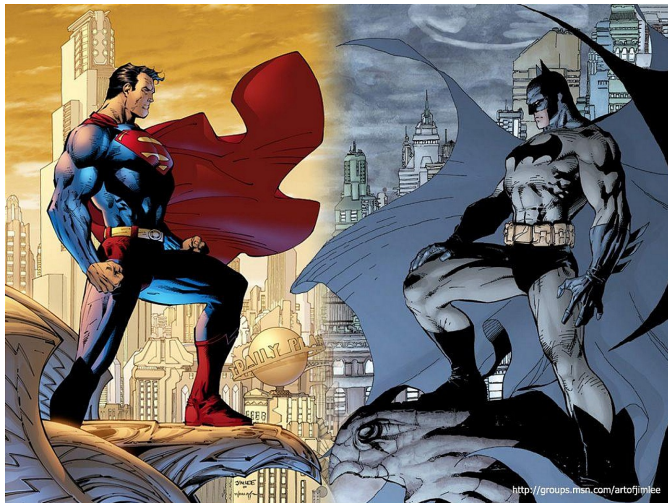


Intro to Game Theory/ Strategic Reasoning



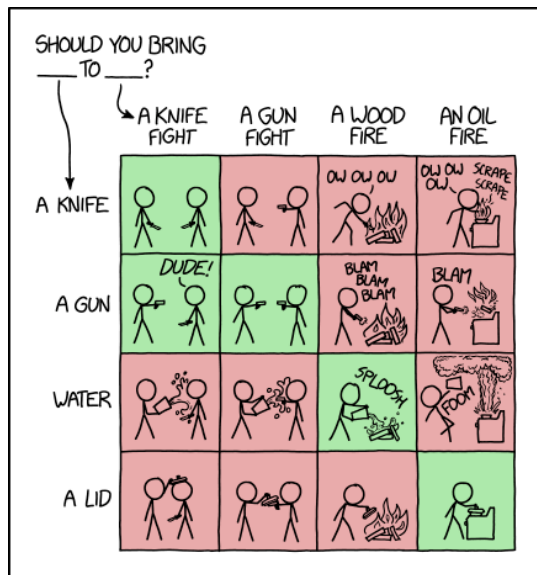
Frederik Mallmann-Trenn
6CCS3AIN

Competition between agents



(groups.msn.com/artofjimlee)

Multi-party decision making



(xkcd.com/1890/)

In the real world



(U.S. Army Military History Institute)

- Strategic analysis.

In the real world



(Adi Talwar/citylimits.org)

- School admissions

In the real world



(froedtert.com)

- Kidney exchange
- Longest chain involved 28 donors and recipients.

The grade game

Report for year beginning _____ day of _____ 191__ and Ending _____ day of _____ 191__

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Yearly Avg.	Face Reached
Reading	A	A	A	A						A+		
Spelling	A	A+	A	A+						A+		
Writing	B	B+	B+	B+						A		
Drawing												
Arithmetic	B	A+	A	A						A		
Grammar	A	B+	B	A						B+		
Geography	C	A	B							A		
Physiology												
Agriculture												
Texas History												
U. S. History												
Civics												
Composition												
Physical Geography												
Literature												
General History												
Algebra												
Geometry												
Physics												
Application												
Department	C	A	A	B						B+		
Days Absent	1	0		4 1/2								
Times Tardy	1	1										

Scale of grading:
 $A+ = 92-100$ $A = 85-90$ $A- = 80-85$ $B+ = 75-80$ $B = 70-75$ $B- = 65-70$
 $C+ = 60-65$ $C = 55-60$ $C- = 50-55$ $D+ = 45-50$ $D = 40-45$
 $F = 35-40$ $T = 30-35$ $TO THE TEACHER$

This report contains full information regarding the progress of the pupil. Fill the blanks regularly and return to parents promptly. See that they are filled in. Do not make any corrections. Do not make any changes with pencil ink. Exercise such care that it will not be necessary to erase. This is a good index to the general character of the pupil. It is a valuable medium of communication between the school and the home. Frequent writing tests on work passed over by the pupil. Most sufficient. Do not expect a full mark. The report is a record of the work. It will assist the parent teacher. Frequently bring inspection by other schools. To this effect for

SCALE OF GRADING
 A+ 92-100 A 85-90 A- 80-85 B+ 75-80 B 70-75 B- 65-70 C+ 60-65 C 55-60 C- 50-55 D+ 45-50 D 40-45 F 35-40 T 30-35 TO THE TEACHER

The parent or guardian will please sign below and return promptly to teacher.

Sept. _____
 Oct. _____
 Nov. _____
 Dec. _____
 Jan. _____
 Feb. _____
 March _____
 April _____
 May _____

Teacher's Signature: *Richard D. Johnson*
 Parent's Signature: *Richard D. Johnson*
 Date: _____

The report should be a record of the community must be a record of the report with the school.

(Lyndon Johnson's Report Card, US National Archives)

The grade game

- Imagine in this module we assign grades as follows
- You are randomly paired with a partner (you do not know who!)
- You have to write X or Y on the piece of paper
- You will get a grade based on the following rules:
- If both you and your partner write X, then you both get a B
- If you write X and your partner writes Y then you get D and your partner gets A
- If you write Y and your partner writes X then you get A and your partner gets D
- If both you and your partner write Y then you both get C

(The Grade Game, Ben Polak)

The grade game

- What would you do?
- What you get depends also on the choice of your partner.
- This is the blueprint of strategic interaction.
- There is a poll on KEATS to find out ...

Choose the side

- Which side of the road to drive on?



(haulagetoday.com)

Choose the side

- Which side of the road to drive on?



(businessinsider.com)

Choose the side

- Which side of the road to drive on?



Any fule kno that.

(Geoffrey Williams/Ronald Searle)

Choose the side

- Which side of the road to drive on?



- Same side as everyone else
(*berkshireeagle.com*)

Choose the side

- How do you choose when you don't know what “everyone else” is doing.

Game theory

- Game theory is a framework for analysing interactions between a set of agents.
- Abstract specification of interactions.
- Describes each agent's preferences in terms of their **utility**.
 - Assume agents want to maximise utility.
- Give us a range of **solution strategies** with which we can make some predictions about how agents will/should interact.

Payoff Matrices

- We can characterise the “choose side” scenario in a **payoff matrix**

		j	
		left	right
i	left	1 0	0 1
	right	0 1	1 0

- we have two agents, each player picking a **(pure) strategy**
- Agent i is the **row player**
gets the lower reward in a cell.
- Agent j is the **column player**
gets the upper reward in a cell.

Payoff Matrices

- We can characterise the grade game scenario in a payoff matrix

		j	
		Y	X
i	Y	2	1
	X	4	3

- Payoffs are the US grade points that correspond to the problem statement.
- From the game earlier: Grade A is 4, Grade B is 3 etc.

Outcomes

- An **outcome** is what we get when we combine the actions of all the players.
- An outcome corresponds to an element of the **payoff matrix**

		j	
		left	right
i	up	1	0
	down	0	1

- We identify outcomes by the moves the players make:

(what i plays, what j plays)

- Thus *(up, right)* identifies the outcome in which i plays *up* and j plays *right*

Payoff Matrices

- Actually there are two matrices here, one (call it A) that specifies the payoff to i and another B that specifies the payoff to j .
- Sometimes we'll write the payoff matrix as (A, B) in recognition of this.
- $A = \begin{pmatrix} 1 & 0 \\ 3 & 1 \end{pmatrix}$ is the payoff matrix for i from the following table

		j	
		left	right
i	up	2	0
	down	0	1
		1	0
		3	1

- Note that $a_{i',j'}$ is the payoff if i picks action i' and j picks action j'