

Handout #4: Property Applications

Review: The Grammar of Extensive Form Games

1. Components

- **Extensive Form Game:** A strategic interaction in which moves may occur sequentially.
- **Player:** Participants in the game.
- **Node:** Point in the games.
- **Edge:** Directed connections between certain nodes.
- **Tree:** A set of nodes and directed edges connecting them.
- **Decision Node:** A node with outgoing edges.
- **Root:** The first node in the game tree. A decision node with only outgoing edges.
- **Terminal Node:** A node with only incoming edges.
- **Action:** Describes what occurs along a given edge.
- **Payoff:** The utility of each player defined at every terminal node.

2. Assumptions

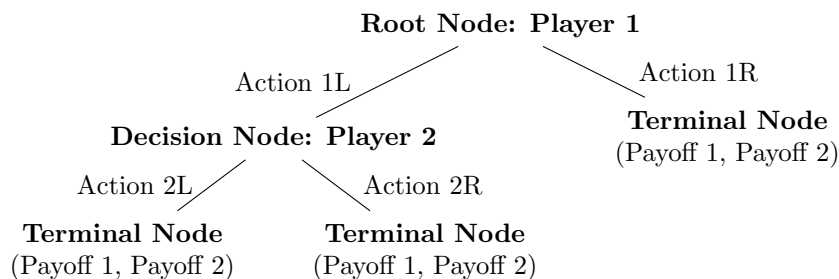
- **Common Knowledge of Rationality:** Players are rational. All players know that all players are rational. All players know that all players know that all players are rational...
- **Principle of Sequential Rationality:** When a player can count on the other players to behave rationally from that point forward.

3. Solution Concepts

- **Pure Strategy:** A pure strategy for a given player specifies what that player would do at each decision node.
- **Subgame:** The portion of an extensive form game which starts from one of the decision nodes and includes all subsequent nodes.
- **Subgame-Perfect Equilibrium (SPE):** When an equilibrium satisfies sequential rationality, we call it Subgame Perfect. SPE require that all players play best-responses (Nash Equilibria) in each subgame.
- **Backwards Induction:** Using rational belief about opponents' actions in future subgames to determine actions in the current subgame. Backwards induction proceeds systematically by determining Nash equilibria in the smallest subgame, and reducing that subgame to a terminal node with the Nash Equilibrium payoffs. Iteratively applying this procedure gets us to the Subgame-Perfect Equilibrium.

Note: In this class we will deal mostly with games of perfect information. Our definitions would change slightly in a game with imperfect information, but this is outside the scope of this course.

Example: An example of an extensive form game is given by the following simple game tree.



Review: Concepts in Property Law

1. Principles for Establishing Ownership

- **First Possession:** Property rights determined by order of arrival.
 - Pro: Relatively simple to determine who possessed property first.
 - Con: Creates an incentive to engage too much in preemptive possessory acts.
- **Tied Ownership:** Ambiguous property rights tied to clear property rights.
 - Pro: Encourages efficient use of the resource.
 - Con: Difficult to establish and verify ownership rights.

2. Temporary vs Permanent Damages

- **Temporary Damages:** Recurring damages for harm which has already occurred.
 - Create an incentive to reduce harm in the future when technology changes.
 - Efficient where damages are easy to measure and innovation occurs rapidly.
- **Permanent Damages:** One-time, permanent fix which tries to anticipate the value of future harm.
 - If bargaining is costly, then permanent damages provide no incentive to reduce harm as technology evolves.
 - Efficient where damages are costly to measure and innovation occurs slowly.

3. Intellectual Property: Property rights applying to ideas or information.

- **Patents:** Private monopolies which cover products or commercial processes.
 - A patent holder whose patent has been infringed can sue for both damages and an injunction against future violations.
 - Patents are property, and can be sold or licensed to others.
 - Transaction costs may be high. Uncertainty on whether a patent is valid (and breadth), uncertainty of outcome of research, and the fact that there might be many parties.
 - Patents make tradeoffs between providing positive dynamic incentives and static/dynamic costs.
 - *Limiting doctrines* which narrow the scope of patents to ideas that are novel, useful, and non-obvious, are used in patent law to reduce inefficiency.
 - Patents in the US are blunt instruments, and do not take into account the relative size of the innovation or rate of turnover across industries.
- **Copyrights:** Property rights over original expressions.
 - Original expressions are often non-rivalrous and non-excludable, and so tend to be underprovided.
 - Applied automatically to expressions without application.
 - Covers only exact text, not general ideas.
 - Copyright enforcement often relies on judgements of "substantial similarity," and whether the derivative work is likely to be seen as a substitute for the original work.
- **Trademarks:** Property rights over brand names or distinctive images/symbols.
 - Trademark law aims to reduce confusion between substitutable products, allowing companies to send a *credible signal of quality* and *reducing consumer search costs*.
 - Protecting trademarks incentivizes *quality-enhancing investments* in a product or product line.
 - *Trademark dilution* can be claimed even when confusion between products is unlikely if the use of a trademarked name is likely to create negative association.
 - Limited protection is given to *trade dress*, or the distinctive visual appearance or packaging of a branded item.
- **Trade Secrets:** information "used in one's business" that gives its owner "an opportunity to obtain an advantage over competitors who do not know or use it."
 - Protected under federal law against *misappropriation* if the trade secret was reasonably defended yet was acquired illegally or unfairly by a competitor.
 - Can be protected by companies through non-compete agreements, but courts can evaluate non-competes to balance dynamic incentives and costs. Courts generally do not protect non-compete agreements which claim protection for human capital gained at a job.

Problems

- (From Pedro Guinsburg's Fall 2016 handout) Jim owns the only bar in a village, and he makes about \$2000 a month. One of his workers, Jarmusch, is not happy with his \$300 wage, and is thinking about leaving and opening his own bar.
If Jarmusch stays, Jim has two choices:
 - Give him a \$200 raise, or
 - Pay him the same.On the other hand, if Jarmusch decides to leave, Jim can choose between:
 - Fight: compete with Jarmusch and lower prices, in this case Jim will get \$600, and Jarmusch gets \$200.
 - Share: share the market with Jarmusch, in this case Jim will get \$1200, and Jarmusch gets \$1000.
 - Find all (pure strategy) Nash equilibria.
 - Find all (pure strategy) Subgame-Perfect Equilibria.
- (The Centipede Game) Two players alternate moves, starting with player 1. Each player starts with \$0. When moving, a player can Stop the game or Continue. If a player Continues, he gives up \$1, while his opponent gains \$3. The game ends when a player Stops or when both players have \$100.¹
 - Draw the game tree for this extensive form game (draw the first few nodes and the last few nodes).
 - Start with the final node. What will happen in the last period of play? Using backwards induction, what can we say about the subgame perfect equilibrium?
 - Do you find this prediction convincing? Why or why not?
- Firm A wants to develop a new drug for cancer. The research and development process costs around \$5 million. After that, it costs virtually nothing to produce each additional dose of this drug. Firm B, after observing firm A's decision, has the option to create a generic drug that has the same effects. The demand function for the drug is $P = -\frac{1}{4}Q + 3000$.
 - What are the revenues for each firm if B enters the market? Solve using Cournot duopoly Model.
 - Represent this game in the extensive form and find the Subgame Perfect Equilibrium.
 - Assume that A acquires a patent on the drug. If B starts imitating/producing, a court rule will issue a damages rule. Draw the extensive form and solve for the SPE.
 - Discuss efficiency in this example. What is your policy suggestion?
- (From sample exam questions) Prof. Quint's favorite bar during graduate school (Antonio's Nut House, for those who know Palo Alto) was occasionally under threat of closing down – every once in a while, a lawyer would move into one of the apartments next door, and threaten to sue for a nuisance injunction due to noise. The social value of the bar consists of the profits it earns, plus its value to its patrons, minus the inconvenience to the neighbors (and the opportunity cost of the space it takes up). Suppose this social value is negative when the neighbors happen to be people who are unusually sensitive to noise, but positive otherwise.
 - Explain the difference between temporary and permanent damages.
 - Explain how permanent damages, paid as “a servitude to the land,” would solve the problem.
 - Who would receive these damage payments if the neighboring homes were owner occupied? If they were rented? What would the impact be on the value of the homes, or the rent charged to tenants?
- Evaluate the following situations in terms of the incentives they create:
 - The U.S. Supreme Court has stated that “a scientific truth, or the mathematical expression of it, is not a patentable invention,” and so patents are not typically granted for mathematical or physical formulas.
 - There are two possibilities for awarding patents. Under a “first-to-file” rule, a patent is awarded to the first person to file for a patent, while under a “first-to-invent” rule, the patent is awarded to the person who first had the idea.
 - The court has ruled that a company flying over a competitor's manufacturing facilities to take pictures is a violation of trade secrets.
 - Consider the following from copyright law: “MGM announced Thursday it has won a temporary injunction in its copyright infringement suit against American Honda Motor Co. over the automaker's re-creation of scenes from James Bond movies for a TV commercial. Honda attorneys had argued the commercial was meant as a parody of spy-thriller movies in general, but last week's ruling by U.S. District Court Judge David Kenyon barred further broadcasts of the ad for Honda's 1995 Civic del Sol model.”²

¹Taken from Bill Sandholm's Game Theory lecture notes for Econ 711. Available at: <https://www.ssc.wisc.edu/~whs/gtie.pdf>
The original game comes from: Rosenthal, R. W. (1981). Games of perfect information, predatory pricing and the chainstore paradox. *Journal of Economic Theory*, 25:92–100.

²<https://www.upi.com/Archives/1995/04/06/MGM-wins-injunction-against-Honda-TV-ad/5780797140800/>

- (e) "Dismaland" was an dystopian artistic take on Disneyland, which was open in the UK for five weeks. Marked as "unsuitable for kids," the theme park was unlikely to be mistaken for Disneyland, but could be viewed through the lens of trademark dilution (though Disney's lawyers did not pursue it).³

³<https://www.theguardian.com/artanddesign/2015/aug/20/banksy-dismaland-amusements-anarchism-weston-super-mare>