A Beautiful Mind
Meets Free Software
Game Theory, Competition and Cooperation

Alexandre Oliva lxoliva@fsfla.org

http://www.fsfla.org/~lxoliva/

Copyright 2005, 2006 Alexandre Oliva; 2009 FSFLA (last modified April 2009)
Permission is granted to make and distribute verbatim copies of this entire document worldwide without royalty,
provided the copyright notice, the document's official URL, and this permission notice are preserved.
http://www.fsfla.org/svn/fsfla/site/blogs/lxo/pres/beautiful-mind/
http://www.fsfla.org/~lxoliva/papers/free-software/beautiful-mind.pdf
Summary

- John Forbes Nash Jr, a Beautiful Mind
- Game Theory
- Free Software
John Nash

- Mathematician awarded 1994’s Nobel Prize
- Inspiration for “A Beautiful Mind” movie
- Proponent of Nash Equilibrium
  - Game Theory
  - Economics
How (not) to get laid

“In competition, individual ambition serves the common good.”
— Adam Smith
How (not) to get laid

Russel Crowe as John Nash:

“If we all go for the blonde we block each other.”
How (not) to get laid

“Not a single one of us is going to get her.
How (not) to get laid

“So then we go for her friends...
How (not) to get laid

“...but they will all give us the cold shoulder, because nobody likes to be second choice.
How to get laid

“Well, what if no one of us goes for the blonde? We don’t get in each other’s way, and we don’t insult the other girls. That’s the only way we win. That’s the only way we all get laid.”
Adam Smith needs revision

“The best result will come from everybody in the group doing what’s best for himself, and the group.” — Russel Crowe as John Nash
Game Theory

- Framework to reason about strategies
- Players are rational and selfish
- Applications
  - Economics
  - Auctions
  - Military
  - Getting laid :-)

Prisoners’ Dilemma

- Two burglars caught near a crime scene
- No evidence other than concealed weapon
- Each one is offered the same deal:
  - confess and testify, no jail time
    - if both do, 10 years for both
  - deny and go to jail for 1 year
    - if the other testifies, serve for 15 years
### Prisoners’ Dilemma

| Jail time | Bob          |        |
|-----------|--------------|--------|
|           | confess      | deny   |
| Al confess| 10\10        | 0\15   |
| deny      | 15\0         | 1\1    |

- No communication ⇒ no cooperation
- Dominant strategy leads to worst result
Tragedy of the Commons

- Commoners use area to graze cattle
- Costs are shared, value isn’t

| Cattle | Value−Cost |
|--------|------------|
| $n$    | $k_p n - k_c N \frac{n}{N}$ |
| $n + 1$ | $k_p (n + 1) - k_{c_{N+1}} \frac{n+1}{N+1}$ |

- Overuse depletes common resource
- Free riding: polluting, overfishing, spamming
Nash Equilibrium

- Generalizes dominant strategies
- No player can individually increase payoff
Gentlemen Prefer Blondes

- Maximin leaves the blonde alone
- Credible commitments enable Pareto Optima
A Beautiful Mind meets Free Software
Timeline

- Software was Free
- Vendors made it proprietary
- Unix
- GNU project
- GNU General Public License
- Kernel Linux
- Unix System V × BSD
Essential Software Freedoms

- Run (Freedom 0)
- Study and Adapt (Freedom 1)
- Copy and Redistribute (Freedom 2)
- Improve and distribute (Freedom 3)
Proprietary Software Vendors

- Seek edge by denying freedoms
- No-cooperation competition
- Minimize losses to competitors
  - Maximizing payoff, value, or none?
- “Individual ambition serves the common good”
  — Adam Smith
- Prisoners go to jail
BSD-like Free Software Vendors

- Only requirement is attribution
- Sharing is good
- Cooperation is welcome
- Free riders are accepted
- Tragedy of the commons
GNU General Public License

- If you get the binaries, you can get the sources
- Copyleft: for all, rights Preserved
- No further requirements

Copyleft software remains Free
GNU GPL-ed Free Software Vendors

- Competition with cooperation
- Seek edge by improving on the commons
  - Contributing back
  - Better grounds to build upon
- “The best result will come from everybody in the group doing what’s best for himself, and the group” — John Nash
- Credible commitment
# Choosing the best strategy

| License      | Proprietary | BSD-like | GNU GPL  |
|--------------|-------------|----------|----------|
| Costs        | $\frac{k}{1}$ | $\frac{k}{n_b}$ | $\frac{k}{n_g}$ |

- Similar software with similar production costs
- Market divided evenly among competitors
- Proprietary vendors can’t share costs
- Relicensing BSD-like code
GNU Philosophy

GNU/Linux

- Credit
- Freedom
- Open Source?
Further Resources

- Roger A. McCain’s “Strategy and Conflict: An Introductory Sketch of Game Theory”
  http://william-king.www.drexel.edu/top/eco/game/game.html

- Theodore L. Turocy and Bernhard von Stengel’s “Game Theory”
  http://www.cdam.lse.ac.uk/Reports/Files/cdam-2001-09.pdf

- http://wikipedia.org on Game Theory
Free the Software!

http://www.gnu.org
http://www.fsf.org/
http://www.fsfla.org
http://www.softwarelivre.org
mailto:lxoliva@fsfla.org
http://www.fsfla.org/~lxoliva