# 2018 PME Conference Schedule

**9:00–10:00: Registration & Breakfast - Lincoln 510**

**10:00–10:15: Welcome & Introduction - Lincoln 510**

Dr. Wim Steeland, Dean, College of STEM  
Elise Eckman, YSU PME Chapter President

<table>
<thead>
<tr>
<th>Time</th>
<th>Lincoln 112</th>
<th>Lincoln 114</th>
<th>Lincoln 115</th>
<th>Lincoln 103</th>
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<tbody>
<tr>
<td>10:20-10:35</td>
<td>Emanuel Psaras</td>
<td>Simon Richard and Alex Schroeder</td>
<td>Vladimir Sworski</td>
<td>COMAP-MCM A and Alex Schroeder</td>
</tr>
<tr>
<td>10:40-10:55</td>
<td>Lewis Dominguez</td>
<td>Joshua Khavari</td>
<td>Richard Ryan</td>
<td>COMAP-MCM A</td>
</tr>
<tr>
<td>11:00-11:15</td>
<td>Kimberly Schveder</td>
<td>Trevor Arrigon</td>
<td>Alexandra Ballow</td>
<td>COMAP MCM B and Bridget Scanga</td>
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<tr>
<td>11:40-11:55</td>
<td>Zachary Linger</td>
<td>Kaitlyn Shirey</td>
<td>Bryan Ritchie</td>
<td>COMAP MCM</td>
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### 11:55–12:50: Lunch - St. John’s Episcopal Church Hall

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<thead>
<tr>
<th>Time</th>
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<th>Lincoln 114</th>
<th>Lincoln 115</th>
<th>Lincoln 103</th>
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<tbody>
<tr>
<td>12:50-1:05</td>
<td>Lulu Liu</td>
<td>Samuel Delatore</td>
<td>Kaila DeChristofaro and Rebecca Himes, and Jessica Leffler</td>
<td>COMAP MCM</td>
</tr>
<tr>
<td>1:10-1:25</td>
<td>Mark Leadingham</td>
<td>Aaron Loveless</td>
<td>Nicholas Caiazza</td>
<td>COMAP MCM</td>
</tr>
<tr>
<td>1:30-1:45</td>
<td>Luke Szramowski</td>
<td>Kory Slusser</td>
<td>Rabin Thapa</td>
<td>Alek Yoder</td>
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### 1:50: Closing Remarks - Lincoln 510

Youngstown State has partnered with AT&T to deliver visitor wireless Internet access on campus through the “atwifi” wireless network. This is an unsecure wireless network and is not protected by any of the University’s cyber-related safeguards. The code for access is: WPZM-gXZH-18. The AT&T wireless network is supported directly by AT&T.
Group theory, as its own branch of mathematics, has been formally studied since approximately the 19th century. Since then, this branch has shown to be very fruitful in developing new concepts and giving further insight on old ones. The main topic of this research was to find out how these group theoretic concepts can be applied to disciplines outside of just mathematics. Using different resources, I try to show how these concepts can be applied to areas such as crystallography, computer science, and physics. The hope is not to inundate the audience with difficult to understand mathematics, but to give meaningful exposition as to how group theory is used in each of the disciplines.

While some complex problems can have complex origins, not all do. This car ride brain teaser is a puzzle that was proposed by a 6th grader: “Could you come up with an expression that used the numbers 1 through 10 in order, that used addition, subtraction, multiplication, division, and exponentiation, and that was equivalent to 40?” This talk explores the solution to the original brain teaser and the many interesting questions that stemmed from our several months-long research.

Topological spaces are one of the fundamental building blocks of mathematics. They have a strong relationship with other mathematical objects such as groups and fields. A covering space of a specific topological space is mapped via a covering map so that all points in the original space are evenly covered by that mapping. Topological spaces have many covering spaces, and categorization of such spaces represented an interesting challenge to 20th century mathematicians. The solution yields a Galois correspondence, which is a relationship between the various covering spaces of a given space on the one hand, and the subgroups of its fundamental group on the other.
Split-step parabolic equation methods (SSPE) are used to model the propagation of high-frequency (HF) signals reflected between the earth's surface and the ionosphere over long distances in a procedure called “skipping.” Three simulated terrain topographies are tested to see if the features in the land create significant changes in the total length the signal can be transmitted. The dielectric function of the air and ionosphere are derived with respect to the altitude and temperature of each, and used in conjunction with the terrain and beam properties in the simulation.
In February 2017, a number theoretic problem was posed in *Mathematics Magazine* by Souvik Dey, a master’s student in India. The problem asked whether it was possible to represent a real number by a finite sum of elements in an open subset of the real numbers. Specifically, the open subset must contain one positive and one negative number. This talk will showcase a solution to this problem, as well as an extension to the real plane.

Is the game of professional baseball fair? For years, fans have provided anecdotal evidence to support the theory that large market teams have an unfair advantage over small market teams in their ability to attract the best players by granting astronomical salaries. In fact, this argument was the basis for a best-selling book and highly acclaimed movie, “Moneyball”. By using the payroll data set from the MLB dating back to 2012 and applying statistical methods, the truth behind the rumors is finally revealed!

Every year, the Barbershop Harmony Society (BHS) holds competitions to see who will be the next International Barbershop Quartet champion. Each competitor, i.e. quartet, consists of four males of any age and singing experience (depending on the type of competition). The quartets sing two songs per round of judging, where they can receive up to 100 points per judge, and their final score is then viewed as a percentage of the total possible points. The winner of the competition is the quartet with the highest score. There are three kinds of competition: one confined to a specific (geographical/regional) district, a qualifying competition per district for the International competition, and the International competition itself. The primary goal of this project is to analyze data from past International competitors to see what factors affect the mean final score of a quartet and, accordingly, determine the placement of each quartet, for the International contest. The variables considered are 1) number of previous competitions attended, 2) the qualifying score of each quartet, and 3) the number of songs sung of three categories, “Ballad,” “Middle,” and “Uptune.” A Bayesian linear model is used to find the variables associated with the final score. We define our likelihood, a suitable prior distribution, and find a posterior using MCMC. R statistical package is used for computations.
Morning Session 10:40-10:55 (continued)

10:40-10:55 Lincoln 103

COMAP Modeling Discussion

All are welcome to discuss this year’s COMAP problems and potential solutions to both the discrete and continuous problems. This informal session is meant to share ideas and strategies for the approach to the problems, which are provided on Page 14 of this abstract book.
Morning Session 11:00-11:15

11:00-11:15 Lincoln 112

Kimberly Schveder

Analysis of Pharmaceutical Manufacturing Data with a Logistic Regression Model

Cleveland State University

Advised by: Dr. Richard Fan

In the case study about addressing the precipitation in a particular generic pharmaceutical drug, a logistic regression was used to model the probability of consumer complaints and the relevant explanatory variables. We examined the significance of each of the explanatory variables. Interactions were discovered between some of the explanatory variables and an association was discovered between two of the explanatory variables.

11:00-11:15 Lincoln 114

Trevor Arrigoni

Generalizing the Pill Problem

Westminster College

Advised by: Dr. Natasha Fontes-Merz

Consider a patient with a pill bottle. In the pill bottle, there are two sizes of pills, large and small. Each day the patient takes the equivalent of a half pill, breaking a large pill into two small pills if one is chosen. What is the expected amount of days it will take the patient to rid the pill bottle of large pills? This question was proposed in 1991 by Knuth and McCarthy as a challenge problem in American Mathematical Monthly. In 2014, Bayer and Brandt researched a generalization of this question: How many ways are there to finish the bottle? We consider a generalization of this problem by considering a pill bottle with three sizes: large, medium and small. We also consider different ways of splitting up the three pills.

11:00-11:15 Lincoln 115

Alexandra Balow

Fairly Divided

Youngstown State University

Advised by: Dr. Thomas Wakefield

The world can be a vastly unfair place. Decisions are subjective and people can be hurt by those subjective decisions. Consider scholarships. Often the candidates are so competitive, it is difficult to decide who should get the scholarships. When two people are tied for the last spot, an arbitrary decision must be made and one applicant will not get what he or she deserves just by chance. Is there a way to distribute goods in such a way that everyone is happy? One way to answer this question is through the field of math called fair division. After applying fair division practices to a real scholarship, it was discovered that a mostly objective decision can be made with human oversight. The algorithm gave similar results to what a human team would.
A box model was used to predict major trends in migration patterns over a 50 year temporal resolution throughout the world. Assumptions were made to isolate the key motivator for migration, that is GDP per capita, or affluence. The model is based on an exponential growth function. Individual growth rates based on the country of origin’s economic development were then nested within each iteration to make relative reproduction within a region more realistic. A stochastic transition matrix was then used to track the movement of immigrants based on original probability data. Results show developed regions becoming the most populated, least developed regions growing in population, while developing regions decline in population. Within 50 years, the model predicts that developed regions become largely populated by immigrants from least developed and developing countries, transforming these developed countries into linguistically diverse regions.
Morning Session 11:20-11:35

David Gessler and Nicole Zimmerman
Youngstown Temperature Forecast
Youngstown State University
Advised by: Dr. Moon Nguyen and Dr. Thomas Wakefield

The Actuaries Climate Index (ACI) has recorded weather patterns between the years 1961–2017, allowing people to access past climate changes in North America through multiple aspects. The ACI gave us the idea to create predictions for the weather in Youngstown over a 30-year period (1987–2017). We used regression to fit several different models to the data and determined the error between the values predicted and the actual values to ultimately predict the best value.

Warren Geither, Parker Servello, and John Yannotty
Investigating the Role of Random Forest in Classifying Cognitive Domain Functionality
Slippery Rock University
Advised by: Dr. Dil Singhabahu

To analyze the effects of ginkgo biloba on cognitive decline, a multi-center study produced neuropsychological (NP) test scores and magnetic resonance imaging (MRI) data for participants aged 75 or older. Various studies have shown correlation between the exercise of a cognitive domain and increased levels of activity in corresponding regions of the brain. Also, current research strongly suggests the existence of a link between the relative size of these regions and the functionality of the corresponding cognitive domain. The main focus of this study is to apply machine learning techniques to the NP scores and MRI measurements to investigate the relationship between the relative size of brain regions and cognitive domain functionality in the context of the progression of Alzheimer’s disease. Currently, random forest is the primary method used for discrete classification. In this case, the algorithm generates a set amount of decision trees from a bootstrapped sample in effort to construct a forest that is capable of classifying a patient’s cognitive ability. Each node in the tree focuses on a particular prediction variable. Those variables with the highest entropy are selected for the initial levels, as they present the most randomness in the bootstrapped sample. Once completed, variables that indicate cognitive impairment can be identified along with the overall classification performance through the means of a confusion matrix and an out of bag error estimate. In order to understand machine learning and its appropriateness to investigate this data, machine learning was examined through underlying probability and statistical theory.

Victoria Jakicic
Zeros of Newform Eisenstein Series on $\Gamma_0(q_1q_2)$
Indiana University of Pennsylvania
Advised by: Dr. Rachelle Bouchat

During a Research Experience for Undergraduates at Texas A&M in the summer of 2017, we examined the zeros of newform Eisenstein series $E_{\chi_1,\chi_2,k}(z)$ of weight $k$ on $\Gamma_0(q_1q_2)$, where $\chi_1$ and $\chi_2$ are primitive characters modulo $q_1$ and $q_2$, respectively. In this talk, we will use the Fourier expansion to examine the zeros where the imaginary part is greater than $\sqrt{k}$.

William Davis and Chris Ligato
Deterministic Model of Geographic Language Distributions
Slippery Rock University
Advised by: Dr. Nicholas Hurl
Complex numbers are inherently two dimensional. So, visualizing complex-valued functions requires four dimensions. We satisfy this requirement by introducing colors to encode the output of the function. Often, we find these colorings to be visually stimulating. Today we will discuss the basics needed to create these colorings.

My senior research project is twofold: dealing with the most effective way to communicate math to popular audiences and with Discrete Morse Functions (DMF) on triangulated surfaces, which allow us to simplify the way we think about the surfaces, deforming them into fewer pieces so that we can study the simplest forms. This process is applicable to computer graphics, and may also play a role in reconciling quantum mechanics with general relativity by modeling space-time as discrete rather than smoothly curved. By defining relationships between the simplices of a surface, we can assign a vertex ordering function and induce a DMF using a standard procedure. By assigning values to vertices in new ways, we can reuse the same process of induction to get different results. The goal is to understand the best way to assign vertex ordering functions in order to create perfect DMF, giving the simplest surface. In this presentation, I plan to show the different kinds of vertex ordering functions, how to find the components of the simplicial complex, and how to induce a DMF. I will also address how DMF deform the surface through visuals and present a theorem that gives information about the critical simplices of a surface after inducing a DMF.

The National Football League is a multi-billion dollar industry but the decisions on the field are not being made correctly. The risk-adverse nature of coaches does not allow for key game decisions to be made. Statistics show that coaches should be making different calls when it comes to 4th down and extra points.

All are welcome to discuss this year’s COMAP problems and potential solutions to both the discrete and continuous problems. This informal session is meant to share ideas and strategies for the approach to the problems, which are provided on Page 14 of this abstract book.
I will talk about three methods to sum a $p$-series ($p = 2$). The first method is how Euler did it. The second method is using residue theorem. The third method is about Fourier Series of piece-wise continuous function.

In this presentation, we'll look at a random-number based game that was first presented to me by my English teacher. We will examine some specific cases, tackle the general case, and discuss some possible extensions to the game.

The purpose of this project is to learn about the pre-processing of functional Magnetic Resonance Imaging (fMRI) and understand the mathematical concepts behind it. This research will be part of a bigger research project, studying attention networks in brains of children whose mothers used substances during their pregnancies and comparing how they perform. The data we will use comes from the Maternal Health Project University of Pittsburgh, where the children of women who used substances and the control subjects had fMRI brain scans performed around their 21st birthday. These fMRI machines capture blood flow in various areas of the brain, allowing us to see when a region of the brain is considered “active”. A region is considered more active than another when there is a higher rate of blood flow into that region. We predict that the children whose mothers used more substances will have less brain activity, and thus less attention, than the children whose mothers did not use substances. Afterwards, we will analyze the data and determine if the partial least-squares regression is a better model to predict the attention in a person’s brain over multiple linear regression. We will be presenting the various steps in the pre-processing method to normalize the brain scan, and why these steps are important. Some of these processes include: motion correction, slice-timing correction, spatial filtering, temporal filtering, and global intensity normalization. All of these steps are important in order to make brain images comparable to one another. Without pre-processing, brain images would be noisy and unstandardized and would make statistical analysis highly inaccurate. Additionally, we will be explaining some mathematical concepts that underlie these methods, and why these methods are known to be beneficial to the analysis of brain imaging.
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Afternoon Session 1:10-1:25

Mark Lendingham
Computing the Synchronizability Index of Strongly Regular Graphs
West Virginia Wesleyan College
Advised by: Dr. Jesse Oldroyd

Synchronizable networks can be viewed physically as a group of flashing fireflies, an audience clapping their hands, or abstractly as a graph with nodes and edges. An undirected, strongly regular graph (SRG) has adjacency matrix and Laplacian matrix with distinct eigenvalues. We then introduce a compact formula for the synchronizability index of a SRG, which is based solely on the structure of the graph. This result is extended to infinite families of graphs in which the same parameters determine the structure no matter the number of nodes in the graph. Additionally, several families' synchronizability indexes are compared against that of their complement graphs.

Aaron Loveless
Distance between two points
Youngstown State University
Advised by: Dr. Thomas Smotzer

In this talk we find the average distance between two randomly chosen points on a unit interval, unit square, and a unit cube. We'll introduce the triangular distribution and polar coordinates to solve for the unit square. We will also set up the integrals for the unit cube using the triangular distribution and spherical coordinates.

Nicholas Caiazza
The Math Behind Cryptocurrency
Westminster College
Advised by: Dr. David Offner

In this research, a new cryptocurrency called CCoin was created to expose the underlying mathematics involved in securing it. In coding a new cryptocurrency, the steps in creating a secure coin become evident with such math as elliptic curve arithmetic, digital signatures, the elliptic curve digital signature algorithm, and SHA-256. With this math, cryptocurrencies can be more secured.

COMAP Modeling Discussion
All are welcome to discuss this year's COMAP problems and potential solutions to both the discrete and continuous problems. This informal session is meant to share ideas and strategies for the approach to the problems, which are provided on Page 14 of this abstract book.

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In this talk, we will discuss what a square friendly set of length $n$ is and how we can find or build such a set, by applying the principle of Pythagorean $n$-tuples. We will also consider how many sets of this type exist, for each length $n$.

People in the investing world developed a tool, called the “Directional Movement Indicator,” that claims to help predict future stock price movements. Due to a lack of published research either proving or disproving this indicator’s effectiveness, I decided to investigate. If it works, why doesn’t everyone use it? If it isn’t effective, why are there groups that advocate for it? In order to find out I developed a program that tested the indicator on historical NYSE data to see how well it worked.

The infinite series of the form

$$\sum_{n=1}^{\infty} \frac{1}{n(n+1)(n+2)\cdots(n+k)} \quad i.e. \quad \sum_{n=1}^{\infty} \left[ \prod_{i=0}^{k} \frac{1}{n+i} \right]; \quad k \in \mathbb{N}$$

appears frequently in various problems related to series. This paper discusses an approach to find precisely what those series converge to by developing a general pattern to resolve them into their equivalent partial fractions followed by the telescoping forms of the series. Meanwhile, the connection of those series with the “Pascal’s Triangle” illustrates the underlying mathematical beauty and symmetry.

What Cayley Tables and Group Theory are and what complex patterns can come from a function of modulus operations will be discussed.
Continuous Modeling (Problem A)
Multi-hop HF Radio Propagation

Background: On high frequencies (HF, defined to be 3–30 MHz), radio waves can travel long distances (from one point on the earth’s surface to another distant point on the earth’s surface) by multiple reflections off the ionosphere and off the earth. For frequencies below the maximum usable frequency (MUF), HF radio waves from a ground source reflect off the ionosphere back to the earth, where they may reflect again back to the ionosphere, where they may reflect again back to the earth, and so on, travelling further with each successive hop. Among other factors, the characteristics of the reflecting surface determine the strength of the reflected wave and how far the signal will ultimately travel while maintaining useful signal integrity. Also, the MUF varies with the season, time of day, and solar conditions. Frequencies above the MUF are not reflected/refracted, but pass through the ionosphere into space. In this problem, the focus is particularly on reflections off the ocean surface. It has been found empirically that reflections off a turbulent ocean are attenuated more than reflections off a calm ocean. Ocean turbulence will affect the electromagnetic gradient of seawater, altering the local permittivity and permeability of the ocean, and changing the height and angle of the reflection surface. A turbulent ocean is one in which wave heights, shapes, and frequencies change rapidly, and the direction of wave travel may also change.

Part I: Develop a mathematical model for this signal reflection off the ocean. For a 100-watt HF constant-carrier signal, below the MUF, from a point source on land, determine the strength of the first reflection off a turbulent ocean and compare it with the strength of a first reflection off a calm ocean. (Note that this means that there has been one reflection of this signal off the ionosphere.) If additional reflections (2 through $n$) take place off calm oceans, what is the maximum number of hops the signal can take before its strength falls below a usable signal-to-noise ratio (SNR) threshold of 10 dB?

Part II: How do your findings from Part I compare with HF reflections off mountainous or rugged terrain versus smooth terrain?

Part III: A ship travelling across the ocean will use HF for communications and to receive weather and traffic reports. How does your model change to accommodate a shipboard receiver moving on a turbulent ocean? How long can the ship remain in communication using the same multi-hop path?

Part IV: Prepare a short (1 to 2 pages) synopsis of your results suitable for publication as a short note in IEEE Communications Magazine.
Discrete Modeling (Problem B)

How Many Languages?

Background: There are currently about 6,900 languages spoken on Earth. About half the world’s population claim one of the following ten languages (in order of most speakers) as a native language: Mandarin (incl. Standard Chinese), Spanish, English, Hindi, Arabic, Bengali, Portuguese, Russian, Punjabi, and Japanese. However, much of the world’s population also speaks a second language. When considering total numbers of speakers of a particular language (native speakers plus second or third, etc. language speakers), the languages and their order change from the native language list provided. The total number of speakers of a language may increase or decrease over time because of a variety of influences to include, but not limited to, the language(s) used and/or promoted by the government in a country, the language(s) used in schools, social pressures, migration and assimilation of cultural groups, and immigration and emigration with countries that speak other languages. Moreover, in our globalized, interconnected world there are additional factors that allow languages that are geographically distant to interact. These factors include international business relations, increased global tourism, the use of electronic communication and social media, and the use of technology to assist in quick and easy language translation.

<table>
<thead>
<tr>
<th>Native Language Rank</th>
<th>Native Language</th>
<th>Family</th>
<th>Native Speakers</th>
<th>Second Language Speakers</th>
<th>Second Language Rank</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mandarin Chinese</td>
<td>Sino-Tibetan</td>
<td>897</td>
<td>193</td>
<td>4</td>
<td>1.09 billion</td>
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<td>2</td>
<td>Spanish</td>
<td>Indo-European</td>
<td>436</td>
<td>91</td>
<td>8</td>
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<td>3</td>
<td>English</td>
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<td>611</td>
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<td>983</td>
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<td>4</td>
<td>Hindustani</td>
<td>Indo-European</td>
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<td>Arabic</td>
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<td>Russian</td>
<td>Indo-European</td>
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<td>113</td>
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<td>9</td>
<td>Punjabi</td>
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<td>?</td>
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<td>10</td>
<td>Japanese</td>
<td>Japonic</td>
<td>128</td>
<td>1</td>
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Retrieved from https://en.wikipedia.org/wiki/List_of_languages_by_total_number_of_speakers on January 17, 2018. All numbers in millions unless otherwise noted. Problem: A large multinational service company, with offices in New York City in the United States and Shanghai in China, is continuing to expand to become truly international. This company is investigating opening additional international offices and desires to have the employees of each office speak both in English and one or more additional languages. The Chief Operating Officer of the company has hired your team to investigate trends of global languages and location options for new offices.

Part I: A. Consider the influences and factors described in the background paragraph above, as well as other factors your group may identify. Based on projected trends, and some or all of these influences and factors, model the distribution of various language speakers over time.

B. Use your model to predict what will happen to the numbers of native speakers and total language speakers in the next 50 years. Do you predict that any of the languages in the current top-ten lists (either native speakers or total speakers) will be replaced by another language? Explain.

C. Given the global population and human migration patterns predicted for the next 50 years, do the geographic distributions of these languages change over this same period of time? If so, describe the change.

Part II: A. Based on your modeling from Part I, and assuming your client company wants to open six new international offices, where might you locate these offices and what languages would be spoken in the offices? Would your recommendations be different in the short term versus the long term? Explain your choices.

B. Considering the changing nature of global communications, and in an effort to save your client company resources, might you suggest that the company open less than six international offices? Indicate what additional information you would need and describe how you would analyze this option in order to advise your client.

Part III: Write a 1-2 page memo to the Chief Operating Officer of the service company summarizing your results and recommendations.
Note: In your analysis, ignore unpredictable or high-impact, low probability events such as asteroid collisions that would cause a catastrophic jump in evolutionary trends over time, and possibly render all languages extinct.

2018 MCM-COMAP Participants from YSU

<table>
<thead>
<tr>
<th>Alanis Chew</th>
<th>Zack While</th>
<th>Shilpa Bhandari</th>
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<tbody>
<tr>
<td>Maddie Cope</td>
<td>Natalie Halavick</td>
<td>Carly DiPietro</td>
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<tr>
<td>Julie Phillis</td>
<td>Ashwin Mishra</td>
<td>Rabin Thapa</td>
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<td>Alexandra Ballow</td>
<td>John Gaboriault-Whitcomb</td>
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<tr>
<td>Nicolas Beike</td>
<td>Kathryn Platt</td>
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<td>William Melodia</td>
<td>Kenneth Diogo</td>
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2018 PME National Meeting at MAA MathFest

Please join us at this year’s meeting to be held August 1 through August 4, 2018, in Denver, Colorado. Students are invited to give fifteen minute talks on any mathematical topic or application in areas such as statistics, computing, or operations research. Topics including expository research, interesting applications, problems, etc. are also welcome. Transportation reimbursement is also available to those who qualify. Visit the National Pi Mu Epsilon website at http://www.math-pme.org for more details.

Ohio Section of MAA Spring Meeting at Miami University

The Ohio Section of the Mathematical Association of America will hold its annual spring meeting at Miami University on Friday, April 6 and Saturday, April 7, 2018. The meeting consists of talks by mathematics faculty, graduate students, and undergraduates from around the state. The Section especially welcomes talks and participation by undergraduate students. In addition to student talks, there is an undergraduate problem solving competition with cash prizes, and a pizza party. We encourage you to give a talk at the meeting or participate in the competition or pizza party.

If you are participating in the problem solving competition, we ask that you register at:

http://constum.ohiomaa.org/

If you have any questions, please do not hesitate to contact Tom Wakefield by phone 330-941-3302 or by email tpwakefield@ysu.edu.
A Warm Welcome to the Participating Schools:

- ASU AZ
- Boardman High School
- Butler County Community College
- Case Western Reserve University
- Chatham University
- Clarion University of Pennsylvania
- Cleveland State University
- Department of Education- LSSSNHS
- Fairmont State University
- Geneva Middle School
- Indiana University of Pennsylvania
- iSTEM Geauga Early College High School
- Kent State University
- Lakeland Community College
- Lorain County Community College
- Penn State Erie, The Behrend College
- Poland Seminary High School
- Siena Heights University
- Slippery Rock University
- Stautzenberger College
- The University of Akron
- Ursuline High School
- West Virginia Wesleyan College
- Westminster College
- Youngstown State University

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Vice President: Zack While
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Dr. Alicia Prieto Langarica
Dr. Thomas Madsen
Dr. Thomas Wakefield
Dr. George Yates

Funding for this conference is provided by the YSU Student Government Association, College of STEM, and National Pi Mu Epsilon Honor Society.

Special thanks to National PME, YSU President Tressel, Dr. Wim Steelant, YSU Student Government, the College of STEM, the Department of Mathematics and Statistics, and the Center for Undergraduate Research in Mathematics (CURMath) at Youngstown State University.