# WORKSHEET #2

GRAPHS AND GAMES

This Worksheet requires doing a presentation in front of the class, not longer than 12mins, in groups of 2 students.

## EXPECTED RESULT

Each group will perform some research on how graphs are used to plan a winning strategy on any game of your choice. It is expected a detailed explanation on

- 1) game concept,
- 2) graph theory/algorithm to model game concept,
- 3) math equation/theory or algorithm needed for winning strategy

Game must **not** be new, existing games are to be presented (though some modifications to original game are allowed).

### PREPARATION LECTURE

Since we are mixing Graph Theory and Game Theory, we need to prepare for this worksheet learning about Game Theory.

You need to read part of Thomas S. Ferguson (Mathematics Department, UCLA), **Game Theory**, Second Edition, 2014. You can find it on <u>https://www.math.ucla.edu/~tom/</u> ... look for section "Electronic Texts" and click on "Text: Game Theory, Second Edition." Note that this text has exercises, that are solved in the last section of the same text. Look for them, and learn.

but only the following marked content:

Introduction.

- Part I: Impartial Combinatorial Games.
  - o Take-Away Games.
  - $\circ$  The Game of Nim.
  - Graph Games.
  - Sums of Combinatorial Games.
  - Coin Turning Games.
  - o Green Hackenbush.
- Part II: Two-Person Zero-Sum Games.
  - The Strategic Form of a Game.
  - Matrix Games. Domination.
  - The Principle of Indifference.
  - Solving Finite Games.
  - The Extensive Form of a Game.
  - Recursive and Stochastic Games.
  - o Infinite Games.

Also we need to complement your Graph Theory with Chapter 10 Binary Trees from the textbook.

Individual Preparation Test will be about Binary Tree exercises (Section Solved Problems in Chapter 10), and Group Preparation Test will be about the Game Theory Exercises. So... do the exercises.

## GRADING

GRADING CRITERIA	GRADE	
Preparation Test (Individual and Group)		5pts
Group uses proper and accurate graph theory to solve chosen game. Statistical or combinatorial calculations can be used, <b>but</b> <b>the baseline</b> <i>mathematical</i> <b>model needs to be a Graph</b> .		4pts
Group uses proper material for presentation. Not just a boring PPTi,e, if it is a card game, at least we expect cards to be shown! Group can explain winning strategy in 12mins		3pts
EVTRA 2nts will be given to the 2 groups with the most complex		

EXTRA 2pts will be given to the 2 groups with the most complex game/graph-based strategy chosen.

#### KEY DATES

- Preparation Test (Individual and group), based on Preparation Lecture, will be done on Sep 14<sup>th</sup>.
- Groups must be formed by Sep 1<sup>st</sup> 5pm, and e-mailed to Oscar and Freddy. Otherwise, groups will be assigned by Professor.
- First batch of presentations are delivered on Sep 19<sup>th</sup> and presentations continue on Sep 21<sup>st</sup>. All groups must be ready on first date, Aux. Professor will randomly pick which group presents the first day.

Start your work as soon as possible, and bring your questions/challenges to discuss with the whole class. Don't leave this until the last day.