ECON 522- SECTION 4- INTELLECTUAL PROPERTY, FUGITIVE PROPERTY, AND EXTENSIVE FORM GAMES

1. Intellectual Property

Intellectual property rights take goods which seem to fit the definition of a public good: non-rivalrous and non-excludable, and tries to get them to fit the definition of a private good: rivalrous and excludable.

	Non-rivalrous	Rivalrous
Non-excludable	National Defense, Knowledge	Commons
Excludable	—-	Apple

Copyrights and patents both assign monopoly rights to information and make it illegal for someone to infringe on these rights, thus making the knowledge at least excludable, and ideally rivalrous as well.

	Non-rivalrous	Rivalrous
Non-excludable	National Defense	Commons
Excludable	Knowledge	Apple, Knowledge

The tradeoff inherent in these property rights is that monopoly can be inefficient, yet we want to create some incentive for people to create knowledge.

2. Adverse Possession

Adverse possession law concerns the rights of squatters. If an individual remains on someone else's property for a certain period without their consent, makes no effort to hide this fact, and their presence is contrary to the interests of the property owner, then they can gain legal title to the property.

3. Fugitive Property

The two main ways of assigning property rights to fugitive property are the rules of first possession and tied ownership. While first possession is simple, it may create incentives to inefficiently extract/obtain resources, while tied ownership is a more complicated rule that may create better incentives. The following example should help illustrate one of the tradeoffs between the rules.

Example 1. Suppose in the Arizona desert just outside of Phoenix a very large underground oasis is discovered containing 10 billion gallons of water. Currently there are 200 private households which own the property directly above the oasis. There are two private water treatment companies in the Phoenix area which would be capable of extracting the water for public use, and they can choose to extract the water Fast or Slow. Company C_1 is technologically more advanced than company C_2, and thus can extract more water when the two companies are using the same strategy, and it can extract the water before C_2 if the two companies use the more technologically intensive Slow method of extraction. However, because company C_2 is smaller and less bureaucratic, it can extract the water faster than C_1 if it chooses to act Fast. Suppose C_1 can extract 6 billion gallons of water if it acts Fast, and can extract the full 10 billion gallons if it acts Slow. C_2 can extract 5 billion gallons if it acts Fast, and 9 billion gallons if it acts Slow. All methods of extraction

have the same cost to the companies, and once one technology has been chosen it is too costly to switch to another. Water treatment is a regulated duopoly, so each firm can sell a gallon of water at a constant price of $.01; this means 1 billion gallons of water can be sold for 10 million dollars.

1. What is the efficient method for extraction of the water?
2. What would happen if the government decides to assign property rights through a rule of first possession (where the first company to tap the water source receives all the rights)? Would it make a difference if transaction costs are high or low?
3. What would happen if the government assigns property rights through tied ownership, so that the owners of the land above the oasis own the rights to the water? Would it make a difference if transaction costs are high or low?

Answers.

1. The efficient method for extraction is for C_1 to extract slowly, since this results in the most water at the same cost as the other methods.
2. If the rule were first possession, the companies would be playing the following game (payoffs in millions of dollars):

	Fast	Slow
Fast	**0, 50**	60, 0
Slow	**0, 50**	100, 0

   The Nash equilibria are in bold. C_2 has a dominant strategy of extracting Fast, which is inefficient. However, if transaction were low enough then the Coase Theorem says that we should get to the efficient allocation: property rights are well defined and tradable. What would happen is C_1 and C_2 would negotiate and C_1 would buy the right to be the first to extract from C_2. Thus, although first possession creates an incentive to act inefficiently fast, as long as transaction costs are low enough this is not a problem.
3. If the government assigned the rights to the landowners, then they could sell those rights to one of the companies. If transaction costs are low, then C_1 would buy the rights and extract the water slowly, since the rights are most valuable to C_1. However, if transaction costs are high, possibly because there are so many people involved in negotiations, then it's possible that no sale would take place and the water would remain underground (which is inefficient).

Example 2: Property on the Nile River Example from Friedman, *Law's Order*, p.118: Every year the Nile river floods, submerging large tracts of farmland in the process. After the waters recede, the river may no longer be in the same place. How should the law define property rights to the valuable farmland near the river?

- We could adopt a rule where everyone's property is always in the same place, even in years when it's underwater or far from the river.
- We could adopt a rule of first possession, so that as the floodwaters recede, the rights to the newly exposed land go to whoever claims it first.

- We could adopt a rule of tied ownership, where the ownership of land at one point along the river is tied to ownership of the land at the same point along the river the previous year.

The last one is apparently what's actually done, and I think it makes the most sense: The first rule causes farmers substantial risk, and does not ensure that those who specialize in growing thirsty crops will have a suitable plot of land to do so. The second rule again creates risk, and could cause inefficient investment in possessory acts. The third rule causes the lowest variance in the pertinent features of one's land (size, proximity to water, not being underwater) from year to year, and only slightly more uncertainty about who owns what than the first rule and much less than the second. So if people are risk averse, it seems quite reasonable.

4. Extensive Form Games and Subgame Perfection

Subgame perfection is the most commonly used equilibrium concept for extensive form games of perfect information. The idea is that your decisions have to be rational not only at the start of the game but at each point in time where you have to make a decision as well. Any subgame perfect equilibrium of a game's extensive form is a Nash equilibrium of its strategic form, but the converse does not hold.
In an extensive form game, a strategy specifies a player's actions at each of his decision nodes. So if I am the second player and my opponent has two actions, my strategy needs to specify what I do after each of those actions.

An Example. Suppose that two firms in a duopoly are making output decisions. Each firm has identical costs $C(q_i) = cq_i$ for some $c > 0$. The firms face the inverse demand curve $P(Q) = a - q_1 - q_2$ for some $a > c$. They each choose between the following output decisions:[1]

$$q^F = \frac{a-c}{4}$$
$$q^C = \frac{a-c}{3}$$
$$q^L = \frac{a-c}{2}$$

Assume for concreteness that $a = 70,\ c = 10$, and hence

$$q^F = 15$$
$$q^C = 20$$
$$q^L = 30$$
$$\pi_i(q_i, q_j) = 60q_i - q_i^2 - q_iq_j$$

Suppose first that they make the decisions at the same time. We can plug these values in to get payoffs, and write down a game in strategic form:

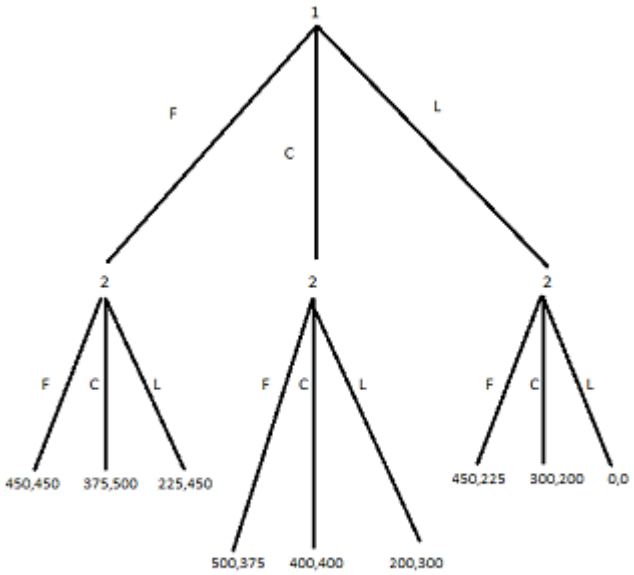
	q^F	q^C	q^L
q^F	450,450	375,500	225,450
q^C	500,375	400,400	200,300
q^L	450,225	300,200	0,0

[1] If you have studied models of oligopoly before, you can compute these: the first is the cartel output (and also the Stackelberg follower output); the second is the Cournot output; and the third is the monopoly output (and also the Stackelberg leader output, and also the output when both firms are perfectly competitive).

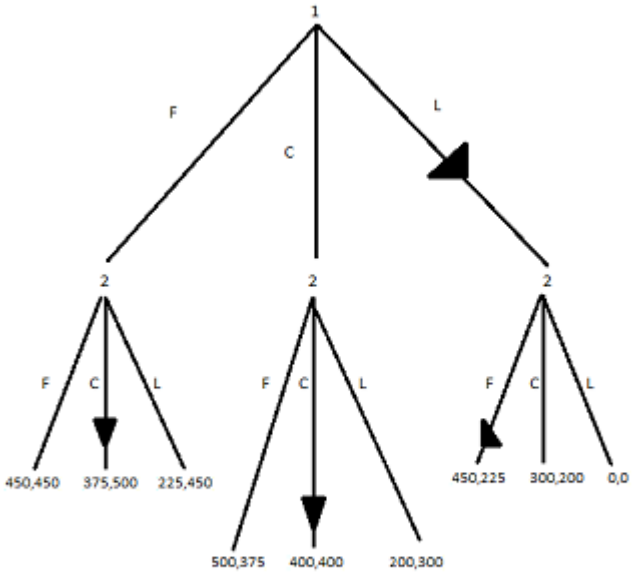
Writing best responses in bold:

	q^F	q^C	q^L
q^F	450,450	375,**500**	**225**,450
q^C	**500**,375	**400**,**400**	200,300
q^L	450,**225**	300,200	0,0

We can see that the unique Nash equilibrium of the simultaneous game is q^C, q^C. Now what if firm 1 goes first? Then we have an extensive form game:



Solution: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