MATH 471: Undergraduate Research in Mathematics

Spring 2015 **Section 001** **3 credit hours**

Instructor: **Dr. Kristen Abernathy**

Office: Bancroft 148

Office Phone: 803-323-4681

Math Department: 803-323-2175

Campus Email: abernathyk@winthrop.edu

Instructor Website: faculty.winthrop.edu/abernathyk

Course Meeting Schedule:	MW 3:30 – 4:45 Sims 114
Office Hours:	M: 2:30 – 3:30 W: 8:30 – 9:30 F: 11:00 – 12:00 And by appointment

The instructor reserves the right to make modifications to this syllabus. Students will be notified in class & by email.

Winthrop University is dedicated to providing access to education. If you have a disability and require specific accommodations to complete this course, contact the Office of Disability Services (ODS) at 323-3290. Once you have your official notice of accommodations from the Office of Disability Services, please inform me as early as possible in the semester.

Course Content

This semester, we will work on problems from the video game industry. Anthony Pecorella, Director of Production at Kongregate and Co-founder of Level Up Labs, will serve as our industry contact. Anthony has provided us several problems that Kongregate, and video game developers in general, are currently working on. In particular, we will investigate two types of games: Incremental Games and Card Collecting Games. In each of these genres, we will have two overlying models to study:

1. **Leveling Up Models:** In video games, characters often level up or gain experience through a variety of settings: special equipment they buy, weapons, and experience gained through solving puzzles or fighting enemies. It is difficult to balance the level of the characters with the level of the enemies. How do you level up so the game is challenging, but still fun?
2. **Pricing Models:** With the rise in popularity of online gaming and mobile devices, there are now a variety of pricing models. Console games are typically priced high (around $60 per game), while online gaming and mobile devices tend to follow two models: (i) player can buy the basic version of the game for a low price (around $15) and must pay additional money to add levels, characters, etc.; (ii) the game can be downloaded for free, but there are advertisements and the player has the option to purchase extra lives, additional features, etc. How does a developer know how to price his/her game? Are there other models that would work better for the video game industry?

Determination of Grade

Written Reports (40%) Students will be expected to submit biweekly written reports updating the instructor and industry contact of their progress. These reports should be 2-3 pages in length and include, but are not limited to, an updated statement of the research problem, progress made since last report, and future goals. These reports will be due 1/21, 2/4, 2/18, 3/4, 3/25, 4/8, and 4/22.

Oral Presentations (20%) On weeks that written reports are not due, students will be expected to give a 5 minute presentation updating the instructor of the progress made and what they will be working on that week. These presentations should be professional and may also be used to demonstrate simulations of the student's model. Presentations will be made on 1/28, 2/11, 2/25, 3/11, 4/1, and 4/15.

Job Application Materials (10%) Part of this course will focus on learning how to prepare for industrial careers in the mathematical sciences. To that extent, students will be expected to find a job advertisement suitable for one with a mathematics degree and prepare a cover letter and resume for that job. The cover letter should address why a mathematician would be suitable for that particular position and how the student's preparation at Winthrop University makes that student a viable candidate for the job. This assignment will be due on 4/27.

Final Report and Presentation (30%) In lieu of a final exam, students will present their semester project in the form of a final report and a final oral presentation. Each group will be expected to prepare a 20 minute presentation that summarizes their work throughout the semester and a final report that includes, but is not limited to, statement of research problem, explanation of assumptions and justification, model design and justification, model testing, and strengths and weaknesses of model. The final report will be due and presentations will be made on Tuesday, May 5th, at 3:00 pm.

Letter Grade Determination:

92-100 A	90-91.99 A-	87-89.99 B+	82-86.99 B	80-81.99 B-	
77-79.99 C+	72-76.99 C	70-71.99 C-	67-69.99 D+	62-66.99 D	60-61.99 D-

Policies

1. Review the student code of conduct for university polices on academic misconduct. Academic misconduct will not be tolerated and will result in a failing grade on the assignment and/or in the course. The full handbook is available online at: (http://www2.winthrop.edu/studentaffairs/handbook/StudentHandbook.pdf)
2. All electronic devises (including cell phones) other than a calculator should be on silent and kept in your book bag or purse throughout class time unless otherwise instructed. (Note if you have some educational, health, or physical reason for an electronic device you must work with your professor to inform them of the accommodation.)

Course Goals and student learning outcomes:

Being exposed to mathematical modeling and undergraduate research, students will meet the following three departmental objectives.

1. Students are able to communicate mathematical ideas, demonstrate mathematical reasoning skills, and create and evaluate mathematical conjectures at various levels of formality.
2. Students apply fundamental mathematical concepts and techniques to solve problems and evaluate results.
3. Students demonstrate the ability to apply appropriate technologies to the study of mathematics and effectively use such technologies to investigate and develop an understanding of mathematical ideas.

This course meets the Logic, Language, and Semiotics requirement through activities and requirements that require students to: (1) use logic and mathematical information to draw reasonable conclusions and (2) use the symbols and language of mathematics to communicate about problems and present solutions.

Tentative Course Calendar
Weeks 1-2: Problem formation and literature review
Weeks 3-5: Model development
Weeks 6-10: Model testing and refining
Weeks 11-13: Sensitivity analysis and data mining
Week 14: Final report writing