Algorithms and Probability in Board Games with a Focus of Bridge

Course Description:
The purpose of this course is to give students an application of algorithms and probability using games such as bridge, chess, and Go. First there will be an introduction to the card game of bridge for those that have never played before. This includes a history of the game and the basics of how to play. Second, there will be an introduction to probability for those that may not have taken a class in statistics or could use a refresher. Then, the course will go in depth on how bridge is an application of probability and how it can be used to improve quickly. Within this context, we will think about how to implement these solutions programmatically. Finally the connection between bridge, chess, and Go AI's will be explored in the last third of the course.

Course Details
Prerequisites: None
Credits: 1
Seats: 20
Lecture Time: 3-4:15pm Monday
Location: ESJB0302
Semester: Spring 2019
Textbook: Notes will be provided by the facilitator
Course Facilitator: Hakan Berk
Faculty Advisor: Dr. Larry Washington
Contact Information
Course Facilitator: Hakan Berk – hberk@umd.edu
Faculty Advisor: Dr. Larry Washington - lcw@math.umd.edu

Course Objectives
By the end of the course, students will be able to

- Understand the history of bridge
- Learn the basics of playing bridge
- Review and understand basic probability, including combinations and permutations
- Learn how to apply probability to bridge in order to make educated plays for both declarer and defense, while thinking about how an AI would approach the same situations
- See how probability can help with more advanced bridge plays
- Understand the history of bridge and programming, how current algorithms work, and explore options for better AI's

- Compare the current bridge AI's to AI's of other games such as Chess and Go. This includes a comparison of the strength of the AI as well as the algorithms used

Schedule:

Week	Topic	Assignment
1	What is the card game bridge?	Assigned: Initial Survey
2	Bidding and Declarer continued	Due: Initial Survey Assigned: Bidding homework
3	Introductory Probability Review	Due: Bidding homework Assigned: Probability homework
4	Combinations and Permutations	Due: Probability homework Assigned: Probability homework part two
5	Bridge Score, Bidding, and Probability	Due: Probability homework part two Assigned: Scoring homework
	Introduction to Probability and Declarer Play	
6	How to take a finesse	Due: Scoring homework Assigned: Finesse examples homework
7	Choosing the percentage play	Due: Finesse homework Assigned: Percentage play examples homework
8	Find the missing cards	Due: Percentage Play homework Assigned: Finding the missing cards homework
9	**Midterm Exam**	
10	Combining your chances	Due: Finding missing cards homework Assigned: Combining Chances homework
11	Suit Combinations	Due: Combining Chances Assigned: Suit Combination example homework
	Programming and Bridge	
12	History of programming and bridge	Due: Suit Combination homework Assigned: History Reflection

13	Why bridge AI's are not as good as other AI's	Due: History Reflection Assigned: Bridge AI Analysis
14	Machine Learning and Bridge	Due: Bridge AI Analysis Assigned: Final Paper
15	N/A	Final Paper

Grading:

Percentage	Title	Description
20%	Class Participation	Participation grade will be based on attendance and how much/well one contributes to playing bridge and learning the concepts
20%	Final Paper	The final paper is a reflection of the course, what a student feels they learned, favorite and least favorite parts of the class, and more.
30%	Weekly Homework Assignments	Weekly homework assignments will be graded for both completion and accuracy.
30%	Midterm Exam	The Midterm Exam will cover the first half of the course and test on basic probability and some applications with respect to bridge.

About the Facilitator

Hakan Berk is a senior electrical engineering student with a passion for bridge. He has played the game for 10 years and has represented the United States in the U21 world championships on three occasions. He also founded and currently runs the University of Maryland Bridge Club. The course combines a passion for both cards and numbers in the hope to create a fun way to apply probability.

Disability Support Accommodations

See the section titled "Accessibility" available at Course Related Policies via http://www.ugst.umd.edu/courserelatedpolicies.html

Academic Integrity
Cases of academic dishonesty will be pursued to the fullest extent possible as stipulated by the Office of Student Conduct. Note that academic dishonesty includes cheating, fabrication, and plagiarism, but also includes helping other students commit acts of academic dishonesty by allowing them to obtain copies of your work. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. Learn more about the Code of Academic Integrity and the Student Honor Council via http://www.shc.umd.edu

Excused Absence and Academic Accommodations
See the section titled "Attendance, Absences, or Missed Assignments" available at Course Related Policies.

Course Evaluations
As this course is brand new, we welcome any suggestions to improve the course both throughout the semester and after it is done. Throughout the semester feel free to contact the course instructor or the faculty advisor at any point to discuss possible suggestions or changes. At the end of the course, please go to https://courseevalum.umd.edu/ to fill out the course evaluation, as the feedback is essential for the improvement of the course.