Required text:

Course Goals: After completing this course, successful students will be able to:

- analyze the behavior of two “players” in games like prisoner’s dilemma;
- interpret the results of game analyses in relevant contexts to help interpret human interactions;
- apply voting methods to understand election procedures in a variety of settings;
- analyze fairness criteria with respect to voting methods;
- understand weighted voting and measures of voting power, and applications of these concepts to real-life settings.

Course topics: The course will investigate topics related to choices and actions in social and political fields and how mathematics can help us analyze and understand these choices. There will be four main topics: game theory models of conflict situations; models of escalation addressing, for example, auctions and the arms race; yes-no voting and measures of power; and social choice voting procedures and fairness criteria.

Homework—Preparing for each class: At the end of each class, I will assign material from your textbook for you to read for the next class. I expect that you will have read and carefully thought about the assigned section(s) before coming to class. In addition, I will assign homework problems and discussion questions so that you can practice working with the material we have discussed in class. These homework problems will usually be reviewed during the next class. The homework will involve a variety of types of activities, including some writing assignments and some longer assignments that could be called projects. Some of these assignments will be collected and graded. In all homework assignments that are to be graded, you will be told in advance that the work will be collected. Students are encouraged to study and work together on ungraded assignments, but graded assignments need to be your individual work unless it is specifically stated in writing that the assignment is a group assignment. Late homework will be accepted only if you are absent due to illness or emergency.
Calculators and Technology: You will need to have a basic four-function calculator to use for this class, and will be expected to bring it with you to class, especially when we discuss voting methods.

Attendance, participation, and organization: Attendance in class is required. During many classes I will begin with a short question for you to answer, which I will collect and grade. Most will be based on the assigned reading, the previous lecture or on the homework. In addition, some of the concepts will be demonstrated through class activities done in small groups during class. In order to participate, you must be in class. Warning: This course will involve an interactive classroom, with significant participation expected on your part.

You are also responsible for obtaining all class handouts and keeping them organized. A three-ring binder for the course, with sections for class notes, handouts, hand-in homework/quizzes and tests will be very helpful. Students should inform the instructor of any unavoidable absence in advance, if possible. Make-up exams will be given only in the case of a documented illness.

Classroom etiquette: You need to come to class prepared. This means that you have carefully read the assigned material, you have worked (seriously) on the assigned homework and you have your notebook and your textbook with you. You are ready to ask and answer questions in class and to work with your classmates on any in-class group activities. This classroom needs to be a place where everyone feels comfortable asking and answering questions; you are expected to treat everyone in class with respect. You need to turn off your cell phone and any other electronic devices (except calculators, of course, if you need them) and put them away during class. Finally, you are expected to be on time for class, to stay until class is over and not leave the class unless there is an emergency. (It is very disruptive to everyone, but especially to your instructor, to have people walking in and out of the classroom.)

Extra help: You are strongly encouraged to ask questions in class and to see Dr. Somers for help outside of class as much as necessary.

Grading: In addition to homework and in-class written questions, there will be weekly quizzes or written assignments, normally given on Fridays, two hour exams, and a mandatory, cumulative final exam. Your course grade will be computed as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage of Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class participation</td>
<td>10% of your grade</td>
</tr>
<tr>
<td>Quizzes, daily questions, and graded homework</td>
<td>40% of your grade</td>
</tr>
<tr>
<td>two hour exams</td>
<td>30% of your grade</td>
</tr>
<tr>
<td>cumulative final exam</td>
<td>20% of your grade</td>
</tr>
</tbody>
</table>

The two hour exams are tentatively scheduled for the dates given below. You are responsible for knowing about any changes to the test dates made during class.

- Wednesday, October 5
- Friday, November 18

Academic Honesty: For graded homework assignments, you may use your class notes and any books or library sources. You may not use the help, orally or in written form, of any individual
other than your instructor unless it is specifically a group assignment and you may not copy someone else’s work or let someone else copy your work. If an assignment is completed by a group of two or more people, each person who contributed to the work must put his or her name on the work. All in-class daily problems, hand-in homework, quizzes and tests are to be done by you individually unless it is specifically stated otherwise in writing by your instructor for a particular event.

The College academic honesty policy appears in your Student Handbook; you are expected to be familiar with it. The Academic Honesty Policy Guidelines specific to mathematics classes are reiterated at the end of this syllabus. They apply to work done outside of class as well as to in-class quizzes and tests. Please read them carefully. If you are unsure about the propriety of a particular procedure or approach, please consult with your instructor before continuing with the assignment.

**Special Accommodations:** Students with disabilities who believe that they may need accommodations in this class are encouraged to contact the Learning Services Office as soon as possible to enhance the likelihood that such accommodations are implemented in a timely fashion.

**Changes in the syllabus:** Some elements of the syllabus may need to be changed over the course of the semester. If such a change is necessary, you will be given a revised syllabus in class.

### ACADEMIC HONESTY POLICY GUIDELINES

#### MATHEMATICS COURSES

The Department of Mathematics and Computer Science supports and is governed by the Academic Honesty Policy of Moravian College as stated in the Moravian College Student Handbook. The following statements will help clarify the policies of members of the Mathematics faculty.

In all homework assignments which are to be graded, you may use your class notes and any books or library sources. When you use the ideas or thoughts of others, however, you must acknowledge the source. For graded homework assignments, you may not use a solution manual or the help, orally or in written form, of an individual other than your instructor. If you receive help from anyone other than your instructor or if you fail to reference your sources you will be violating the Academic Honesty Policy of Moravian College. For homework which is not to be graded, if you choose, you may work with your fellow students. You are responsible for understanding and being able to explain the solution of all assigned problems, both graded and ungraded.

All in-class or take-home tests and quizzes are to be completed by you alone without the aid of books, study sheets, or formula sheets unless specifically allowed by your instructor for a particular test.
Tentative Weekly Schedule

Week of August 29-September 2: Course introduction; introduction to non-zero sum games and notation; prisoner’s dilemma; prisoner’s dilemma classroom game; three additional interesting two-person non-zero sum games. Friday: short paper on analysis of game theory in Puccini’s opera *Tosca* or Edgar Allen Poe’s story “The Mystery of Marie Roget”.

Week of September 7-September 9: Conclusion of game theory topics; discussion questions and short presentations by pairs of students.

Week of September 12-September 16: Modelling the Yom Kippur War and the cold war; sequential models of games and game trees; short paper on Sampson and Delillah.

Week of September 19-September 23: Yes-no voting and weighted voting systems; introduction to terminology, swap robustness and trade robustness; analysis of U. N. Security Council and European Economic Community.

Week of September 26-September 30: Analysis of two commonly used power indices: Shapley-Shubik and Banzhaf; extensions and applications of these power indices.

Week of October 3-October 7: Finish power indices; first exam.

Week of October 12-October 14: Introduction to social choice procedures; examination of why we may want to use a method other than majority or plurality rule; short paper giving a biography and contributions of one of the heavy-weights of voting theory (John von Neumann, John Nash, Kenneth Arrow, the Marquis de Condorcet, Thomas Hare, Duncan Black, Vilfredo Pareto Borda, or someone else).

Week of October 17-October 21: Additional social choice procedures and applications to contexts from elections in other countries to football polls. Visualizing social choice procedures geometrically. Short paper on voting procedures used in various TV shows, like *American Idol*, *Survivor*, or *Last Comic Standing*.

Week of October 24-October 28: Devising and understanding desirable properties of social choice procedures; short paper on the criteria for a fair voting system and the possibility of relaxing one or more. Short paper on a particular public election like the 1991 Louisiana gubernatorial election, the 2002 French presidential election, voting for host city for the Olympic games, or some other election.

Week of October 31-November 4: Analyzing properties of social choice procedures—positive and negative results; Kenneth Arrow and Arrow’s Impossibility Theorem.

Week of November 7-November 11: Understanding paradoxes, and in particular those that occur with the various voting methods; back to the geometry of social choice procedures to help understand these paradoxes.
Week of November 14-November 18: Introduction to Approval Voting, and second exam. Debates on the “best” voting method. (Note that the two most accomplished contemporary researchers in voting theory do not agree on “best”.)

November 21: (Thanksgiving week) Introduction to the Electoral College—possibly a guest speaker.

Week of November 28-December 2: the winner-take-all rule; why the Electoral College is still used today; implications of not using to recent elections; power in the Electoral College; alternatives to the Electoral College.

Week of December 5-December 9: Dollar auction and escalation in real life.

December 12: Overview and final wrap-up