \frac{3}{2}, \text{ or equivalently } \sum_{\text{cyclic}} \frac{a(b + c)}{(b + c)^2} \ge \frac{3}{2}.$$
Summing these two inequalities, we have
$$\sum_{\text{cyclic}} \frac{(a - b)(a - c) + a(b + c)}{(b + c)^2} \ge \frac{3}{2}.$$

$$\sum_{\text{cyclic}} \frac{(a-b)(a-c) + a(b+c)}{(b+c)^2} \ge \frac{3}{2}$$

$$\frac{c^2 + ab}{(a+b)^2} + \frac{a^2 + bc}{(b+c)^2} + \frac{b^2 + ca}{(c+a)^2} \ge \frac{3}{2}.$$
(2)

From Vasile Cirtoaje, Algebraic Inequalities, p. 318, we have

$$\frac{2c^2 + 5ab}{(a+b)^2} + \frac{2a^2 + 5bc}{(b+c)^2} + \frac{2b^2 + 5ca}{(c+a)^2} \ge \frac{21}{4}.$$
 (3)

Substituting (2) and (3) into (1) gives the desired result.

Problem 658. *Proposed by Panagiote Ligouras, Leonardo Da Vinci High School, Noci, Italy.*

Let a, b, c be the sides, m_a, m_b, m_c the medians, h_a, h_b, h_c the heights, l_a, l_b, l_c the angle bisectors and R the circumradius (radius of the circle inside which the triangle can be inscribed) of triangle ABC. Prove that

$$\frac{l_a^2}{h_a}\sqrt{\frac{m_a^2 - h_a l_a}{l_a^2 - h_a^2}} + \frac{l_b^2}{h_b}\sqrt{\frac{m_b^2 - h_b l_b}{l_b^2 - h_b^2}} + \frac{l_c^2}{h_c}\sqrt{\frac{m_c^2 - h_c l_c}{l_c^2 - h_c^2}} \le 6R.$$

Solution by Scott Brown, Auburn University, Montgomery, AL.

According to the solution to problem J136 in *Mathematical Reflections*, Issue 6, p. 10, we have (see http://awesomemath.org/wp-content/ uploads/reflections/2009_5/MR_5_2009_solutions.pdf)

$$\frac{l_a^2}{h_a} \sqrt{\frac{m_a^2 - h_a^2}{l_a^2 - h_a^2}} = 2R,$$

with similar results for sides b and c. Combining these results gives

$$\frac{l_a^2}{h_a}\sqrt{\frac{m_a^2 - h_a^2}{l_a^2 - h_a^2}} + \frac{l_b^2}{h_b}\sqrt{\frac{m_b^2 - h_b^2}{l_b^2 - h_b^2}} + \frac{l_c^2}{h_c}\sqrt{\frac{m_c^2 - h_c^2}{l_c^2 - h_c^2}} = 6R.$$
 (1)

We can easily show that

$$\frac{l_a^2}{h_a} \sqrt{\frac{m_a^2 - h_a l_a}{l_a^2 - h_a^2}} \le \frac{l_a^2}{h_a} \sqrt{\frac{m_a^2 - h_a^2}{l_a^2 - h_a^2}}$$

by simplifying to $h_a \leq l_a$, Similar results hold for b and c. Combining these results and applying equality (1), we have

$$\frac{l_a^2}{h_a}\sqrt{\frac{m_a^2 - h_a l_a}{l_a^2 - h_a^2}} + \frac{l_b^2}{h_b}\sqrt{\frac{m_b^2 - h_b l_b}{l_b^2 - h_b^2}} + \frac{l_c^2}{h_c}\sqrt{\frac{m_c^2 - h_c l_c}{l_c^2 - h_c^2}} \le 6R,$$

which is the desired inequality.

Also solved by the proposer.

Kappa Mu Epsilon News

Edited by Peter Skoner, Historian

Updated information as of October 2010

Send news of chapter activities and other noteworthy KME events to

Peter Skoner, KME Historian Saint Francis University 117 Evergreen Drive 313 Scotus Hall Loretto, PA 15940 or to pskoner@francis.edu

Chapter News

AL Alpha – Athens State University

Chapter President – Melisa Dutton; 240 Current members; 21 New Members

Other Spring 2010 Officers: Carl Kuby, Vice President; Shannon Harwell, Secretary; and Patricia Glaze, Corresponding Secretary and Faculty Sponsor

The Alabama Alpha Chapter at Athens State University has been busy. Our students have participated with the Math and Computer Science (MACS) Club for two events: During the SGA-sponsored "Welcome Back Week" we helped promote membership in MACS. We also assisted MACS during The Old Time Fiddler's Convention by selling smoked BBQ ribs to raise money for charities.

New Initiates - Whitney Renee Angus, Melisa Stevens Dutton, Mary Katelyn Graves, Joshua Scott Hamilton, Kimberly Haney, Shannon Banks Harwell, Brian Douglas Hechler, Joshua Daniel Helton, Haley Jordan Hensley, Jeremy Allen Holloway, Christina Rae Brunson Kennedy, Jennifer Locklear, Lara Malone, Dr. Ronald L. Merritt, Jr., Madeleine Miller, Jillian M. Nelson, Vincent Nuckols, Kim Nguyen Pierce, Jerrica Ashley Simpson, Kristin Nicole Timlin, and Eric Wade Vest.

AL Gamma – University of Montevallo

John David Herron, Corresponding Secretary

New Initiates - Lynsey Cargile, Heather Hardeman, Ashleigh Jones, Karly Miller, and Jordan Palmer.

AL Zeta – Birmingham Southern College

Chapter President – Xinyan Yan; 28 Current Members; 23 New Members Other Spring 2010 Officers: Loree Killebrew, Vice President; Michael Graham, Secretary and Treasurer; Mary Jane Turner, Corresponding Secretary; and Dr. Bernadette Mullins, Faculty Sponsor

On March 31, the spring Kappa Mu Epsilon colloquium featured Dr. Karli Morris of the University of Montevallo who spoke to a packed crowd about "Trace Forms of Abelian Extensions of Number Fields."AL Zeta inducted 23 new members on April 15, 2010.

New Initiates - Courtney Alexander, John Bahakel, Steven Carter, Jacob Conner, Ryan Creel, Christine Denning, Carleson Dozier, Stephanie Elliott, Kristen Farr, David Flatt, Emily Fredericksen, Tianran Geng, Stephanie Gossett, Xuanjianai Han, Jeralyn Jersey, Doo Kyung Kim, Brittany Laeger, Jessica Mayne, Trippman Otis, Kaitlynn Roark, Amy Clare Schumacher, Andrew Stein, and Rebecca Terry.

AL Eta - University of West Alabama

Hazel Truelove, Corresponding Secretary

New Initiates - Kristen Barton, Genevieve Baughman, Jillie Brokenshaw, Emillie Conway, Bradley Cook, Kristy Crews, Katie Ford, David Hendrix, Younbae Jun, Daniel Lanterman, Audra Oliver, Jay Smith, Rachel Spurgin, and Larry Weatherly.

AL Theta – Jacksonville State University

Dr. David W. Dempsey, Corresponding Secretary

New Initiates - Michelle Temitayo Anike Amosu, Korey Bentley, Timothy Daniel Bowden, Valarie Ann Boyd, Eric Glenn Brown, Andres F. Camacho, Melissa Diane Camp, David C. Chaney, Jason D. Cleveland, Tara L. Cook, David W. Dempsey, Leah Julann Dennis, Jeffrey J. Dodd, Amy P. Franklin, Tyler Alexander Gable, Christina Rachael Ginn, Brandy Justine Greenleaf, Katie Diann Henson, Chad L. Horton, Jordyn N. Houser, Sunde M. Jones, Ashley L. Jordan, Oxana Petrovna Katalevskaya, James Frederick Kelley, Sherry B. Kennedy, Rhonda Y. Kilgo, Jaedeok Kim, Youngmi Kim, Cain Eric Kirk, Martha Knight, Jayne Anne Lampley, Thomas E. Leathrum, Anna Welsh Miller, Catrina Dee Mize, Kristie L. Osborne, Lindsey M. Osborne, Jimmy Dean Roebuck, III, Kristin Diane Shirey, Jamie K. Shirley, Jessica Victoria Silvia, Kimberly Page Trantham, Amanda Carol Webster, and Audria Adamson White.

CA Delta - California State Polytechnic University Pomona

Patricia Hale, Corresponding Secretary

New Initiates - Robert Beck, Hector Chavez, Morgan Cole, Miguel Cordova, An Do, Amy Franklin, Talena Garman, Jennifer Hall, Amber Larkins, Nicholas Laurenti, Jessica Mattock, Michael Mayer, Anthony Medina, Omar Mendez, Antonio Ochoa, Jordan Tousignant, Omar Vergara, Ka Wong, Karen Wood, and Shubo Wu.

CA Zeta – Simpson University

Chapter President – Nguyen Tran; 7 Current Members Isaiah Lankham, Corresponding Secretary

While the Chapter had no new initiates during the 2009-2010 academic year (having been installed during Spring 2009), the following activities were co-sponsored with the Simpson University Mathematics Department– Simpson University Mathematics Department Seminar, February 19, 2010, Speaker: Thomas Mattman, Professor of Mathematics, Cal. State University, Chico, CA, Topic: How to untie a knot (and become ruler of the world); and Simpson University Mathematics Department Seminar, March 12, 2010, Speaker: Paul Stonehouse, Assistant Professor of Outdoor Ed., Simpson University, Topic: The Mathematics of Orienteering.

CO Beta - Colorado School of Mines

Chapter President - David Lipp; 38 Current Members; 28 New Members Other Spring 2010 Officers: Sarah Valovcin, Vice President; Courtney Rohde, Secretary; Tyler Rust, Treasurer; and Terry Bridgman, Corresponding Secretary

We successfully hosted our first (of hopefully, many) Pi-Mile Fun Run.

CO Gamma – Fort Lewis College

Erich McAlister, Corresponding Secretary

New Initiates - Derek Banallie, Vanessa Benally, Shane Brady, Justin Hahn, Alexander Lalire, Kristara Lee, Mary Rose Paiz, Sarah Terrill, and Amber Joy Watkins.

CT Beta – Eastern Connecticut State University

Spring 2010 Officers: Mizan R. Khan, Treasurer; and Christian L. Yankov, Corresponding Secretary

New Initiates - Michael Buckland, Michael Calvo, Emma Cox, Molly Dunn, Andrew Lawton, Michael Masterson, Michael Park, Jessica Pelletier, Mark Satchell, Neal Sherman, and Elizabeth Thibault.

FL Beta – Florida Southern College

Allen Wuertz – Corresponding Secretary

New Initiates - Jill Nicole Dickerson, Terry Earl Jenkins Jr., Sarah D. Moening, Natalia Ruiz, Nhung My Troung, and Danielle Marie Walsh.

FL Gamma – Southeastern University

Dr. Berhane T. Ghaim, Corresponding Secretary

New Initiates – Janet Artis, Jayen Bhakta, Timothy Burnham, Shaina Cannavaro, Louis Caponi, Shearen Fredere, Deborah Hazelbaker, Brittany Hurst, TeaEun Kim, Gary Kimball, Stephen Prosser, David Revell, Todd Schraw, Meaghan Simms, and Samantha Staples.

GA Alpha – University of West Georgia

Scott Sykes, Corresponding Secretary

New Initiate - Timothy Brodeur.

GA Beta – Georgia College and State University

Dr. Laurie Huffman, Corresponding Secretary

New Initiates - Robert Angelucci, Robert Blumenthal, Jessica Broadnax, Marcela Chiorescu, Grayson Davis, Joshua Hollar, James Hyer, Moses Isang, Jeffrey Ivie, Dimitrios Kakavelakis, Brendan Kelly, Chuang Luke, Willibroad Maimo, William McCorkle, Karen Mundschenk, Shannon Pope, Nigel Sanyangore, Andrew Shealy, Nolan Thomson, Matthew Ulm, John Walsh, and Zhouyan Xie.

GA Gamma – Piedmont College

Hans Shmidheiser, Corresponding Secretary

New Initiates – Kimberly Allen, Ashley Rutledge, Zachary Thomaswick, and Emily Woodward.

GA Epsilon – Wesleyan College

Chapter President – Azea Mustafa; 15 Current Members; 15 New Members

Other Spring 2010 Officers: Shreejaya Shrestha, Vice President; Bhumika Thapa, Treasurer; and Dr. Joe Iskra, Corresponding Secretary

We at Wesleyan are very proud to have established the Georgia Epsilon Chapter of KME on March 30, 2010, and thank Dr. Ron Wasserstein for conducting the installation ceremony and giving a most enjoyable talk afterward. While we did not have any activities during the last month of this semester, the formation of the chapter was recognized at Wesleyan's Honors Day Convocation on April 22, 2010.

New Initiates - Sadikshya Adhikary, Xiaochen Dong, Yiwei Han, Azea Mustafa, Ankit Pokhrel, Sudha Regmi, Mona Shrestha, Shreejaya Shrestha, Supriya Shrestha, Sadichha Sitaula, Bhumika Thapa, Dahlia Wright, and Feiya Zhao.

HI Alpha - Hawaii Pacific University

Hung (Tim) Lu, Corresponding Secretary

New Initiates – Tabitha Carreira, Kristen Dominci, John Eddington, Kimberly Hellman, Marcie Kagawa, Chelsey Kannan, Gerald Kupris, Andrew Scotto, Jonathan Weeks, and Derek Wyss.

IA Alpha – University of Northern Iowa

Chapter President – Jaime Zeigler; 12 Current Members, 16 Faculty; 7 New Members

Other Spring 2010 Officers: Tristam Nebelsick, Vice President; Kelsey Staudacher, Secretary; David Rygh, Treasurer; and Mark D. Ecker, Corresponding Secretary

Our first spring KME meeting was held on February 17, 2010 at Professor Syed Kirmani's residence where student member Tristam Nebelsick presented his paper "Mathematics of Poker and Blackjack Strategy." Our second meeting was held on March 24, 2010 at Professor Mark Ecker's residence where student member Nate Kelly presented his paper on "The Work of Euclid." Student member Samantha James addressed the spring initiation banquet with "Analysis of Suicide Rates in the United States." Our banquet was held at Godfather's Pizza in Cedar Falls on April 28, 2010 where seven new members were initiated.

New Initiates – Lauren Booten, Kimberly Gavin, Samantha James, Timothy Marlow, Melinda McDowell, Khang Ming, and Sarah Mogolov.

IA Beta – Drake University

Lawrence Naylor, Corresponding Secretary

New Initiates - Yoobin Choi, Alexander Hoyer, and Steven Johnson.

IA Gamma – Morningside College

Eric Canning, Corresponding Secretary

New Initiates - Joe Danks, Leah Nielsen, Brad Penning, and Chris Spicer.

IA Delta – Wartburg College

Chapter President – Ashley Schulteis; 35 Current Members; 12 New Members

Other Spring 2010 Officers: David Carlson, Vice President; Samantha Irvin, Secretary; Adam Pederson, Treasurer; Dr. Terry Letsche, Faculty Sponsor; and Brian Birgen, Corresponding Secretary

In March, twelve new initiates were welcomed at our annual banquet and initiation ceremony. Our speaker was Shannon Lillibridge Archer, a 2006 Wartburg Alum and math major who recently graduated from Drake Law School and passed her bar exam. In May, together with the Physics and Computer Science clubs, we hosted the department end of the year picnic. There were other social meetings throughout the year.

New Initiates – Aaron Frink, Hilary Gerk, Samantha Irvin, Whitney Larish, Sarah Matt, Brandon Moeller, Matthew Oakland, Jennifer Pothast, Benjamin Rector, Andrew Reisner, Karin Schmidt, and Zeya Zhang.

IL Delta - University of St. Francis

Richard J. Kloser, Corresponding Secretary

New Initiates - Kyrsten L. Becker, Jennifer M. Festin, Michelle E. Franzen, Larissa E. Kries, Jennifer A. Merrill, Michael J. Murray, Esther Olivo, Nicholas R. Reicher, and Amy R. Shugan.

IL Zeta – Dominican University

Chapter President – Natalie Waksmanski; 24 Current Members; 12 New Members

Other Spring 2010 Officers: Kim Plesnicar, Vice President; Michelle Nowak, Secretary; Nicole Marin, Treasurer; and Aliza Steurer, Corresponding Secretary

The Illinois Zeta chapter of KME and the Math Club at Dominican University operate together as one student organization. This spring the members of both worked hard to increase their activities around campus. They organized an origami event, participated in a regional calculus competition, held a school-wide mathematics competition, organized the annual spring KME initiation ceremony, and held a Math Club/KME social. The members look very forward to their fall 2010 activities.

New Initiates – Halina Bednarz, Karina Cisneros, Ashley Gans, Sandra Garcia, Catalina Guerrero, Amber Hickey, Michael Howitz, Jospeh Merkel, Arne Olsen, Kathryn Somerfield, Herbert Tomlinson, and Laura Volpe.

IL Eta – Western Illinois University

Boris Petracovici, Corresponding Secretary

New Initiates – Amy Byers, Joseph Illichman, Andrew Davis Mansheiim, and Franck Olivier Ndjakou Njeunje.

IL Theta – Benedictine University

Chapter President – Michael Whitley; 253 Current Members; 5 New Members

Other Spring 2010 Officers: Michael Mutersbaugh, Vice President; Victoria Blumen, Secretary; Jared Gustafson, Treasurer; and Dr. Thomas Wangler, Corresponding Secretary

In the Spring 2010 semester, the chapter sponsored a PI Day event, a game night, a Calculus Competition, and inducted 5 new members into the Illinois Theta Chapter of KME.

New Initiates – Victoria Blumen, Thymur Chaudhry, Katherine Clark, Bohdan Khomtchouk, and Tina Nguyen.

IN Alpha – Manchester College

James Brumbaugh-Smith, Corresponding Secretary

New Initiates – Timothy Brauch, John Bruce, Natalie Collar, Kelli Jordan, and Thomas Kesling.

IN Gamma – Anderson University

Dr. Stanley L. Stephens, Corresponding Secretary

New Initiates - Elizabeth A. Barwick, Katherine A. Barwick, Paige A. Berg, Grant D. Baumgartner, Jason S. Boomsma, Jacqueline K. Burgher, Leslie M. Kohl, Tyler S. Nussbaum, and Mark D. Swank.

IN Delta – University of Evansville

Chapter President – Jacob Kahle; 41 Current Members; 20 New Members Other Spring 2010 Officers: Sue Helfert, Vice President; Trent Tenbarge, Secretary; Dr. Talitha Washington, Webmaster; Dr. Adam Salminen, Corresponding Secretary; and Dr. Mohamma Azarian, Faculty Sponsor

New Initiates - Gulzat K. Atymtayeva, Kent E. Bayens, Derek Wayne Burrows, Kelly Collins, Lindsay Cezanne Cornett, Ibhade Eigbobo, Eddy Frank Fotsing Kamboh, Colin Gray, Sue E. Helfert, Michael Huff, Neal Millay, Jonathan Mochau, Jacob A. Nardulli, Emmanuel O. Omere, Kyle C. Picha, Jesse Squires, Nicholas Stafford, Brantly Sturgeon, Trent Tenbarge, and Kathleen T. Upton.

KS Alpha – Pittsburg State University

Tim Flood, Corresponding Secretary

New Initiates - Emily Alonzo, Tyler Anliker, Hannah Auman, Juan Bernie, John Book, Jessica Booth, Clinton Burke, Bethany Burns, Blake Byford, Jessica Catron, Kodzo Dekpe, Casey Donahoo, Wesley Doolittle, Melissa Fanning, Krysten Fraley, Sean Harper, Caleb Hays, Chad Hays, Hannah Himes, Lara Ismert, Jordan Jameson, Brad Jordan, Min Jung, Laura Kaufmann, Jason Kramer, Natalie Lopez, Eric Love, Michelle McCullough, Jessica Moore, Emily Murray, Attalie Neal, Vanessa Peach, Ashley Reavis, Tyler Smith, Carson Stephens, MaryJo Swann, Joshua Valenti, Matthew Vaughn, Dr. Jeremy Wade, and Melanie Wolfe.

KS Beta - Emporia State University

Chapter President - Yuchen Chen; 10 New Members

Other Spring 2010 Officers: Jennifer Long, Vice President; Yuying Cao, Secretary; Whitney Turley, Treasurer; and Connie Schrock, Corresponding Secretary

KS Gamma - Benedictine College

Chapter President - Matthew Weaver; 13 Current Members; 4 New Members

Other Spring 2010 Officers: Caitlin Kelly, Vice President; Tina Henning, Secretary and Treasurer; and Eric West, Corresponding Secretary

KS Epsilon - Fort Hays State University

Jeffrey Sadler, Corresponding Secretary

New Initiates - Sara Mann, Justin Maughan, Joshua Platt, and Nolan Trapp.

KY Beta – University of the Cumberlands

Chapter President – Lola Embree; 48 Current Members; 16 New Members Other Spring 2010 Officers: Andrzej Lenard, Vice President; Bethany Quinn, Secretary; Cynthia Kaeser, Treasurer; Dr. Jonathan Ramey, Corresponding Secretary; and Dr. John Hymo, Faculty Sponsor

On February 24, 2010, the Kentucky Beta chapter held an initiation and a banquet at the Cumberland Inn. Kappa Mu Epsilon inducted twelve new student members at the banquet, presided over by outgoing president, Lola Embree. As an additional feature, senior awards were given by the department at the banquet. On April 30, the chapter inducted four additional student members at the Gatliff Chapel.

Jointly with the Mathematics and Physics Club, the Kentucky Beta Chapter hosted Dr. Carroll Wells from David Lipscomb University on April 12. He spoke about "Math in the Movies: Correct or Incorrect?" On April 13, members also assisted in hosting a regional high school math contest, held annually at University of the Cumberlands. On April 1 and April 30, the entire department, including the Math and Physics Club, Sigma Pi Sigma (Physics Honors Society), and the Kentucky Beta Chapter, held two picnics at Briar Creek Park.

LA Gamma – Northwestern State University

Leigh Myers, Corresponding Secretary

New Initiates - Philip Adams, Jessica Bass, Garrett Dancik, Mary Reeves, Elizabeth Robichaux, and Martha Smiley.

LA Delta – University of Louisiana at Monroe

Youssef Dib, Corresponding Secretary

New Initiates - Jennifer Ballard, Rosalie Baylock, Chelsea Bertrand, Jarred Bertrand, Courtney Collins, Jerry Dahl, Katherine Davis, Seth Debruhl, Bradley Dorman, Kimberly Eckert, Anna Eley, Heather Finn, Bradon Foret, Stephen Foster, Juowen Huang, Ricky Jackson, Kayla Laney, Allison Louviere, Aaron Miyahira, Angela Moore, Chuong Michael Nguyen, Jennifer Paylor, Katie Platt, Deontè Powell, Grace Reynolds, Kadie Romano, Ashley A. Sanders, Prashant Sharma, Dorothy Shelton, Elizabeth Ann Smith, Majesta Smith, Ethan Wiggins, and Nichole Witmyer.

MD Alpha – College of Notre Dame of Maryland

Margaret Sullivan, Corresponding Secretary

New Initiates - Sarah J. Coulter, Sarah Hergenhahn, Sadika Maharjan, Jessica Maier, Rebecca Pettitt, Taylor Riley, and Kanyarat Wanachalerm.

MD Beta – McDaniel College

Dr. Harry Rosenzweig, Corresponding Secretary New Initiates – Morgan DeHart and Michael Donders.

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MD Delta – Frostburg State University

Chapter President – Kelly Seaton; 27 Current Member; 7 New Members Other Spring 2010 Officers: Joshua Wilson, Vice President; Joseph Bascelli, Secretary; Bradley Phillips, Treasurer; Mark Hughes, Corresponding Secretary; and Frank Barnet, Faculty Sponsor

The Maryland Delta Chapter had an active spring semester. After an organizational meeting in February, seven new members were welcomed into KME at our Induction Ceremony on March 7. At the ceremony, faculty sponsor Dr. Frank Barnet gave a lecture on three-dimensional images called anaglyphs. Before spring break, we had a run of our annual Easter Egg sale. Our March meeting featured a lecture by faculty sponsor Dr. Mark Hughes on the mathematical legacy of the Greek mathematician Pappus of Alexandria. In April, we had a KME Movie Night for the campus community where we showed a film on the artistic and mathematical aspects of origami. The origami theme was continued during our April meeting with a lecture on the mathematics of origami presented by our department chair Dr. Marc Michael. During the April meeting we held officers elections and we congratulate Josh Wilson who will be our president during the upcoming year as well Rachel Skipper (vice president), Jesse Otto (secretary) and Kevin Loftus (treasurer). We finished our semester with a special treat in May; namely, a lecture by NASA scientist and Nobel laureate in physics, Dr. John Mather. He gave a wonderful lecture on the Big Bang Theory to a packed lecture hall of 150 followed by a reception. Finally, we wish the best of luck to graduating members Kelly Seaton, Joe Bascelli and Brad Phillips. All three served as officers and their good work is much appreciated.

New Initiates - John Cupp, Brian Hallee, Kevin Loftus, Robert Murtha, Jesse Otto, Rachel Skipper, and Richard Wall.

MD Epsilon – Stevenson University

Chapter President – Jennifer Kurek; 26 Current Members, 15 New Members

Other Spring 2010 Officers: Brittany Miller, Vice President; Justin Bobo, Secretary; Matthew Bramble, Treasurer; and Dr. Christopher E. Barat, Corresponding Secretary

In celebration of Mathematics Awareness Month and its theme of "Mathematics and Sports," the Chapter sponsored a talk by Rob "Stats" Guerrera of ESPN Radio's Mike and Mike in the Morning. The April 29 presentation was entitled "Stats Don't Lie: How a Statistical Revolution Changed the Face of Baseball." At the end of the talk, Guerrera received an honorary Bachelor's degree in Applied Mathematics. The event received coverage on Mike and Mike's TV/radio simulcast.

MI Alpha – Albion College

Mark Bollman, Corresponding Secretary

New Initiates - Ben Copeland, Rachel Kain, and Robert Sessions.

MI Delta – Hillsdale College

Chapter President – Jennifer Falck; 45 Current Members; 22 New Members

Other Spring 2010 Officers: Jonathan Gregg, Vice President; Benjamin Wood, Secretary; and David Murphy, Corresponding Secretary

During the Spring 2010 semester we hosted an Origami Night on March 3, a Paper Airplane Challenge on March 14, and our Spring Initiation on April 9. Origami Night was a great success. This event was open to everyone on campus and was widely publicized via posters and mass emails to students and faculty. At least 50 people took part in the event, in which we watched the documentary "Between the Folds" on the evolution of origami as an art form and the influence mathematics has had in bringing about this change. In addition to KME members, at least 20 nonmember students plus 6 faculty members and 1 member of the community (told about our event by a staff member who read our email) attended the event. Following the video, people made their own origami constructions at various stations we set up following instructions that we provided or designs of their own. Several who attended expressed their surprise that mathematics and art were in any way related and many more reported how much they had enjoyed the event.

Our second event of the spring semester, our Paper Airplane Challenge, was the first event in this year's Geek Week on campus. The goal of Geek Week is to promote honor societies on campus and to encourage their interaction. It is also a fundraising event for charity. We had two fundraising activities, both of which took place at our Paper Airplane Challenge. Participants could enter a paper airplane constructed at our event into any of three competitions (duration of flight, target/precision flying, and loop-the-loop competitions) for a \$1 donation. Also, as our event was held on March 14 (Pi Day), we sold pie by the slice with all revenue donated to charity. The Paper Airplane Challenge and Pie sale together raised \$46.75 this year, all of which was contributed to Circle K (another campus organization that is the college branch of Kiwanis International).

Our final event this semester was our Initiation Ceremony and Picnic, held on April 9. We are pleased to report that this semester we had our largest group of new members (22) join in the entire 14 year history of the Michigan Delta Chapter. New Initiates - Gladys Anyenya, Gregory A. Arpin, Gwendolyn A. Buchhop, Erin Rebecca Derrick, Cortney Donovan, Katherine Marie English, Simcha Felder, Kerry Ann Frost, Jonathan M. Grant, Charles A. Grimmett, Edward Hojnacki, Sean P. Holmes, Meredith J. Langlois, Robert E. Lochner, Ian D. Markwood, Jake Morgan, Aaron M. Mortier, Leah E. Poole, Thomas Sawyer, Heidi Schweizer, Russell H. TerBeek III, and Hannah D. Yee.

MI Epsilon – Kettering University

Chapter President – Katy Zayan (A Section) and Mattyew Sornig (B Section); 198 Current Members and 15 Faculty Members; 33 New Members Other Spring 2010 Officers: Derek Hazard (A Section) and Starla Walters (B Section), Vice Presidents; Jessi Harden (A Section) and Shahnoor Amin (B Section), Secretaries; Jessi Harden (A Section) Treasurer; and Boyan N. Dimitrov, Corresponding Secretary

The Michigan Epsilon chapter is to a certain degree considered part of the newly separated Department of Mathematics. For the Winter and Spring quarters of 2010, there were 33 new KME initiates. The initiation consisted of a dinner attended by new initiates, their parents, and relatives; preliminary remarks by the faculty sponsor; and the initiation ceremony. A mathematics competition with awards and think-tank elimination was entertaining to all of the guests.

The Mathematics Department is actively working on curriculum improvements, offering more courses for Kettering students, which classify our university as a VEE program completed institution. New courses in Financial Mathematics, Time Series, and Biostatistics are regularly offered. For nine years Kettering University has financially supported the Mathematics Olympiads, organized by the Mathematics Department faculty. The Mathematics Olympiad at Kettering is a competition designed to identify and encourage students with interests and abilities in mathematics. This year by the end of November will be the 10th Olympiad at Kettering. Our goal is to develop the Olympiad into one of the most prestigious mathematical competitions in the region. More news about the Olympiad can be found at http://paws.kettering.edu/~acheng/Olympiad/olympiad.html.

New Initiates - Michael D. Antonacci, Keishawna M. Baker, James A. Beattie, Joseph C. Burtch, Huong T. Chim, Bryan A. Coburn, Jonathan O. Conell, Nicole E. Findlay, Adam Frank, Denise M. Gantt, Mitchell E. Gatesman, John R. Haase, Tyler M. Haberer, Dennis Indrawan, William R. Jensen, Chen Guang Jiang, George R. Kelly, Jacob T. Kippe, Adam R. Koenig, Robert D. Looyengoed, Stephen G. Lusko, Ryan S. McGuire, Adlai Mibitz, Thomas W. Orr, Rukayat Oyedele, Austin W. Pratt, Anthony L. Rivas, Casey K. Rollins, Kasey L. Simons, Michael J. Steinert, Andrew C. Sullivan, Margaret E. Walch, and Xuntuo Wang.

MO Alpha – Missouri State University

Chapter President – Christina Tharp; 38 Current Members; 8 New Members

Other Spring 2010 Officers: Jacob Swett, Vice President; Ashley Lewis, Secretary; Brett Foster, Treasurer; and Jorge Rebaza, Corresponding Secretary

Seminars were held on the following dates with the following speakers: 02/17/10, John Carter (Physics), MSU; 03/24/10 Mathematics Challenge Contest; and 04/21/10, Shelby Kilmer (Mathematics), MSU.

New Initiates - Michael Finnegan, Kristin Gilpin, Lee Hicks, Kayla Kimminau, William Mize, Matthew Thompson, Tiffany Thompson, and Blake Wallace.

MO Beta – University of Central Missouri

Chapter President – Jennifer Hayes; 25 Current Members, 8 New Members

Other Spring 2010 Officers: Andrew Stallmann, Vice President; Phat Hoang, Secretary; Cynthia Craft, Treasurer; Rhonda McKee, Corresponding Secretary; and Steve Shattuck and Dale Bachman, Faculty Sponsors

Missouri Beta Chapter enjoyed hosting the North Central Regional Convention on April 23-24, 2010.

New Initiates - Charles Brock, Simone Catsimanes, James Gossell, Samuel Kovacic, Pamela Mitchell, Kyle Nobbe, Richard Petsch, and Abbey Jo Seider.

MO Gamma - William Jewell College

Dr. Neil Nicholson, Corresponding Secretary

New Initiates - Erin Armstrong, Alex Bernskoetter, Joedd Biggs, Lisa Burbridge, Christian Day, and Cassandra Johnson.

MO Zeta – Missouri University of Science and Technology

Dr. Vy K. Le, Corresponding Secretary

New Initiates - Jacob Alyea, Kevin Armendariz, Jake Boutic, Michael Carte, Caleb Chambers, Brandi Clark, Cody Cox, Kyle Ensign, Andrew Fish, Sam Goodfellow, Kirtesh Khengar, A.J. Linhares, Nathan Martin, Jon McKinney, Tim Meyer, Trevan Michael, Bryant Morgan, Johnathan Mulcahy-Stanislawczyk, Alan Pulley, Jeff Shelburg, and Stewart Sanchez.

MO Theta – Evangel University

Chapter President – Rosemary Sherwood; 16 Current Members; 8 New Members

Other Spring 2010 Officers: Lindsay Paur, Vice President; and Don Tosh, Corresponding Secretary

Meetings were held monthly. In January, we installed eight new members. In April, Dr. Rosh and three students attended the Regional Convention in Warrensburg. Also in April, we had our end-of-year social at the home of Don Tosh. New Initiates - Brandon Burdette, Nicholas Hestand, Jonathan M. Hodges, Kate Hooper, Steven Kent Maruszak, Lindsay M. Paur, Samuel Brian Poe, and Rosemary Dee Sherwood.

MO Iota – Missouri Southern State University

Charles Curtis, Corresponding Secretary

New Initiates - Victor Belt, Joseph Blaylock, Joseph Brown, Audrey Buckland, Mishael Herrmann, Laura Lehman, Bradley Mills, Shawn Nelson, Natalie Samayoa, Yuanjin Liu, and Juan Vazquez.

MO Kappa – Drury University

Dr. Carol Browning, Corresponding Secretary

New Initiates - Anish Chakrabarti, M. Susanne Feldman, Guyue Fu, Bret Gallion, Samantha Gripka, J. Evan Johnson, Megan Redding, Ryan Mihalik, Andrew Montgomery, and Matthew Taylor.

MO Lambda - Missouri Western State University

Dr. Steve Klassen, Corresponding Secretary

New Initiates - Bernadette Drees, Samantha Eaton, Emily Miller, Matthew Moffitt, Hillary Turner, Jeremy Wallace, and Tingxiu Wang.

MO Mu – Harris-Stowe State University

Ann Podleski, Corresponding Secretary

New Initiates - Lauren Campbell, Ahmadou Fall, Meeli Ferguson, Asia Finch, Michelle Patton, and Waltrin Richards.

MO Nu – Columbia College

Magda Price, Chapter President; 16 Current Members; 7 New Members Other Spring 2010 Officers: Andrew Grote, Vice President; Becca Kunce, Secretary; Chris Hawkins, Treasurer; Dr. Kenny Felts, Corresponding Secretary and Faculty Sponsor

New Initiates - Kyle Christian, Julie Kronable, Austin Miller, Amanda Mohaupt, Aaron Palmer, Sean Powers, and Kyle Storm.

MS Alpha – Mississippi University for Women

Chapter President – Kerri Dewitt; 11 Current Members; 5 New Members Other Spring 2010 Officers: Matthew Toncrey, Vice President; Tyler Greer, Secretary; Jami Henry, Treasurer; Dr. Shaochen Yang, Corresponding Secretary; and Dr. Joshua Hanes, Faculty Sponsor

The MS Alpha Chapter held their Spring 2010 initiation ceremony on April 7, 2010. A meeting was also conducted on April 21, 2010.

New Initiates: Christopher F. Boone, Kerri K. Dewitt, Tyler R. Greer, Jami C. Henry, and Matthew J. Toncrey.

MS Epsilon – Delta State University

Paula Norris, Corresponding Secretary New Initiates – Matthew Norris and Mary Swatley.

NC Epsilon - North Carolina Wesleyan College

Chapter President – Tiffany McCord; 8 New Members Other Spring 2010 Officers: Ben Lilly, Vice President; Kristina Sherrod, Secretary, Bill Yankosky, Corresponding Secretary and Faculty Sponsor

On Thursday, March 18, 2010, the North Carolina Epsilon Chapter of KME held its annual induction ceremony. The chapter welcomed 8 new members which increased the total membership to 30 after only three years. Current members, alumni, new inductees and their families and friends were invited to the ceremony. North Carolina Wesleyan College President Jim Gray welcomed the attendees, the induction ceremony took place and a short program followed. Five mathematics major alumni visited and spoke about what they are doing now with their degrees. All are doing slightly different things and were able to talk about different careers one could pursue with a mathematics degree. After their brief presentations, there was a small reception where those in attendance had the opportunity to talk directly with the alumni. The event was a great success and we hope to do this again in the future.

NC Zeta – Catawba College

Chapter President – Scott Campbell; 18 Current Members; 6 New Members

Other Spring 2010 Officers: John Hoehman, Vice President; Zachary Owen, Secretary; Cody Ashby, Treasurer; and Doug Brown, Corresponding Secretary and Faculty Sponsor

The NC Zeta Chapter inducted six new members in a ceremony held on April 21, 2010. After the ceremony, members and guests enjoyed a screening of Flatland, the Movie. The Chapter, in conjunction with the Catawba College Math Club, sponsored two talks given by members Scott Campbell and Cindy Cook as well as holding a joint fundraiser at a Catawba basketball game. Several student and faculty members attended the regional MAA meeting held at Elon University in April and many presented at the meeting and/or competed on the student Math Jeopardy team. Scott Campbell is our first student member to graduate, having processed on May 15. Scott will begin work on a Master's degree in Mathematics at Georgetown University in the fall and goes with the congratulations and best wishes of the Chapter.

New Initiates – Spencer Ashley, Dustin Craft, Deon Cuffie-Joseph, Lori Fraley, Bridgett Henderson, and Mary McKee.

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NC Eta – Johnson C. Smith University

Chapter President – Niketa Jones; 16 New Members Other Spring 2010 Officers: Maurice Scott, Vice President; Shimeca Bowman, Secretary; Quadashia Walker-Moss, Treasurer; Dr. Lakeshia R. Legette, Corresponding Secretary; and Dr. Livinus Uko, Faculty Sponsor

The North Carolina Eta Chapter of Kappa Mu Epsilon was installed at 1:30 p.m. on Thursday, March 18, 2010, at a ceremony in the Technology Center on the campus of Johnson C. Smith University, Charlotte, North Carolina. The meeting was conducted by Quadashia Walker-Moss. KME President Ron Wasserstein served as the Installing Officer. The first officers of North Carolina Eta were also installed. About 25 people were in attendance. After the formal ceremonies, Wasserstein presented a talk entitled "What Probability and Forrest Gump Teach Us About the North Carolina Lottery."

New Initiates - R'Ameereah Alexander, Lorren Baldwin, Elliot Betrand, Shimeca Bowman, Catherine Few, Dawnite Gilmore, Marcia Higgins, Brian Hunt, Niketa Jones, Lakeshia Legette, Andrew Milden, Quadasia Walker-Moss, Maurice Scott, Livinus Uko, Chenea Wilson, and Shawana Wilson.

NE Alpha – Wayne State College

Chapter President – April Groteluschen; 3 Current Members Other Spring 2010 Officers: Emily Gardner, Vice President; Amy Doerr, Secretary; Jennifer Haselhorst, Treasurer; and Dr. Jennifer Langdon, Corresponding Secretary and Faculty Sponsor

In the Spring of 2010, the Nebraska Alpha Chapter of KME met approximately every two weeks. We had a movie night and a semester ending picnic celebration. We are looking forward to this fall when we will initiate many new members.

NE Beta – University of Nebraska Kearney

Chapter President – Abby Om; 11 Current Members; 3 New Members Other Spring 2010 Officers: Valerie Sis, Vice President; Tierra Webb, Secretary; Wesley Sanders, Treasurer; and Dr. Katherine Kime, Corresponding Secretary and Faculty Sponsor

In April, we had a luncheon celebrating the 50th anniversary of the installation of the Nebraska Beta Chapter of KME. This was held in the Alumni House near campus. We invited all charter members that we could locate. Five charter members were able to attend, with three guests. At least five other charter members who could not attend responded. Those responses, some of which included biographies, were read by current student members at the luncheon. We also held initiation, and finally there was an excursion to the beautiful new planetarium on campus.

New Initiates - Daniel Erpelding, Chen Lu, and Haolong Ning.

NE Delta – Nebraska Wesleyan University

Chapter President – Brent McKain; 20 Current Members; 3 New Members Other Spring 2010 Officers: Macklin Warrington, Vice President; Abbi Raasch, Secretary; and Melissa Erdmann, Corresponding Secretary and Faculty Sponsor

We grilled delicious food for an evening meal and initiated three new members. The new initiates were not grilled; their high academic standing assured us that they were indeed qualified to be in Kappa Mu Epsilon. New Initiates – Cole Marolf, Abigail Raasch, and Macklin Warrington.

NH Alpha – Keene State College

Vincent J. Ferlini, Corresponding Secretary

New Initiates - Stephan Bismarck, Cali Bowman, Stephanie Brooker, Christa Cody, Laura Demanche, Alison Dreyfuss, Susan Jo Foss, Elisabeth Herber, Minjung Kim, Nicole Lia, Anna Lienghot, Alyssa Marinaccio, Colleen Nielsen, Michelle Partridge, Brian Pember, Patricia Pomerleau, Abigail Porter, Tyrel Souza, Justin Thibault, and Ashley White.

NJ Beta - Montclair State University

John G. Stevens, Corresponding Secretary

New Initiates - Maria-Belen Araneda, Kelsey A. Johannessen, Elise M. Lahiere, Kaitlyn Murphy, Gi Yoon Shin, and Leyla Yildirim.

NJ Delta – Centenary College of NJ

Chapter President – Ismael Garcia III; 8 Current Members; 9 New Members

Other Spring 2010 Officers: Andrew Pancoast, Vice President; Elizabeth Dutton, Secretary; Linda Ritchie, Treasurer; and Kathy Turrisi, Corresponding Secretary and Faculty Sponsor

On Sunday, April 25, 2010 nine students were inducted into the NJ Delta Chapter at the annual ceremony. The graduating seniors received their honor cords and those eligible received The Mathematics Merit Award which is given by the Mathematics and Natural Sciences Department at Centenary College. The Mathematics Merit award is given to graduating students who exemplify outstanding achievement in mathematics.

New Initiates - Kimberly Baird, Ashley M. Burger, Elizabeth Grace Dutton, Jazmine A. Farrell, Brandon Iuzzolino, Kimberly Kupper, Lia Ordile, Samantha Jane Piscitelli, and Amanda Sypniewki.

NJ Epsilon – New Jersey City University

Dr. Beimnet Teclezghi, Corresponding Secretary

New Initiates - Abiodun Banner, Dr. Deborah Bennett, Asmaa Bouayao, Salma Bouazaoui, Juliette Cabrera, Phil Carrillo, Dr. Sandra Caravella, Dr. Zhixiong Chen, Cody Ching, Dr. Yi Ding, Walter Fedzina, Tracy Goycochea, Dr. Karen Ivy, Teresa Kalinowski, Elizabeth Manfrede, Peter M. Morin, Maria Quiambao, Dr. Richard Riggs, Edwin Rivera, Dr. Freda Robbins, Dr. Beimnet Teclezghi, and Christopher Williams.

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NM Alpha – University of New Mexico

Pedro F. Embid, Corresponding Secretary

New Initiates - Brian Bentley, Jared A. Booth, Dusty Brooks, Basak Gocmen, Lauren Jaeger, Garrett E. MacMath, Michael Nakamaye, Luis M. Palomino, James Platt, Margaret Root, Michael Sena, Lucia Short, Jeffrey Samson, and Brea Spann.

NY Eta – Niagara University

Maritza M. Branker, Corresponding Secretary

New Initiates - Christina Fetzer, Kathryn Potter, Matthew F. Rongey, Rebecca Reese, and Terry Seyler.

NY Iota – Wagner College

Dr. Zohreh Shahvar, Corresponding Secretary

New Initiates - Alexandra Albertson, Cassandre Annarumma, Thomas Beesley, Melanie Cambria, Paula Chamberlain, Kathryn Chepiga, Rachel Chille, Lauren D'Elia, Nicholas DeConti, Vincent DeLuca, Elizabeth Rae Hawley, Crystal KilKenny, Elise Manzella, Michael Ranieri, Alexandra Ricciard, Lisa Nicole Schneider, and Elena Stekolchik.

NY Kappa – Pace University

Lisa Fastenberg, Corresponding Secretary

New Initiates - Jessica Calamera, Erica Dziato, Karen Miller, John Monaco, Amanda Tejada, and Silvana Vitello.

NY Lambda – C.W. Post Campus of Long Island University

Chapter President – Kaitlin Egan; 25 Current Members; 12 New Members Other Spring 2010 Officers: Michelle DiDomenico; Vice President; Jennifer Hanly, Secretary; Tara J. Koebel, Treasurer; Dr. Andrew M. Rockett, Corresponding Secretary; and Dr. Mahmoud Zeinalian, Faculty Sponsor

Twelve students were initiated by the chapter officers during our annual banquet at the Greenvale Town House restaurant on the evening of April 18th, bringing the chapter membership to 325. After the initiation, Dr. James Peters introduced alumni Richard Mazanek and Serena Spears, who spoke on "Consulting Actuarial Science." Dr. Katherine Hill-Miller, Dean of the College of Arts and Sciences, recognized the recipients of the departmental awards for 2009-2010: the Claire F. Adler Award to Kaitlin Egan; the Lena Sharney Memorial Award to Michelle DiDomenico; the Joseph Panzeca Memorial Award to Jennifer Hanly; and the Hubert B. Huntley Memorial Award to Janine Neyssen. Dr. Maithili Schmidt-Raghavan recognized Andrea Wapnick, the recipient of the Dean Schmidt Scholarship Award. Dr. James Peters reported on the KME New England/Northeast Regional Convention hosted the previous weekend at St. Joseph's College by New York Omicron and acknowledged the three student speakers who represented our chapter: Michelle DiDomenico, Jamie Earley, and Lauren Zanfini.

New Initiates - Laura Kaspszak, Fanny Kleisler, Alyson Lamberti, Janine Neyssen, Divyeshkumar Patel, Debra Prevete, Stephanie Rebimbas, Nicole Vasheo, Andrea Wapnick, Mark Whitehouse, Hua Xu, and Lauren Zanfini.

NY Mu – St. Thomas Aquinas College

Dr. Marie Postner, Corresponding Secretary

New Initiates - Andrew Asaro, John Errico, Jr., Samantha Estey, Donna Lavelle, Matthew Matcovich, Jessica O'Halloran, and Eder Paredes.

NY Nu – Hartwick College

Chapter President – Amanda Cappelli

Other Spring 2010 Officers: Dechhin Lama, Vice President; Julie Kessler, Secretary; Rebecca Lounsbury, Treasurer; and Ron Brzenk, Corresponding Secretary and Faculty Sponsor

On April 15, 2010, the New York Nu chapter inducted its 19th class of new initiates; 10 students joined this spring.

New Initiates - Victoria Brady, Katheleen Button, Angela Eberly, Gary Holeck, Julie Kessler, Dechhin Lama, Rebecca Lounsbury, Qin Ouyang, Shannon Walsh, and Xinni Xie.

NY Omicron – St. Joseph's College

Chapter President – Melissa Bernstein; 196 Current Members; 22 New Members

Other Spring 2010 Officers: Julie-Anne Henken, Vice President; Nicole Hatzispirou, Secretary; Charles C. Essig, Treasurer; Elana Reiser and David Seppala-Holtzman, Corresponding Secretaries; and Donna Pirich, Faculty Sponsor

We held two induction ceremonies, one on our Patchogue campus and one on our Brooklyn campus, and inducted 22 new members. We also ran the northeast regional KME convention in April 2010. This event was very successful and well attended by local chapters.

New Initiates - Michelle Brendli, Staci Cambria, Ricardo A. Campos, Paige Cardaci, James Carr, Elizabeth Fiorella, Kerri Ann Handel, Brandon Kern, Alexandra Lau, Kelly Laveroni, Emily Lembo, Kelsey Helena Lohsen, Joanna Merin, Teresa Napoli, Gabriela Rodrigues, Krista Sanniola, Christopher Seigneuray, Concetta Simon, Kimberly Vallone, Robert Walter, Marissa White, and Kristina Zito.

NY Pi – Mount Saint Mary College

Chapter President - Jessica Scarlata

Other Spring 2010 Officers: Vanessa Byrne, Vice President; and Lee Fothergill, Corresponding Secretary

Lee Fothergill, the faculty advisor, inducted 13 new members into the New York Pi chapter on March 29, 2010. The outgoing president, Jessica Scarlata, and VP, Vanessa Byrne have been leaders of the Math Club at Mount Saint Mary College in Newburgh, NY. We have had a variety of events this year including math luncheons, a guest speaker, and the infamous Students vs. Faculty competition. KME and math club also volunteer their time at a local middle school preparing students for a national mathematics competition. At our final luncheon of the semester Matt Fowler won the digits of Pi contest.

New Initiates - Jaime L. Cocco, Rachel Freitas, Christopher Gage, Elaina Luongo, Karen McCaffrey, Mary W. Newhard, Kaitlyn O'Malley, Brandi Ripa, Jill A. Robinson, Melanie R. Scheetz, Rebecca Seepersad, Gregory Tyler, and Amy M. Whalen.

NY Rho - Molloy College

Manyiu Tse, Corresponding Secretary

New Initiates - John Beleckas, Lisa Carroll, Katrina Christoffersen, Marissa Cusa, Isamar DelaCruz, Scarlett Demchak, Deirdre Fronda, Amin Hashimi, Tolulade Jegede, Christine Jochade, Thomas Jordan, Deidra Keenan, Jessica Kelly, Gina Lagalante, Laura Lundquist, Christina Napolitano, Edward Quackenbush, Luz Rosado, Cara Rudolfsky, Allison Ryan, Brian Santos, Alison Scalice, Alexander Scanlon, Christine Scully, Lara Sehne, Amanda Sorrentino, Kimberly Thompson, Diana Towers, Nicholas Wood, Joseph Yasinoski, and Jennifer Zontini.

OH Gamma – Baldwin Wallace College

Chapter President – Mallory Underwood; 54 Current Members; 11 New Members

Other Spring 2010 Officers: Kelsey Rife, Vice President; Katie Fisher, Secretary; Kevin Stoll, Treasurer; and David Calvis, Corresponding Secretary Ohio Gamma held their initiation ceremony on Friday, April 30, 2010.

New Initiates – Adam J. Bianchi, Michelle A. Blevins, Matthew J. Ciha, Christopher L. Cramer, Julia A. Donajkowski, Gina L. Mingo, Adam E. Pengal, Hannah V. Shoemaker, Anthony M. Testa, Alexander J. Trzeciak, and Sarah L. Widner.

OH Epsilon – Marietta College

Chapter President – Lauren Litts; 13 Current Members; 18 New Members Other Spring 2010 Officers: Jacob Klincuski, Vice President; and John Tynan, Corresponding Secretary and Faculty Sponsor

New Initiates - Evan Asire, Aaron Balderson, Jacob Bills, Troy Clark, John Forshey, Ryan Godwin, Matthew Ischy, David Johnson, Christopher Kenny, Jacob Klincuski, Lauren Litts, Xiaotian Ma, Caleb Muller, Heath Pottmeyer, Matthew Righter, Darren Simmons, Will Vance, and Emma Vierheller.

OH Zeta – Muskingum University

Richard Daquila, Corresponding Secretary

New Initiates - Tanner Barnes, Dr. Laura Bosley, Elizabeth Doolittle, Sarah Hare, Alissa Kirkbride, Daniel Kovacevic, Ryan Loe, Douglas McClain, David Pitre, Andrea Richard, Ted Shroyer, Caleb Slavinski, Rodney Troyer, Karen Wells, Jayme Workinger, and Lauren Zink.

OH Eta – Ohio Northern University

Donald Hunt, Corresponding Secretary

New Initiates - Nicholas Scott Baker, Adam J D'Amico, Cathleen Jewell, Dave Mangus, Michelle Nicol, John Matthew Rader, Scott C Schnelle, and Matthew Smith.

OK Alpha – Northeastern State University

Chapter President – Toni Slagle; 61 Current Members; 9 New Members Other Spring 2010 Officers: Seth Vansell, Vice President; Jonathan Moyer, Secretary; Chris Palmer, Treasurer; and Dr. Joan E. Bell, Corresponding Secretary and Faculty Sponsor

Our spring initiation brought 9 new members into our chapter. We sponsored a book sale in January. We made over \$100 that will help support our activities next year. At our January meeting we worked on problems from The Pentagon, and submitted one solution for publication. KME sponsor, Dr. Joan E. Bell, gave a hands-on presentation in March: Want to Learn How to Solve the Rubik's Cube? Our chapter acquired a large display case this year. We are pleased to display items from the early days of KME, such as copies of The Pentagon from 1947 and 1949, the OK Alpha newsletter from 1940, and the page of the membership book where the signatures of founders Professor L. P. Woods and Dr. Emily Kathryn Wyant appear. We also displayed some of the math T-shirts we have recently designed and items from past KME presentations, such as stellated octahedrons. OK Alpha chapter members (Toni Slagle, Jacob Curley, Elizabeth Brittain, Colin Clinton, Jory Wade, Brandon Childress) and future members (Ryan Berkley and James Sherrell) attended the 72nd annual Oklahoma-Arkansas section meeting of the Mathematics Association of America and participated in the student competitions. We sponsored an Ice Cream social for math students and faculty, during which we enjoyed the DVD "The United States of Mathematics Presidential Debate."

New initiates: Kenton Adams, Cheryle Boesen, Mary Brittain, Nathan Cole, Jacob Curley, Russell Harjo, Jonathan Henson, Zachariah Kindle, and Justin Porterfield.

PA Alpha – Westminster College

Natacha Fontes-Merz, Corresponding Secretary

New Initiates - Brendan Banks, Jeremy Booher, Emily Dolsak, Coty Hainsey, Erin Keck, Richard Ligo, and Robert Rhodes.

PA Beta - La Salle University

Chapter President – James Iannizzotto; 6 Current Members; 20 New Members

Other Spring 2010 Officers: Veronica Ventura, Vice President; Rose Venuto, Secretary; Erik Way, Treasurer; and Stephen Andrilli, Corresponding Secretary and Faculty Sponsor

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With the departure of the previous faculty sponsor from La Salle, Stephen Andrilli took over as the new faculty sponsor in mid-academic year. During the last year or so, we had not initiated any new members, and as a consequence, there were no undergraduate KME members at La Salle for most of this current academic year. Therefore, we decided to re-invigorate the chapter. The highlight of our chapter's news is that we inducted a record number of new initiates this year (20 undergraduates altogether, taken from our current sophomore, junior, and senior classes) at a ceremony on April 19, 2010. For this initiation, the current KME President, Dr. Ron Wasserstein, traveled to Philadelphia to give a talk entitled, "What Probability and Forrest Gump Teach Us About the Pennsylvania Lottery." The chapter officers listed above were among those initiated on April 19. They also served as corresponding officers of our university's Math Club. Among the KME Chapter / Math Club activities for this past year were a (close to) Pi Day showing of the MAA film, "The Great Pi/E Debate", monthly meetings, a Bowling For Primes competition, a Math Basic Skills competition (for fun), a tangram solving session, and a pretzel sale to raise funds. Elections were held in April for next year's KME Chapter/Math Club officers.

New Initiates - Christopher Caronna, Mary Patrice Conville, Joan Croskey, Ryan Cunningham, Laura Gallagher, Luke Giordano, Emily Heath, Antoinette High, James Iannizzotto, Kerriann Kane, Stephen Kernytsky, Sean McMichael, Michelle Mintzer, Paul Orzechowski, Thomas Pannulla, Christine Quinn, Veronica Ventura, Rose Venuto, Kimberly Voorhees, and Erik Way.

PA Delta - Marywood University

Thomas Kent, Corresponding Secretary

New Initiates - Jason Bugno, Nicole Coggins, Matthew Nonnemacher, Louis Pasqualicchio, Michael Rosar, Nicholas Surgent, and Kayla Troast.

PA Eta – Grove City College

Dale L. McIntyre, Corresponding Secretary

New Initiates - Audrey DeVries, Andrew Gerber, Emma Holdrich, Mark Matthews, Nicole Powers, Christina Scurlock, Chelsea Snyder, Bradley Weaver, Kathryn Wilt, and Hannah Young.

PA Theta - Susquehanna University

Lisa Orloff Clark, Corresponding Secretary

New Initiates - Alexander Doudt, Elizabeth George, Brian Gilbert, Ben Kopec, Matthew Modrick, Nabin Mulepati, Kyrstin Shadle, Julianne Vega, and Bryn Whitmire.

PA Iota – Shippensburg University

Chapter President – Laura Henzy; 730 Current Members

Other Spring 2010 Officers: Chad Nunemaker, Vice President; Lauren Robinson, Secretary; Drew Snyder, Treasurer; Dr. Paul Taylor, Corresponding Secretary; and Dr. Ji Young Choi, Faculty Sponsor

New Initiates - Tracy Haines, Laura Henzy, Chad Nunemaker, Lauren M. Robinson, Tara Sheeder, Drew Snyder, Kelly Toppin, and Edi Rumano.

PA Kappa – Holy Family University

Chapter President – Michael Browning; 11 Current Members; 6 New Members

Other Spring 2010 Officers: Jacqueline Galelli, Vice President; Sabrina Luczyszyn, Secretary; Ashley McCaw, Treasurer; and Sister Marcella Louise Wallowicz CSFN, Corresponding Secretary and Faculty Sponsor

On March 11, the chapter anticipated PI-Day by hosting the annual pie-eating competition. Keeping up a family tradition, Ryan O'Driscoll was crowned this year's champion. His brother Tim, was last year's winner. On March 12, the chapter hosted its annual high school mathematics competition. Thirty students from area schools competed in Algebra/Geometry, Pre-Calculus and Calculus contests. The chapter will partner with a local grade school in the Fall to establish a Mathletes team. Chapter members will coach the students one afternoon per week.

New Initiates - Catherine Blumenstock, Kristina Calhoun, Jillian Keeve, Piotr Kopinski, Michelle Kustra, and Alyssia Overline.

PA Lambda – Bloomsburg University

Elizabeth Mauch, Corresponding Secretary

New Initiates - Stephen Cole, Thomas Harrin, Brett Lindner, Devin Miller, Aaron Ohl, Eric Ruth, Rebecca Stevenson, and Kristyn Swingle.

PA Mu – Saint Francis University

Chapter President – Darci Jones

Other Spring 2010 Officers: Michelle Wetzel, Vice President; Rachel Capizzi, Secretary; Aaron Osysko, Treasurer; Peter Skoner, Corresponding Secretary; and Katherine Remillard, Faculty Sponsor

The Pennsylvania Mu Chapter of Kappa Mu Epsilon Mathematics (KME) Honor Society held induction ceremonies on Tuesday, April 13, 2010 in the Christian Hall Conference Room at Saint Francis University. A dinner preceded the actual initiation ceremony for the nineteen new members. The ceremony was led by KME President Darci Jones, Past-President Tim Gaborek, Treasurer Aaron Osysko, faculty sponsor Dr. Katherine Remillard, and corresponding secretary Dr. Peter Skoner.

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Pennsylvania Mu helped sponsor, along with the Laurel Highlands Mathematics Alliance, the Tenth Annual Math Day, held on March 18, 2010 on the campus of Saint Francis University. There were 131 high school students and 11 teachers from 10 school districts in attendance for the event. The students attended two of ten presentations located all around campus including College Selection Jeopardy; Global Warming? You Decide with Excel; Modeling: Yes, it's Math; Pi is a Harsh Mistress: A Tale of Irrational Passion; Psychology Experiments to Study Behavior; Sacred Geometry; Solve the World's Problems, Make a Good Living, and Earn College Credits for Almost Free; The Game of Set; The Monte Hall Game: What is Behind Door One? A Prize, a Goat or an Actuary?; and Video Games: Fun and Entertainment, but How Do They Work? All high school students then had a chance to win a mathematics tee shirt when they played Who Wants to Look Like a Millionaire in a New Tee Shirt? by answering the fastest-finger question in the shortest amount of time and then answering five mathematics questions while on the hot seat in the JFK Auditorium. This year, through the generous support of the Buhl Foundation of Pittsburgh, PA, registration fees were kept to a minimum, and additional materials and gifts (including a math tee shirt) were provided to all who attended.

Three KME faculty and alumni, along with six KME student members participated in Try Math A Lot, a day of mathematics challenges for sixth and seventh grade students. It was held at the University of Pittsburgh at Johnstown on Wednesday, May 5, 2010. The Saint Francis University contingent coordinated a mathematics quiz bowl, one of the three activities that the more than 300 students from about 25 schools rotated through. New Initiates - Erin Briley, Jared Burd, Seth Burkert, Katherine Dacanay, Lauren Grabowski, Patrick Himes, Brittany Kovacs, Chris Kurtz, Brendon LaBuz, Erica Liska, Matthew Mary, James Mayer, Lauren McConnell, Travis Rosmus, Jennifer Sabol, Catherine Schirra, Matthew Skoner, Laura Stibich, and Colleen Stock.

PA Nu – Ursinus College

Jeffrey Neslen, Corresponding Secretary

New Initiates - Allison Bugenis, Annabel Clarance, Brett Emery, Christin Rodgers, Karissa Smith, Brandon Sullivan, Lloyd Tannenbaum, and Charles Yespelkis.

PA Xi - Cedar Crest College

Patrick Ratchford, Corresponding Secretary New Initiate - Yumiko Sugawara.

PA Pi – Slippery Rock University

Elise Grabner, Corresponding Secretary

New Initiates - James Bichler, Rex Edmonds, Jessica Hoffman, Zachary Hopkins, Karissa King, Andrew Mayle, Dennis Pace, Benjamin Pearce, Nethkelum Perera, and Krista Scott. **PA Rho – Thiel College**

Chapter President – David Wierzchowski; 25 Current Members; 12 New Members

Other Spring 2010 Officers: Krista Wissenbach, Vice President; Adam Troup, Secretary; Alex Johnson, Treasurer; and Max Shellenbarger, Corresponding Secretary and Faculty Sponsor

On Sunday, March 14, 2010, twelve new members were initiated into the Pennsylvania Rho Chapter of Kappa Mu Epsilon at Thiel College, Greenville, PA. Professor Max Shellenbarger, faculty sponsor, and David Wierzchowski, current President, served as the Masters of Ceremony. Professor David Miller, guest speaker, gave a talk about some of the connections between business and mathematics throughout history, as related to our tax code. The members were then initiated and the new officers inducted.

New Initiates - Ashley Ahrens, Randy Bartlett, Rebecca Betteridge, Scott Hunkus, Alex Johnson, Evan Krizon, Ling Liu, Kayla McCaskey, Benjamin Moran, Rachel Niece, Jacob Shaffer, and Marica Turan.

PA Sigma – Lycoming College

Santu de Silva, Corresponding Secretary

New Initiates - Kelli Battenfeld, Allyson Blizman, Kimberly Fox, Kevin Pfister, Yicen Pu, Madalyn Smith, and Sara Taylor.

RI Alpha – Roger Williams University

Annela Kelly, Corresponding Secretary

New Initiates - Vivienne Clayton, Sarah Jeanfavre, Adrianna Johnson, Christian Lopez, Suzanne Steele, and Kelilah Wolkowicz.

TN Alpha – Tennessee Technological University

Andrew Hetzel, Corresponding Secretary

New Initiates - Fidel Abella, Joshua Bacon, Evelyn Bissell, Troy Brachey, William Bruning, Basiel Bunting, William Burns, Courtney Carr, David Clay, Kevin Cunningham, Brian Gunter, Alex Hagenbuch, Emily Hancock, Robbie Hodge, Ashley Jaeger, Katti Johanns, Steven Jones, Jared Krupski, Charles Lampman, Mara LaPorte, Blake McNew, Anthony Morgan, Reshea Norris, Rebecca Paul, Lindsey Reed, Erika Residori, William Scott, Jake Smith, and Jacob Stubbs.

TN Beta – East Tennessee State University

Chapter President – Jeffrey Bonnell; 766 Current Members; 11 New Members

Other Spring 2010 Officers: Jeremy Brooks, Vice President; Elizabeth Harris, Secretary; Andrew "Cade" Herron, Treasurer; Bob Gardner, Corresponding Secretary; and Robert Beeler, Faculty Sponsor

The Tennessee Beta chapter of Kappa Mu Epsilon held two seminars during spring semester 2010. On February 25, KME faculty sponsor Dr. Bob Gardner presented "Euclid's Elements - A 2,500 Year History" (for details, see http://faculty.etsu.edu/gardnerr/Geometry-History/abstract.htm) and on February 26, a showing of the Nova episode "A Mathematical Mystery Tour" was given in commemoration of the 25th anniversary of the premiere of this show (for details, see http://faculty.etsu.edu/gardnerr/Math-Mystery-Tour/mathematical-Mystery-Tour.htm).

Eleven new members of the Tennessee Beta chapter were inducted at the ETSU Department of Mathematics and Statistics Honors Banquet held on April 13, 2010. The keynote speech for the banquet was given by Dr. Jan Medlock of Clemson University on "Using Math to Control the Flu." New Initiates - Jeffrey Bonnell (graduate student), Jeremy Brooks, Brandi Canter, Sharon Cameron, Jessie Deering, Michael Deren, Cihan Eroglu (graduate student), Lindsey Fox, Adam Hall, William Hamieson, Andrew "Cade" Herron, Ryen Lapham, Haiyin Li (graduate student), Alissa Rockney, Katie Schiermeyer, and Wesley Surber, and Courtney Yatteau.

TN Gamma – Union University

Chapter President – Will Sipes; 12 New Members

Other Spring 2010 Officers: Rebecca Eaton, Vice President; Jacob White, Secretary/Treasurer; Dwayne Jennings, Corresponding Secretary; and Matt Lunsford, Faculty Sponsor

The Tennessee Gamma Chapter initiation banquet was held on April 19, 2010 at the Old Country Store in Jackson, TN. The banquet speaker was teacher and KME member Mrs. Alicia Tull (Class of '98). The initiation ceremony inducted 12 new members, including new mathematics professor George Moss. The new officers are Rebecca Eaton, President; Emilie Huffman, Vice-President; Kim Lukens, Secretary/Treasurer and Seth Kincaid, Webmaster/Historian.

New Initiates - Stephen Brooks, Rachel Carbonell, Claire Elmblad, Libby Ford, Jill Frank, Grayson Hardaway, Kimberly Lukens, George Moss, Elizabeth Olson, Rachel Quinn, Christian Wallen, and Edward Scott Yarbro Jr.

TN Delta – Carson-Newman College

Chapter President – Gretchen Hill; 311 Current Members; 3 New Members

Other Spring 2010 Officers: Luke Morton, Vice President; Andrew Hansen, Secretary; and Kenneth Massey, Treasurer, Corresponding Secretary, and Faculty Sponsor

C-N chapter KME faculty, students, alumni, and retirees enjoyed our Spring initiation picnic at Cherokee Dam. An eagle flew around the edge of the lake, inspiring us as Carson-Newman Eagles to soar to new heights. After the burgers were grilled and devoured, we played the traditional student-faculty lacrosse game until it got so dark we couldn't see what was happening.

New Initiates - Brittany Gentile, Lucas Harry, Allison Hopkins, Lata Kodali, Schuyler Matteson, Terry Rogers, Brandi Trout, and Hannah Whitaker.

TX Alpha – Texas Tech University

Magdalena Toda, Corresponding Secretary

New Initiates - Diego Acevedo, Rami Alrayes, Brad Armstrong, Matthew Barnes, Austin Beam, Mark Broadway, Wade Brown, John Calhoun, Bailey Davenport, Daniel English, Hiron Fernando, Rebecca Gabrilska, Spencer Gill, Kyle Grunwald, William Hunter, Samuel Jimenez, Laura Juarez, Bryan Judd, Ryan Kostohryz, Stephanie Krol, Nick Lehman, Russell Mayne, Phillip McElroy, RB Neely, Philip Oliver, Garren Opdenhoff, Yaseer Parupia, Andrew Phillips, Justin Polk, Katherine Priebe, Natalya Read, Craig Rhyne, Elizabeth Scheers, Scott Schroer, Cord Scorgie, Carlos Siri, Magdalena Toda, Daniel Tesfai, and Colin Watts.

TX Kappa – University of Mary Hardin-Baylor

Chapter President – Christi D'Herde; 11 Current Members; 5 New Members

Other Spring 2010 officers: Ashley Lawson, Vice President; Helen Wong, Secretary; Trevor Ash, Treasurer; Dr. Peter H. Chen, Corresponding Secretary; and Maxwell Hart, Faculty Sponsor

New Initiates - Trevor Ash, Meri Hughes, Clifton Martin, Alana McFarland, and Hei-Yui Wong.

TX Lambda – Trinity University

Diane Saphine, Corresponding Secretary

New Initiates - Claire Baxter, Mellissa Delcont, Matthew Galla, Theresa Hupf, Caroline Krisa, Thayer Lazarin, Tasha Lovell, James Nordlund, Dushyant Pattni, Kevin Perkins, Paurakh Rajbhandary, and Julia Zangirolami.
TX Mu – Schreiner University

Chapter President – Leigh Ann Brown; 10 Current Members; 13 New Members

Other Spring 2010 Officers: Denise Begley, Vice President; Stephen Franklin, Secretary; Matthew Moreno, Treasurer; William M. Sliva, Corresponding Secretary; and Clinton Coles, Faculty Sponsor

New Initiates - Kathleen Marie Altmiller, Ashly Nicole Bouthot, Audra Danielle Burnap, Keleigh Rae Donaldson, Ashley Eubanks, Colton Gaitan, Caitlin R. Gayle, Rachele Korin Herzog, Cameron Leslie Kuhn, Colin M. Lawson, Brandon Dean Pape, Antonio Ramirez, and Evan Gillis Williamson.

VA Gamma – Liberty University

Dr. Tim Van Voorhis, Corresponding Secretary

New Initiates - MiHyun An, Riley Baker, Barbara Beller, David Colonna, David DiCarlo, Adam Docksteader, John Faughn, Jennifer Gray, Jonathan Griffith, Abigail Halpin, Brittney Johnson, Jennifer Klugh, Kylie Marsh, Jason Myers, Elizabeth Perin, Logan Sturm, and Sushant Thapa.

WI Alpha – Mount Mary College

Roxanne Back, Corresponding Secretary - 277 Current Members; 8 New Members

New Initiates - Myriem Lahmam Bennani, Dana Howard, Kristin Karlinsky, Michelle Mueller, Cassandra Niesing, Elysium Pajhuab, Patricia St. George, and Gail Beth Wagshall.

WI Gamma – University of Wisconsin-Eau Claire

Chapter President – Mark Bauer; 20 New Members

Other Spring 2010 Officers: Joshua Frinak, Vice President; Lindsay Brunshidle, Secretary; Hong Yang, Treasurer; and Dr. Simei Tong, Corresponding Secretary and Faculty Sponsor

Members from Wisconsin Gamma gave four presentations at MAA-Wisconsin Section meetings in spring 2010. Nine members who graduated in the spring went on to graduate schools, six of them are in Ph.D. programs. Mark Bauer received an internship during the summer at Department of Homeland Security. He worked at a national lab for ten weeks.

WV Alpha – Bethany College

Dr. Mary Ellen Komorowski, Corresponding Secretary

New Initiates - Jennifer Marie Anderson, Lindsay K. Brewer, Tiffany R. Furbee, Samantha Jo Hall, Kevin Luke Kaauamo, Kelli Maree McAbier, and Alissa Lee Moss.

WV Beta - Wheeling Jesuit University

Theodore Erickson, Corresponding Secretary

New Initiates - Scott Moses and Courtney Sanner.

Kappa Mu Epsilon National Officers

| Ron Wasserstein | President |
|---|-----------------|
| American Statistical Association 732 N Washington Street | |
| Alexandria, VA 22314-1943 | |
| ron@amstat.org | |
| Rhonda McKee | President-Elect |
| Department of Mathematics | |
| University of Central Missouri | |
| mckee@ucmo.edu | |
| Mark Hamner | Secretary |
| Department of Mathematics and Computer Scie | nce |
| Denton TX 76204 | |
| mhamner@twu.edu | |
| | |
| Cynthia Woodburn | Treasurer |
| Department of Mathematics Pittsburg State University | |
| Pittsburg, KS 66762-7502 | |
| cwoodbur@pittstate.edu | |
| Peter Skoner | Historian |
| Department of Mathematics | |
| Saint Francis University | |
| pskoner@francis.edu | |
| Kevin Reed | Webmaster |
| Department of Science and Technology | |
| Evangel University | |
| Springfield, MO 65802 | |
| KME National Website: | |
| http://www.kappamuepsilon.org/ | |

Active Chapters of Kappa Mu Epsilon

Listed by date of installation

Chapter

Location

Installation Date

| OK AlphaNortheastern State University, Tahlequah18 April 1931IA AlphaUniversity of Northern Iowa, Cedar Falls27 May 1931KS AlphaPittsburg State University, Pittsburg30 Jan 1932MO AlphaMississippi University for Women, Columbus30 May 1932MS AlphaMississippi University for Women, Columbus30 May 1932MS BetaMississippi State University, Mississippi State14 Dec 1932NE AlphaWayne State College, Wayne17 Jan 1933KS BetaEmporia State University, Athens5 March 1935IL BetaEastern Illinois University, Charleston11 April 1937AL GammaUniversity of North Alabama, Florence20 May 1937AL GammaUniversity of Montevallo, Montevallo24 April 1937OH AlphaBowling Green State University, Bowling Green24 April 1937MG BetaUniversity of Central Missouri, Warrensburg10 June 1938XX AlphaTexas Tech University, Lubbock10 May 1940KS GammaBenedictine College, Atchison26 May 1940KS GammaBenedictine College, Atchison26 May 1940KS AlphaTexas Tech University, Cookeville5 June 1941MI AlphaCentral Michigan University, Mount Pleasant25 April 1942N AlphaTexnesce Technological University, Denton7 May 1947MG GammaWilliam Jewell College, Liberty7 May 1947MG GammaGoldoad State University, Fort Collins16 May 1940M AlphaMachester College, North Manchester16 May 1949M | | | |
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| AL BetaUniversity of North Alabama, Florence20 May 1935AL GammaUniversity of Montevallo, Montevallo24 April 1937OH AlphaBowling Green State University, Bowling Green24 April 1937MI AlphaBowling Green State University, Bowling Green24 April 1937MI AlphaAlbion College, Albion29 May 1937MO BetaUniversity of Central Missouri, Warrensburg10 June 1938TX AlphaTexas Tech University, Lubbock10 May 1940KS GammaBenedictine College, Atchison26 May 1940IA BetaDrake University, Des Moines27 May 1940TN AlphaTennessee Technological University, Cookeville5 June 1941MI BetaCentral Michigan University, Mount Pleasant25 April 1942NJ BetaMontclair State University, Upper Montclair21 April 1944IL DeltaUniversity of St. Francis, Joliet21 May 1945KS DeltaWashburn University, Topeka29 March 1947MO GammaTexas Woman's University, Denton7 May 1947TX GammaTexas Woman's University, Fort Collins16 May 1948MO EpsilonCentral Methodist College, Berea6 June 1947CO AlphaColorado State University, Fort Collins16 May 1949IN AlphaManchester College, North Manchester16 May 1949IN AlphaManchester College, North Manchester16 May 1949IN AlphaManchester College, North Manchester16 May 1953PA AlphaWestminster College, North Manchester16 May 1953PA AlphaW | IL Beta | Eastern Illinois University, Charleston | 11 April 1935 |
| AL GammaUniversity of Montevallo, Montevallo24 April 1937OH AlphaBowling Green State University, Bowling Green24 April 1937MI AlphaAlbion College, Albion29 May 1937MO BetaUniversity of Central Missouri, Warrensburg10 June 1938TX AlphaTexas Tech University, Lubbock10 May 1940KS GammaBenedictine College, Atchison26 May 1940IA BetaDrake University, Des Moines27 May 1940TN AlphaTennessee Technological University, Cookeville5 June 1941MI BetaCentral Michigan University, Mount Pleasant25 April 1942NJ BetaMontclair State University, Upper Montclair21 April 1944IL DeltaUniversity of St. Francis, Joliet21 May 1947KS DeltaWashburn University, Topeka29 March 1947MO GammaWilliam Jewell College, Liberty7 May 1947TX GammaTexas Woman's University, Denton7 May 1947TX GammaColorado State University, Fort Collins16 May 1948MO EpsilonCentral Methodist College, Berea6 June 1941OH JaphaMachester College, Nilwaukee11 May 1947MS GammaUniversity of Southern Mississippi, Hattiesburg21 May 1949N AlphaMachester College, North Manchester16 May 1948MO EpsilonCentral Methodist College, Fayette18 May 1949N AlphaMachester College, North Manchester16 May 1950PA AlphaWestminster College, North Manchester16 May 1953N BetaButler University, Phil | AL Beta | University of North Alabama, Florence | 20 May 1935 |
| OH AlphaBowling Green State University, Bowling Green24 April 1937MI AlphaAlbion College, Albion29 May 1937MO BetaUniversity of Central Missouri, Warrensburg10 June 1938TX AlphaTexas Tech University, Lubbock10 May 1940KS GammaBenedictine College, Atchison26 May 1940IA BetaDrake University, Lubbock21 May 1940TN AlphaTennessee Technological University, Cookeville5 June 1941MI BetaCentral Michigan University, Mount Pleasant25 April 1942NJ BetaMontclair State University, Upper Montclair21 May 1945KS DeltaWashburn University, Topeka29 March 1947MO GammaWilliam Jewell College, Liberty7 May 1947VI AlphaMount Mary College, Milwaukee11 May 1947OH GammaBaldwin-Wallace College, Berea6 June 1947CO AlphaColorado State University, Fort Collins16 May 1948MC EpsilonCentral Methodist College, Rayette18 May 1949NS GammaUniversity of Southern Mississippi, Hattiesburg21 May 19450IN AlphaManchester College, North Manchester16 May 1950PA AlphaWestminster College, New Wilmington17 May 1950IN BetaButler University, Philadelphia19 May 1953VA AlphaVirginia State University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1959N BetaLasalle University, Radford12 Nov 1959N BetaEast Tennessee Stat | AL Gamma | University of Montevallo, Montevallo | 24 April 1937 |
| MI AlphaAlbion College, Albion29 May 1937MO BetaUniversity of Central Missouri, Warrensburg10 June 1938TX AlphaTexas Tech University, Lubbock10 May 1940KS GammaBenedictine College, Atchison26 May 1940IA BetaDrake University, Des Moines27 May 1940TN AlphaTennessee Technological University, Cookeville5 June 1941MI BetaCentral Michigan University, Mount Pleasant25 April 1942NJ BetaMontclair State University, Upper Montclair21 April 1944IL DeltaUniversity of St. Francis, Joliet21 May 1945KS DeltaWashburn University, Topeka29 March 1947MO GammaWilliam Jewell College, Liberty7 May 1947TX GammaTexas Woman's University, Denton7 May 1947VI AlphaMount Mary College, Milwaukee11 May 1947OH GammaBaldwin-Wallace College, Berea6 June 1947CO AlphaColorado State University, Fort Collins16 May 1949NA JaphaManchester College, North Manchester16 May 1949NA JaphaManchester College, New Wilmington17 May 1950NA JaphaWastminster College, New Wilmington17 May 1950NA JaphaVirginia State University, Patersburg29 Jan 1955PA BetaLaSalle University, Patersburg29 Jan 1955PA BetaLasalle University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1959PA GammaWaynesburg College, Waynesburg23 | OH Alpha | Bowling Green State University, Bowling Green | 24 April 1937 |
| MO BetaUniversity of Central Missouri, Warrensburg10 June 1938TX AlphaTexas Tech University, Lubbock10 May 1940KS GammaBenedictine College, Atchison26 May 1940IA BetaDrake University, Des Moines27 May 1940TN AlphaTennessee Technological University, Cookeville5 June 1941MI BetaCentral Michigan University, Mount Pleasant25 April 1942NJ BetaMontclair State University, Upper Montclair21 April 1944IL DeltaUniversity of St. Francis, Joliet21 May 1945KS DeltaWashburn University, Topeka29 March 1947MO GammaWilliam Jewell College, Liberty7 May 1947TX GammaTexas Woman's University, Denton7 May 1947VI AlphaMount Mary College, Milwaukee11 May 1947OH GammaBaldwin-Wallace College, Berea6 June 1948MO EpsilonCentral Methodist College, Fayette18 May 1949IN AlphaManchester College, North Manchester16 May 1945NAlphaWestminster College, New Wilmington17 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Petersburg29 Jan 1955IN GammaAnderson University, San Luis Obispo23 May 1958N BetaEast Tennessee State University, San Luis Obispo23 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959N BetaEast Tennessee State University, San Luis Obispo <td>MI Alpha</td> <td>Albion College, Albion</td> <td>29 May 1937</td> | MI Alpha | Albion College, Albion | 29 May 1937 |
| TX AlphaTexas Tech University, Lubbock10 May 1940KS GammaBenedictine College, Atchison26 May 1940IA BetaDrake University, Des Moines27 May 1940TN AlphaTennessee Technological University, Cookeville5 June 1941MI BetaCentral Michigan University, Mount Pleasant25 April 1942NJ BetaMontclair State University, Upper Montclair21 April 1944IL DeltaUniversity of St. Francis, Joliet21 May 1945KS DeltaWashburn University, Topeka29 March 1947MO GammaWilliam Jewell College, Liberty7 May 1947TX GammaTexas Woman's University, Denton7 May 1947VI AlphaMount Mary College, Milwaukee11 May 1947OH GammaBaldwin-Wallace College, Berea6 June 1947CO AlphaColorado State University, Fort Collins16 May 1949MS GammaUniversity of Southern Mississippi, Hattiesburg21 May 1949NAlphaManchester College, North Manchester16 May 1950N BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952NA AlphaVirginia State University, Anderson5 April 1957CA GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1959VA AlphaVirginia State University, San Luis Obispo23 May 1959N BetaEast Tennessee State University, San Luis Obispo23 May 1959N BetaEast Tennes | MO Beta | University of Central Missouri, Warrensburg | 10 June 1938 |
| KS GammaBenedictine College, Atchison26 May 1940IA BetaDrake University, Des Moines27 May 1940TN AlphaTennessee Technological University, Cookeville5 June 1941MI BetaCentral Michigan University, Mount Pleasant25 April 1942NJ BetaMontclair State University, Upper Montclair21 April 1944IL DeltaUniversity of St. Francis, Joliet21 May 1945KS DeltaWashburn University, Topeka29 March 1947MO GammaWilliam Jewell College, Liberty7 May 1947TX GammaTexas Woman's University, Denton7 May 1947VI AlphaMount Mary College, Milwaukee11 May 1947OH GammaBaldwin-Wallace College, Berea6 June 1947CO AlphaColorado State University, Fort Collins16 May 1948MO EpsilonCentral Methodist College, Fayette18 May 1949N AlphaManchester College, North Manchester16 May 1950PA AlphaWestminster College, New Wilmington17 May 1950N BetaButler University, Philadelphia19 May 1953VA AlphaVirginia State University, Patersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1959VA AlphaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Rearney, Kearney11 Dec 1959N DeltaUniversity of Nebraska—Kearney, Kearney11 Dec 1959 | TX Alpha | Texas Tech University, Lubbock | 10 May 1940 |
| IA BetaDrake University, Des Moines27 May 1940TN AlphaTennessee Technological University, Cookeville5 June 1941MI BetaCentral Michigan University, Mount Pleasant25 April 1942NJ BetaMontclair State University, Upper Montclair21 April 1944IL DeltaUniversity of St. Francis, Joliet21 May 1945KS DeltaWashburn University, Topeka29 March 1947MO GammaWilliam Jewell College, Liberty7 May 1947TX GammaTexas Woman's University, Denton7 May 1947VI AlphaMount Mary College, Milwaukee11 May 1947OG AlphaColorado State University, Fort Collins16 May 1948MO EpsilonCentral Methodist College, Fayette18 May 1949N AlphaManchester College, North Manchester16 May 1945NA JaphaWestminster College, North Manchester16 May 1950N AlphaWestminster College, New Wilmington17 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Petersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959N BetaRadford University, Rearney, Kearney11 Dec 1959N DeltaUniversity of Keyneska—Kearney, Kearney11 Dec 1959 | KS Gamma | Benedictine College, Atchison | 26 May 1940 |
| TN AlphaTennessee Technological University, Cookeville5 June 1941MI BetaCentral Michigan University, Mount Pleasant25 April 1942NJ BetaMontclair State University, Upper Montclair21 April 1944IL DeltaUniversity of St. Francis, Joliet21 May 1945KS DeltaWashburn University, Topeka29 March 1947MO GammaWilliam Jewell College, Liberty7 May 1947TX GammaTexas Woman's University, Denton7 May 1947VI AlphaMount Mary College, Milwaukee11 May 1947OG AlphaColorado State University, Fort Collins16 May 1948MO EpsilonCentral Methodist College, Fayette18 May 1949MS GammaUniversity of Southern Mississippi, Hattiesburg21 May 1949IN AlphaManchester College, North Manchester16 May 1949IN BetaButler University, Indianapolis16 May 1950IN BetaButler University, Philadelphia19 May 1953VA AlphaVirginia State University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959N BetaRadford University, Radford12 Nov 1959N DeltaUniversity of Nebraska—Kearney, Kearney11 Dec 1959 | IA Beta | Drake University, Des Moines | 27 May 1940 |
| MI BetaCentral Michigan University, Mount Pleasant25 April 1942NJ BetaMontclair State University, Upper Montclair21 April 1944IL DeltaUniversity of St. Francis, Joliet21 May 1945KS DeltaWashburn University, Topeka29 March 1947MO GammaWilliam Jewell College, Liberty7 May 1947TX GammaTexas Woman's University, Denton7 May 1947WI AlphaMount Mary College, Milwaukee11 May 1947OH GammaBaldwin-Wallace College, Berea6 June 1947CO AlphaColorado State University, Fort Collins16 May 1948MO EpsilonCentral Methodist College, Fayette18 May 1949MS GammaUniversity of Southern Mississippi, Hattiesburg21 May 1949IN AlphaManchester College, North Manchester16 May 1950PA AlphaWestminster College, New Wilmington17 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Philadelphia19 May 1953VA AlphaVirginia State University, San Luis Obispo23 May 1958TN BetaEast Tennessee State University, San Luis Obispo23 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959N DeltaUniversity of Keynsyille12 Nov 1959N DeltaUniversity of Keynsyille23 May 1959 | TN Alpha | Tennessee Technological University, Cookeville | 5 June 1941 |
| NJ BetaMontclair State University, Upper Montclair21 April 1944IL DeltaUniversity of St. Francis, Joliet21 May 1945KS DeltaWashburn University, Topeka29 March 1947MO GammaWilliam Jewell College, Liberty7 May 1947TX GammaTexas Woman's University, Denton7 May 1947WI AlphaMount Mary College, Milwaukee11 May 1947OH GammaBaldwin-Wallace College, Berea6 June 1947CO AlphaColorado State University, Fort Collins16 May 1948MO EpsilonCentral Methodist College, Fayette18 May 1949MS GammaUniversity of Southern Mississippi, Hattiesburg21 May 1949IN AlphaManchester College, North Manchester16 May 1950PA AlphaWestminster College, New Wilmington17 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Petersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1958TN BetaEast Tennessee State University, Radford12 Nov 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959N DeltaUniversity of Nebraska—Kearney, Kearney11 Dec 1959 | MI Beta | Central Michigan University, Mount Pleasant | 25 April 1942 |
| IL DeltaUniversity of St. Francis, Joliet21 May 1945KS DeltaWashburn University, Topeka29 March 1947MO GammaWilliam Jewell College, Liberty7 May 1947TX GammaTexas Woman's University, Denton7 May 1947WI AlphaMount Mary College, Milwaukee11 May 1947OH GammaBaldwin-Wallace College, Berea6 June 1947CO AlphaColorado State University, Fort Collins16 May 1948MO EpsilonCentral Methodist College, Fayette18 May 1949MS GammaUniversity of Southern Mississippi, Hattiesburg21 May 1949IN AlphaManchester College, North Manchester16 May 1949IN AlphaManchester College, North Manchester16 May 1950PA AlphaWestminster College, New Wilmington17 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Petersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959N DeltaUniversity of Nebraska—Kearney, Kearney11 Dec 1959 | NJ Beta | Montclair State University, Upper Montclair | 21 April 1944 |
| KS DeltaWashburn University, Topeka29 March 1947MO GammaWilliam Jewell College, Liberty7 May 1947TX GammaTexas Woman's University, Denton7 May 1947WI AlphaMount Mary College, Milwaukee11 May 1947OH GammaBaldwin-Wallace College, Berea6 June 1947CO AlphaColorado State University, Fort Collins16 May 1948MO EpsilonCentral Methodist College, Fayette18 May 1949MS GammaUniversity of Southern Mississippi, Hattiesburg21 May 1949IN AlphaManchester College, North Manchester16 May 1950PA AlphaWestminster College, North Manchester16 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Petersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1958TN BetaEast Tennessee State University, Johnson City22 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959N E BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959N DeltaUniversity of Nebraska—Kearney, Kearney11 Dec 1959 | IL Delta | University of St. Francis, Joliet | 21 May 1945 |
| MO GammaWilliam Jewell College, Liberty7 May 1947TX GammaTexas Woman's University, Denton7 May 1947WI AlphaMount Mary College, Milwaukee11 May 1947OH GammaBaldwin-Wallace College, Berea6 June 1947CO AlphaColorado State University, Fort Collins16 May 1948MO EpsilonCentral Methodist College, Fayette18 May 1949MS GammaUniversity of Southern Mississippi, Hattiesburg21 May 1949IN AlphaManchester College, North Manchester16 May 1950PA AlphaWestminster College, North Manchester16 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Petersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1958TN BetaEast Tennessee State University, Radford12 Nov 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959N EletaUniversity of Nebraska—Kearney, Kearney11 Dec 1959N DeltaUniversity of Nebraska—Kearney, Kearney11 Dec 1959 | KS Delta | Washburn University, Topeka | 29 March 1947 |
| TX GammaTexas Woman's University, Denton7 May 1947WI AlphaMount Mary College, Milwaukee11 May 1947OH GammaBaldwin-Wallace College, Berea6 June 1947CO AlphaColorado State University, Fort Collins16 May 1948MO EpsilonCentral Methodist College, Fayette18 May 1949MS GammaUniversity of Southern Mississippi, Hattiesburg21 May 1949IN AlphaManchester College, North Manchester16 May 1950PA AlphaWestminster College, North Manchester16 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Petersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959N DeltaUniversity of Nebraska—Kearney, Kearney11 Dec 1959 | MO Gamma | William Jewell College, Liberty | 7 May 1947 |
| WI AlphaMount Mary College, Milwaukee11 May 1947OH GammaBaldwin-Wallace College, Berea6 June 1947CO AlphaColorado State University, Fort Collins16 May 1948MO EpsilonCentral Methodist College, Fayette18 May 1949MS GammaUniversity of Southern Mississippi, Hattiesburg21 May 1949IN AlphaManchester College, North Manchester16 May 1950PA AlphaWestminster College, North Manchester16 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Petersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Nebraska—Kearney11 Dec 1959ND EltaUniversity of Svarsville27 May 1960 | TX Gamma | Texas Woman's University, Denton | 7 May 1947 |
| OH GammaBaldwin-Wallace College, Berea6 June 1947CO AlphaColorado State University, Fort Collins16 May 1948MO EpsilonCentral Methodist College, Fayette18 May 1949MS GammaUniversity of Southern Mississippi, Hattiesburg21 May 1949IN AlphaManchester College, North Manchester16 May 1950PA AlphaWestminster College, North Manchester16 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Philadelphia19 May 1953VA AlphaVirginia State University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959ND BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959 | WI Alpha | Mount Mary College, Milwaukee | 11 May 1947 |
| CO AlphaColorado State University, Fort Collins16 May 1948MO EpsilonCentral Methodist College, Fayette18 May 1949MS GammaUniversity of Southern Mississippi, Hattiesburg21 May 1949IN AlphaManchester College, North Manchester16 May 1950PA AlphaWestminster College, North Manchester16 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Philadelphia19 May 1953VA AlphaVirginia State University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959ND BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959 | OH Gamma | Baldwin-Wallace College, Berea | 6 June 1947 |
| MO EpsilonCentral Methodist College, Fayette18 May 1949MS GammaUniversity of Southern Mississippi, Hattiesburg21 May 1949IN AlphaManchester College, North Manchester16 May 1950PA AlphaWestminster College, North Manchester16 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Philadelphia19 May 1953VA AlphaVirginia State University, Petersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959ND BetaUniversity of Svansville27 May 1960 | CO Alpha | Colorado State University, Fort Collins | 16 May 1948 |
| MS GammaUniversity of Southern Mississippi, Hattiesburg21 May 1949IN AlphaManchester College, North Manchester16 May 1950PA AlphaWestminster College, New Wilmington17 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Philadelphia19 May 1953VA AlphaVirginia State University, Petersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, Johnson City22 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959N DeltaUniversity of Svansville27 May 1960 | MO Epsilon | Central Methodist College, Favette | 18 May 1949 |
| IN AlphaManchester College, North Manchester16 May 1950PA AlphaWestminster College, North Manchester16 May 1950PA AlphaWestminster College, New Wilmington17 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Philadelphia19 May 1953VA AlphaVirginia State University, Petersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1958TN BetaEast Tennessee State University, Johnson City22 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959ND DeltaUniversity of Evansville27 May 1960 | MS Gamma | University of Southern Mississippi, Hattiesburg | 21 May 1949 |
| PA AlphaWestminster College, New Wilmington17 May 1950IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Philadelphia19 May 1953VA AlphaVirginia State University, Petersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1958TN BetaEast Tennessee State University, Johnson City22 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959N DeltaUniversity of Evansville27 May 1960 | IN Alpha | Manchester College, North Manchester | 16 May 1950 |
| IN BetaButler University, Indianapolis16 May 1952IN BetaButler University, Indianapolis16 May 1952KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Philadelphia19 May 1953VA AlphaVirginia State University, Petersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1958TN BetaEast Tennessee State University, Johnson City22 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Evansville27 May 1960 | PA Alpha | Westminster College, New Wilmington | 17 May 1950 |
| KS EpsilonFort Hays State University, Hays6 Dec 1952PA BetaLaSalle University, Philadelphia19 May 1953VA AlphaVirginia State University, Petersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1958TN BetaEast Tennessee State University, Johnson City22 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Evansville27 May 1960N DeltaUniversity of Evansville27 May 1960 | IN Beta | Butler University. Indianapolis | 16 May 1952 |
| PA BetaLaSalle University, Philadelphia19 May 1953VA AlphaVirginia State University, Petersburg29 Jan 1955IN GammaAnderson University, Petersburg29 Jan 1955CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1958TN BetaEast Tennessee State University, Johnson City22 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Evansville27 May 1960N DeltaUniversity of Evansville27 May 1960 | KS Epsilon | Fort Havs State University, Havs | 6 Dec 1952 |
| VA AlphaVirginia State University, Petersburg29 Jan 1955IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1958TN BetaEast Tennessee State University, Johnson City22 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Evansville27 May 1960N DeltaUniversity of Evansville27 May 1960 | PA Beta | LaSalle University, Philadelphia | 19 May 1953 |
| IN GammaAnderson University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, Anderson5 April 1957CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1958TN BetaEast Tennessee State University, Johnson City22 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959N DeltaUniversity of Evansville27 May 1960 | VA Alpha | Virginia State University, Petersburg | 29 Jan 1955 |
| CA GammaCalifornia Polytechnic State University, San Luis Obispo23 May 1958TN BetaEast Tennessee State University, Johnson City22 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959N DeltaUniversity of Evansville27 May 1960 | IN Gamma | Anderson University, Anderson | 5 April 1957 |
| TN BetaEast Tenessee State University, Johnson City22 May 1959PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959IN DeltaUniversity of Evansville27 May 1960 | CA Gamma | California Polytechnic State University, San Luis Obispo | 23 May 1958 |
| PA GammaWaynesburg College, Waynesburg23 May 1959VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959IN DeltaUniversity of Evansville27 May 1960 | TN Beta | East Tennessee State University. Johnson City | 22 May 1959 |
| VA BetaRadford University, Radford12 Nov 1959NE BetaUniversity of Nebraska—Kearney, Kearney11 Dec 1959ND BetaUniversity of Evansville27 May 1960 | PA Gamma | Waynesburg College, Waynesburg | 23 May 1959 |
| NE Beta University of Nebraska—Kearney, Kearney 11 Dec 1959 IN Delta University of Evansville 27 May 1960 | VA Beta | Radford University, Radford | 12 Nov 1959 |
| IN Delta University of Evansville Evansville 27 May 1960 | NE Beta | University of Nebraska—Kearney, Kearney | 11 Dec 1959 |
| | IN Delta | University of Evansville, Evansville | 27 May 1960 |

| OH Epsilon | Marietta College, Marietta | 29 Oct 1960 |
|------------|--|---------------|
| MO Zeta | University of Missouri-Rolla, Rolla | 19 May 1961 |
| NE Gamma | Chadron State College, Chadron | 19 May 1962 |
| MD Alpha | College of Notre Dame of Maryland, Baltimore | 22 May 1963 |
| CA Delta | California State Polytechnic University, Pomona | 5 Nov 1964 |
| PA Delta | Marywood University, Scranton | 8 Nov 1964 |
| PA Epsilon | Kutztown University of Pennsylvania, Kutztown | 3 April 1965 |
| AL Epsilon | Huntingdon College, Montgomery | 15 April 1965 |
| PA Zeta | Indiana University of Pennsylvania, Indiana | 6 May 1965 |
| AR Alpha | Arkansas State University, State University | 21 May 1965 |
| TN Gamma | Union University, Jackson | 24 May 1965 |
| WI Beta | University of Wisconsin-River Falls, River Falls | 25 May 1965 |
| IA Gamma | Morningside College, Sioux City | 25 May 1965 |
| MD Beta | McDaniel College, Westminster | 30 May 1965 |
| IL Zeta | Domincan University, River Forest | 26 Feb 1967 |
| SC Beta | South Carolina State College, Orangeburg | 6 May 1967 |
| PA Eta | Grove City College, Grove City | 13 May 1967 |
| NY Eta | Niagara University, Niagara University | 18 May 1968 |
| MA Alpha | Assumption College, Worcester | 19 Nov 1968 |
| MO Eta | Truman State University, Kirksville | 7 Dec 1968 |
| IL Eta | Western Illinois University, Macomb | 9 May 1969 |
| OH Zeta | Muskingum College, New Concord | 17 May 1969 |
| PA Theta | Susquehanna University, Selinsgrove | 26 May 1969 |
| PA Iota | Shippensburg University of Pennsylvania, Shippensburg | 1 Nov 1969 |
| MS Delta | William Carey College, Hattiesburg | 17 Dec 1970 |
| MO Theta | Evangel University, Springfield | 12 Jan 1971 |
| PA Kappa | Holy Family College, Philadelphia | 23 Jan 1971 |
| CO Beta | Colorado School of Mines, Golden | 4 March 1971 |
| KY Alpha | Eastern Kentucky University, Richmond | 27 March 1971 |
| TN Delta | Carson-Newman College, Jefferson City | 15 May 1971 |
| NY Iota | Wagner College, Staten Island | 19 May 1971 |
| SC Gamma | Winthrop University, Rock Hill | 3 Nov 1972 |
| IA Delta | Wartburg College, Waverly | 6 April 1973 |
| PA Lambda | Bloomsburg University of Pennsylvania, Bloomsburg | 17 Oct 1973 |
| OK Gamma | Southwestern Oklahoma State University, Weatherford | 1 May 1973 |
| NY Kappa | Pace University, New York | 24 April 1974 |
| TX Eta | Hardin-Simmons University, Abilene | 3 May 1975 |
| MO Iota | Missouri Southern State University, Joplin | 8 May 1975 |
| GA Alpha | State University of West Georgia, Carrollton | 21 May 1975 |
| WV Alpha | Bethany College, Bethany | 21 May 1975 |
| FL Beta | Florida Southern College, Lakeland | 31 Oct 1976 |
| WI Gamma | University of Wisconsin—Eau Claire, Eau Claire | 4 Feb 1978 |
| MD Delta | Frostburg State University, Frostburg | 17 Sept 1978 |
| IL Theta | Benedictine University, Lisle | 18 May 1979 |
| PA Mu | St. Francis University, Loretto | 14 Sept 1979 |
| AL Zeta | Birmingham-Southern College, Birmingham | 18 Feb 1981 |
| CT Beta | Eastern Connecticut State University, Willimantic | 2 May 1981 |
| NY Lambda | C.W. Post Campus of Long Island University, Brookville | 2 May 1983 |
| MO Kappa | Drury University, Springfield | 30 Nov 1984 |
| CO Gamma | Fort Lewis College, Durango | 29 March 1985 |

| NE Delta | Nebraska Wesleyan University, Lincoln | 18 April 1986 |
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| TX Iota | McMurry University, Abilene | 25 April 1987 |
| PA Nu | Ursinus College, Collegeville | 28 April 1987 |
| VA Gamma | Liberty University. Lynchburg | 30 April 1987 |
| NY Mu | St. Thomas Aquinas College, Sparkill | 14 May 1987 |
| OH Eta | Ohio Northern University. Ada | 15 Dec 1987 |
| OK Delta | Oral Roberts University, Tulsa | 10 April 1990 |
| CO Delta | Mesa State College, Grand Junction | 27 April 1990 |
| PA Xi | Cedar Crest College, Allentown | 30 Oct 1990 |
| MO Lambda | Missouri Western State College, St. Joseph | 10 Feb 1991 |
| TX Kappa | University of Mary Hardin-Baylor, Belton | 21 Feb 1991 |
| SC Delta | Erskine College. Due West | 28 April 1991 |
| SD Alpha | Northern State University, Aberdeen | 3 May 1992 |
| NY Nu | Hartwick College Oneonta | 14 May 1992 |
| NH Alpha | Keene State College, Keene | 16 Feb 1993 |
| LA Gamma | Northwestern State University Natchitoches | 24 March 1993 |
| KY Beta | Cumberland College, Williamsburg | 3 May 1993 |
| MS Ensilon | Delta State University Cleveland | 19 Nov 1994 |
| PA Omicron | University of Pittsburgh at Johnstown Johnstown | 10 April 1997 |
| MI Delta | Hillsdale College Hillsdale | 30 April 1997 |
| MI Ensilon | Kettering University Flint | 28 March 1998 |
| KS Zeta | Southwestern College Winfield | 14 April 1998 |
| TN Ensilon | Bethel College McKenzie | 16 April 1998 |
| MO Mu | Harris-Stowe College, St. Louis | 25 April 1998 |
| GA Beta | Georgia College and State University Milledgeville | 25 April 1998 |
| AL Eta | University of West Alabama Livingston | 4 May 1998 |
| NY Xi | Buffalo State College, Buffalo | 12 May 1998 |
| NC Delta | High Point University, High Point | 24 March 1999 |
| PA Pi | Slipperv Rock University Slipperv Rock | 19 April 1999 |
| TX Lambda | Trinity University, San Antonio | 22 November 1999 |
| GA Gamma | Piedmont College Demorest | 7 April 2000 |
| LA Delta | University of Louisiana Monroe | 11 February 2001 |
| GA Delta | Berry College, Mount Berry | 21 April 2001 |
| TX Mu | Schreiner University Kerrville | 28 April 2001 |
| NI Gamma | Monmouth University | 21 April 2002 |
| CA Epsilon | California Bantist University Riverside | 21 April 2002 |
| PA Rho | Thiel College, Greenville | 13 February 2004 |
| VA Delta | Marymount University Arlington | 26 March 2004 |
| NY Omicron | St. Joseph's College, Patchogue | 1 May 2004 |
| IL Iota | Lewis University. Romeoville | 26 February 2005 |
| WV Beta | Wheeling Jesuit University, Wheeling | 11 March 2005 |
| SC Epsilon | Francis Marion University, Florence | 18 March 2005 |
| PA Sigma | Lycoming College, Williamsport | 1 April 2005 |
| MO Nu | Columbia College, Columbia | 29 April 2005 |
| MD Epsilon | Stevenson University. Stevenson | 3 December 2005 |
| NJ Delta | Centenary College, Hackettstown | 1 December 2006 |
| NY Pi | Mount Saint Mary College. Newburgh | 20 March 2007 |
| OK Epsilon | Oklahoma Christian University. Oklahoma City | 20 April 2007 |
| HA Alpha | Hawaii Pacific University, Waipahu | 22 October 2007 |
| NC Epsilon | North Carolina Weslevan College. Rocky Mount | 24 March 2008 |
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| CA Zeta | Simpson University, Redding | 4 April 2009 |
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| NY Rho | Molloy College, Rockville Center | 21 April, 2009 |
| NC Zeta | Catawba College, Salisbury | 17 September, 2009 |
| RI Alpha | Roger Williams University, Bristol | 13 November, 2009 |
| NJ Epsilon | New Jersey City University, Jersey City | 22 February, 2010 |
| NC Epsilon | Johnson C. Smith University, Charlotte | 18 March, 2010 |
| AL Theta | Jacksonville State University, Jacksonville | 29 March, 2010 |
| FL Gamma | Southeastern University, Lakeland | 31 March, 2010 |

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