

## **MATH 10110-01: Principles of Finite Mathematics**

### Project Guidelines

In place of a third midterm exam for this class, you will instead complete a project related to what we have covered in class this semester. The point of this project is to encourage you to explore the mathematical side of an area that you are interested in. Some ideas for project topics are listed below, but feel free to propose another idea of your own. This project is your chance to see how mathematics can be useful in your everyday life.

You can work with a partner on your project, or you can work alone. Since this project is worth 100 points (the same as a midterm exam), you should put substantially more effort into this project than a normal homework assignment.

The basic idea is that you will pick a topic that you are interested in and then meet with me to discuss ideas about what you should include in your project. No two projects can be exactly alike. After you complete your project, you will turn in something written summarizing what you did and what you learned. For some projects, a report will be the best format for this; for other projects, a poster or some other format might be better. We can discuss what format is best for you on a one-on-one basis after you pick your topic. You will also give a brief presentation (5-10 minutes) to your classmates to explain what you did at the end of the semester.

#### **Important Dates:**

Monday, March 26: Project topics due (Turn in a brief paragraph summarizing what you'd like to try to do.)

Friday, March 30: Deadline to meet with Stacy to discuss ideas about what your project should include

Wednesday, April 11: Deadline to show Stacy your work-in-progress or rough draft

Friday, April 27: Final Projects Due

Friday, April 27 & Monday, April 30: Presentations

#### **Possible Project Ideas:**

1) Probabilities of winning and expected payoff in the Power Ball Lottery, another gambling game, or a game show

2) Risks in real-life (For example, is it more dangerous to fly or to drive?) If you choose this topic, there is a video online that can give you ideas.

3) The Birthday Problem (What is the smallest number of people that you need to have in a room so that the probability that at least two people in the room have the same birthday is at least 50%? At least 99%?)

4) Give a survey to at least 50 people on campus about a topic of your choice and draw some conclusions about all Notre Dame students based on this survey.

5) Find examples of how probability and statistics are used in psychology or by the media.

6) Figure out the winning strategy for variations of games that we talked about in class (Examples: Game of Nim with more than 2 piles, Hat Game, "Heads Up", etc.)

7) Figure out the probabilities of each type of poker hand. Test these probabilities by dealing 50 different poker hands and looking at their relative frequencies.

8) Learn about Newcomb's Paradox.

9) Learn about the mathematics behind auctions.

10) Learn about the Marriage Theorem (related to set theory).

11) Gather data (like box scores from a season) from one of your favorite sports, and figure out some probabilities for future games based on this data. (For example, figure out if a team is more likely to win a game if they are ahead after a certain number of periods/quarters/innings/etc. Does the number of penalties/fouls/etc. a team has in a game affect the outcome of the game?)

12) For those of you who like sports, pick a couple of offensive and defensive moves that an opponent plays a lot. Now pick a few moves with which you would counter those moves. For example, in karate, my opponent might do a front kick or a punch. I might, in response, do a block or shift and counterattack. Estimate probabilities of success for your counter moves (possibly by watching video) and work out an optimal strategy for you against this opponent using game theory.

13) Gather data about the Academy Awards and figure out some probabilities based on this data. (For example, what's the probability that a person wins an Academy Award if he/she has been nominated zero/one/two/etc. times before? What genre of film is most likely to win best picture?)

14) Anything else you're interested in!