Strategy in Law and Business
Problem Set 1
February 14, 2006

1.   Find the Nash equilibria for the following Games:

A:

		Criminal Suspect 2	
Criminal Suspect 1		Remain Silent	Confess
	Confess	**0**, -10	**-8**, -8
	Remain Silent	**-1**, -1	**-10**, 0

Confess, Confess

B:
In this version of the Prisoner's Dilemma, there are 3 criminals and the prosecution needs 2 witnesses to testify to get the conviction. He offers the following deal to each criminal: if you confess and testify against the other two, we won't use your confession against you if we can convict both of the other guys. If we can't get the conviction against both of the other guys, we'll be lenient with you if you confess (i.e., you'll serve a reduced term). If any individual doesn't confess and the other two don't rat him out, he'll serve the minimum term (i.e., a term less than the reduced term mentioned above). Also, if you don't confess and we can get a conviction against you, you will serve an additional term for obstructing justice.

Criminal Suspect 1 Remains Silent

		Criminal Suspect 3	
Criminal Suspect 2		Confess	Remain Silent
	Confess	-12, **-5**, -5	-1, **-5**, -1
	Remain Silent	-1, **-1,** -5	-1, **-1**, -1

Criminal Suspect 1 Confesses

		Criminal Suspect 3	
Criminal Suspect 2		Confess	Remain Silent
	Confess	-10, **-10**, -10	-5, **-5**, -12
	Remain Silent	-5, **-12,** -5	-5, **-1**, -1

Confess, Confess, Confess
Remain Silent, Remain Silent, Remain Silent

C:
Re-write the game in 1.B if the prosecutor only needs one witness to get a conviction, and he promises not to use a criminal's confession against that criminal. If the criminal is ratted out by one of the others (and does not confess himself), he gets 12 years in jail. If

1. A client hires a plaintiff's lawyer to litigate his case. The lawyer offers the client three possible fee structures. Option 1 involves paying the lawyer a flat fee to the lawyer of $750,000 win or lose. Client retains right to reject any settlement and lawyer bears litigation costs. Option 2 involves paying the lawyer 50 percent of any eventual settlement or judgment and the client retains the right to reject any settlement offer. Lawyer bears litigation costs. Option 3 involves paying the lawyer 35 percent of any settlement or judgment, and the client retains the right to reject any settlement offer, but if he does, he must cover the expenses involved in taking the case to trial. Option 4 involves paying the lawyer 25 percent of any settlement or judgment and the lawyer has the right to unilaterally accept or reject any settlement and the lawyer pays any litigation expenses himself. If the case goes to trial, there's a 25 percent chance of the plaintiff winning $6 million, a 40 percent chance of winning $3 million; otherwise, the plaintiff loses (i.e., gets nothing). Going to trial costs $100,000 to the plaintiff and $500,000 to the defendant. Settlement negotiations proceed with the defendant making an offer; if the offer is rejected, the parties go to trial.

1.a Depict this game in extensive form

If the case goes to trial, the expected value of the judgment is .25*(6,000,000) + .4*(3,000,000) + .35*(0) = $2.7 million

If it goes to trial:

Under fee arrangement 1, the lawyer gets $750,000-100,000=650,000; the plaintiff gets 2,700,000-750,000 = 1,950,000; the defendant pays 2,700,000+500,000=3,200,000.

Under fee arrangement 2, the lawyer gets .5*(2,700,000)-100,00 = 1,250,000; the plaintiff gets .5*(2,700,000) = 1,350,000; the defendant pays 3,200,000.

Under arrangement 3, the lawyer gets .35*(2,700,000)=945,000 if the client previously rejected an offer or 845,000 if the client has not rejected an offer; the plaintiff gets .65*(2,700,000)-100,000=1,655,000 if he previously rejected an offer or 1,755,000 if he hasn't rejected an offer; the defendant pays 3,200,000.

Under arrangement 4, the lawyer gets .25*(2,700,000)-100,000 = 575,000; the plaintiff gets .75*(2,700,000)=2,025,000; the defendant pays 3,200,000.

The trick here is to know that the defendant will make an offer that makes himself better off and whoever gets to make the settlement decision a little better off.

Thus, under arrangement 1, the client will accept any offer where he gets > 1,950,000 so the defense will offer 2,700,000.01 (which is better than what happens at trial; under 2, the client will accept anything giving him 1,350,000.01 so the defense offers 2,700,000.02; under 3, the client will accept anything giving him 1,650,000.01 so the defense offers 2,546,153.86; under 4, the lawyer will accept paying him 575,000.01 so the defense offers 2,300,000.04.

In the first stage of the game, the client will pick the fee arrangement giving him the highest payoff which is arrangement 1. So sketch the game with the first move involving the client's fee type choice, the second move involving the defense's offer and the next move involving the relevant player's acceptance/rejection of the offer, with the game culminating either in the acceptance or the trial.

1.b Solve this game
Client chooses 1, defendant offers 2,700,000.01, and client accepts with the following payouts: client (1,950,000.01); lawyer (750,000); defendant (-2,700,000.01).

1.c Re-solve the game for the case where litigation success probabilities depend on the fee structure in the following way: trial under flat fee, plaintiff wins $6 million with probability of 10 percent (loses otherwise); trial under 50 percent fee, plaintiff wins $6 million with probability of 50 percent (loses otherwise); trial under 35 percent fee, probability of winning $6 million is 35 percent (loses otherwise; trial under 25 percent fee, plaintiff wins $6 million with probability 25 percent (loses otherwise).

Same structure as above except that trial payouts change:

1: at trial, plaintiff gets .1*(6,000,000) – 750,000 = -150,000; lawyer gets 750,000-100,000=650,000; defense pays .1*(6,000,000)+500,000=-1,100,000.

2: at trial plaintiff gets .5*.5*(6,000,000)=1,500,000; lawyer gets .5*.5*(6,000,000)-100,000 = 1,400,000; defendant pays .5*.5*(6,000,000)+500,000 = -3,500,000.

3: at trial, plaintiff gets .65*.35*(6,000,000)-100,000=1,265,000; lawyer gets .35*.35(6,000,000)=735,000; defense pays .35*(6,000,000)+500,000= -2,600,000.

4: at trial plaintiff gets .25*.75*(6,000,000) = 1,125,000; lawyer gets .25*.25*(6,000,000)-100,000 = 275,000; defendant pays .25*(6,000,000)+500,000 = -2,000,000.

On the surface, it looks like the defendant will not make an offer under 1 since going to trial is negative value for the client (though, in real life, perhaps the lawyer would lower his fee)

Under 2, defense offers 3,000,000.02

Under 3, defense offers 1,946,153.86

Under 4, defense offers 1,100,000.04

So game works out with the client picking fee structure 2, the defense offering 3,000,000.02, the client accepts and the game ends with payoffs: client (1,500,000.01); lawyer (1,400,000.01); defense (-3,000,000.02)

2. A class action lawyer brings a class action case. The court sets a trial date 3 periods from the filing date. If the case goes to trial, the judge will award the plaintiff class $2.1 million and the lawyer will get 1/3 in fees. If the case settles before trial, the lawyer still gets 1/3 in fees. In every period, the plaintiff lawyer makes a settlement offer and the defendant accepts (ending the game) or rejects (causing the game to go to the next period. For every period, the plaintiff's lawyer suffers a cost of $100,000 in opportunity costs (i.e., cases foregone). The defendant faces no costs (beyond settlement or judgment).

    2.a Solve this game.
The defense knows that if it gets to trial, it will pay 2,100,000 and the plaintiffs lawyer will get a fee of 700,000. However it also knows that the plaintiffs lawyer will lose 3*100,000 while waiting to get to trial. So, the defendant knows that the trial outcome is only worth 400,000 to the lawyer. So if it offers a settlement that generates a slightly higher fee than that to the lawyer in the first period, he is better off than going to trial and he will accept it (he won't accept anything lower; he would accept a higher offer, but that requires the defense to pay more so it doesn't make sense). Game plays out with defense offering a tiny bit more than 1,200,000 and the payoffs are basically (lawyer 400,000.01; defense -1,200.000.03)

    2.b Assume now that the defendant has a per period rate of return of 10 percent, such that money spent in period 1 (for settlement) will not be available in the defendant's portfolio in negotiation periods 1, 2, 3 or in the trial period; money spent in period 2 will not be available for periods 2, 3, or the trial period; etc. Re-solve the game.

Note that nothing has changed for the lawyer; thus he still needs a settlement of 1,200,000.03 to make it worthwhile for him to accept in period 1. We merely need to determine whether or not this settlement is still a good deal for the defense. If the defense makes this deal, the cost to it is [(1 + .1)^3]*1,200,000 (note: think of it this way, if the defense holds onto the money it is worth 1.1*1,200,000 = 1,320,000 at the end of the 1st period which is worth 1.1*1,320,000 = 1,452,000 at the end of the 2nd period which is worth 1.1*1,452,000=1,597,200 at the end of the 3rd period. If this amount is less than what it will cost to go to trial (i.e., 2,100,000), the deal is still worthwhile for the defense. Since it is less, the defense offers 1,200,000 to the lawyer in period 1 and he accepts as above.

2.c Assume now that the plaintiff's lawyer is not paid on a contingency fee basis, but instead is paid on the lodestar basis in which the court pays the attorney $100,000 per period and he faces no opportunity cost (i.e., he has no outside options). Defendant's costs are same as in 2.b. Re-solve the game.
The lawyer does not settle under any scenario so defense makes no offer.

2.d Assume that the attorney is paid as in 2.c, but he only gets his fee if the case is successful. The class action is successful (i.e., judgment for $2.1 million) with a probability of 50 percent (judgment for $0 otherwise). Defendant's costs are as in 2.b. Re-solve the game
The lawyer will not accept any offer in periods 1 or 2 but will basically accept anything in period 3 since he wants to lock in his per period rate. Knowing this, the defense offers $1 in period 3 (Note: I now recognize an ambiguity in the question; I had meant that the attorney only gets the fee if he settles or if he is successful at trial, as is the case under lodestar, but this question is unclear as to what the lawyer gets for a settlement. Sorry).

3. Assume there are 2 types of insurance customers: high risk and low risk. Insurance is bought in period 1 and covers losses in period 2. The population of customers is split evenly between the two types. In period 2, low risk types have a 10 percent chance of suffering an insurable loss of $1000. High risk types have a 50 percent chance of suffering an insurable loss of $500 and a 10 percent chance of suffering a loss of $1000. Insurers can not tell the difference between types.
3.a Assume insurance regulations require insurers to offer just 1 price (and one set of coverage terms) to anyone seeking insurance. What price do they charge and who buys insurance?
Charge .1*1000 + .5* 500=$350 and only risky types buy.

3.b Assume that insurance regulators require all individuals to buy insurance and they regulate prices. What price will regulators set in this market to guarantee that insurers make no profits (assume overhead costs for the insurers is zero).

Set price .5*.1*1000 + .5*.5*500+.5*.1*1000 = $225 such that the insurer makes $125 on each low risk type but loses $125 on each high risk type (in expectation).

3.c Assume people are not required to buy insurance. Further, assume the insurer can offer different policies with different prices. Is a separating equilibrium possible? Give an example of two sets of policies (i.e., terms and prices) in which everyone buys insurance and the insurer breaks even (i.e., makes neither a profit nor loss). Hint: think of offering one policy that has a flat fee and covers all losses and a different policy that carries a fee and a deductible (or alternately, a flat fee but only covers losses above some amount).

You could charge $350 and cover all loses and offer a separate policy that charges $100 but only covers losses above $500.

one of the others rats on the criminal and he does confess as well, he gets 10 years in jail. If one of the criminals confesses but the others don't, the confessing criminal gets no jail time. If all remain silent, they each get 1 year in jail. Having the 2 other criminals rat you out is no worse than having just one of them rat you out. Set up the game and solve for the Nash equilibrium (equilibria).

Criminal Suspect 1 Remains Silent

	Criminal Suspect 3		
Criminal Suspect 2		Confess	Remain Silent
	Confess	-12, **-10**, -10	-12, **0**, -12
	Remain Silent	-12 **-12**,0	-1, **-1**, -1

Criminal Suspect 1 Confesses

	Criminal Suspect 3		
Criminal Suspect 2		Confess	Remain Silent
	Confess	-10, **-10**, -10	-10, **-10**, -12
	Remain Silent	-10, **-12**, -10	0, **-12**, -12

Confess, Confess, Confess

2. Represent the following as an extensive form game (i.e., as a game tree) and use it to predict how the game will unfold:

A. You are a plaintiff's attorney working on a contingency fee basis. You must decide whether or not to bring a case. You know that if you bring the case and win, you will receive 1/3 of the judgment in attorney's fees. If the case goes to trial and you win, the judgment will be for $1,000,000. The defendant can decide whether to fight the claim or not. If the defendant fights the claim, you have a 40% of winning. If the defendant does not fight the claim, your chances of success are 60%. To bring the claim, you must pay $75,000 in filing fees and preparation costs (including opportunity costs due to cases you must forego in order to bring this one) and you will not be reimbursed for these costs. To fight the claim, the defendant must invest $300,000, for which it will not be reimbursed.

Plaintiff bring or not bring followed by defense fight or not fight.

If plaintiff decides not to bring, payoffs are 0,0. If plaintiff brings and defense fights, plaintiff lawyer gets 400,000/3 – 75,000; defense pays 700,000. If defense doesn't fight, plaintiff lawyer gets 600,000/3-75,000; defense pays 600,000. Through backwards induction, it's easy to see defense won't fight a claim, so plaintiff lawyer compares 125,000 to 0 and chooses to bring the suit.

B. Re-do 2.A for the case in which the defendant has counsel on retainer and so the marginal cost of fighting the suit is only $100,000.

Same as above except now the cost to the defense if it fights is 500,000 which is less than what it will pay if it doesn't fight, so it fights. Plaintiff then compares payout from

bringing the suit which is about 58,000 to the 0 it gets if no suit is brought. So suit is brought and the defense fights.

C. What would happen if, before the games above are played, the plaintiff's lawyer has one chance to offer a settlement to the defendant (which the defendant can accept and end the game or reject and continue the games as described above). The plaintiff's lawyer still gets 1/3 of the settlement but no longer has to pay the $75,000 in filing fees and preparation costs.

The lawyer will make an offer that gives him a better payoff and the defense will accept anything that is cheaper, so in game one plaintiff offers 599,999.99 and the defense accepts. In game 2 the plaintiff offers 499,999.99 and the defense accepts.

D. What if it is the defendant has the chance to make one offer (and the plaintiff either accepts and ends the game or rejects and continues the games laid out above).

The defense will make an offer that lowers his cost and the plaintiff will accept anything that gives him a better payout. In game one, defense offers 375,000.03 and the lawyers accepts; in game 2, the defense offers 175,000.03 and the lawyer accepts.

E. What happens if the game is laid out as in 2.A, but if the defendant decides to fight, the players enter a simultaneous game in which each side has to decide whether to fight a little or a lot. If both sides fight a lot, the plaintiff wins $500,000 (and the lawyer gets a 1/3 of that), but the plaintiff's lawyer must undertake an additional preparation cost of $30,000 (again, he is not reimbursed). The additional cost to the defendant of fighting a lot is $50,000. If neither fights a lot, the plaintiff wins $500,000 and neither side faces costs above those laid out in 2.A. If the plaintiff fights a lot and the defendant fights a little, the plaintiff wins $750,000 (and again incurs additional cost of $30,000), while the defendant incurs just the cost listed in 2.A. If the plaintiff fights a little and the defendant fights a lot, the plaintiff loses (but incurs no additional cost above that laid out in 2.A), while the defendant again incurs an additional $50,000 cost to fight a lot.

The way to solve this game is to figure that the bring suit-fight branch's payoffs will be the result of the following simultaneous game

	Plaintiff lawyer		
defense		Lot	Little
	Lot	-850,000, **61,667**	-350,000, **-75,000**
	Little	-1,050,000, **145,000**	-800,000, **91,667**

The solution for this game is both fight a lot generating payoffs of 61,667 and -850,000 respectively. Clearly, the defense is better off not fighting at all. So the solution is that the plaintiff brings the suit and the defendant doesn't fight.

1. The Speaker of the House of U.S. Representatives (a very important position since the Speaker is effectively the agenda setter of the House) depends on 2 things for the retention of his job: 1) his party must hold a majority of seats in the House; and 2) his party must elect him through a majority rule vote (i.e., the minority party representatives do not vote for the Speaker). Use the insights of the median voter theorem to describe how a sitting speaker will use his agenda setting power if his only goal is to retain his position as Speaker (i.e., he has no natural policy preferences of his own or else they are entirely sublimated to his goal of retaining his position).

Brief Sketch of Answer: The median voter theorem says that a candidate who desires only electoral success will attempt to please the median voter (i.e., that voter who has equal numbers of other voters who are both more "liberal" and more "conservative" than he is). Thus, to secure his position within his party, the Speaker will support the policy preferences of the median of his party (i.e., the median Republican). However, to keep his party in power, the Speaker has an incentive to favor policies preferred by the median voter in the nation generally. If we assume, all other things equal, Republicans are farther right than Democrats, it is likely that the median Republican representative is significantly farther to the right than the median voter in the U.S. This poses a dilemma for the Speaker. If he attempts to use his agenda setting power to make his party's median happy, he will tend to "kill" proposals that are viewed as moderate from a national perspective (since if he doesn't, the Congress as a whole is likely to pass them even though these proposals will be unattractive to the party median) which will make it more likely that his party will lose seats (since under the party, the congress will generally only produce legislation that appears "extreme" to the median U.S. voter). On the other hand, if he allows moderate proposals to come to a vote (and presumably win a vote) in order to please the national median, he will lose the support of his party's median.

Visually, you might depict the situation approximately like this (where M stands for the relevant median and L stands for the left extreme and R stands for the right extreme)

US Voters
L--------------------------------M---------------------------------R
Minority Party
L------------------------
Majority Party
**   --------------------M--------------------R**

2. Grade inflation is generally seen as a negative thing in terms of a school's reputation (e.g., a school that has a reputation for grade inflation tends to be seen as an "easy" school). However, most people who have studied the phenomenon believe it is rampant in US schools (at the primary, secondary, and collegiate levels). Arguably, even those teachers/professors who view grade inflation as harmful to a school's reputation engage in the practice. Analyze the cause of this seeming inconsistency from a collective action standpoint and offer some potential solutions to mitigate the incentive problems teachers/professors face.

Basically, the reputation is a public good (at least among all those who have some stake in the school such as students, alumni, teachers, etc) which means that anything anyone does to improve it (e.g., cut back on grade inflation) will not capture all the benefits for himself (i.e., all the stakeholders will benefit) but the costs will be borne privately (e.g., student complaints, lack of enrollment for the classes you want to teach, etc.). This is the classic collective action problem. Everyone would be better off if others undertook actions to fight grade inflation. However, for an individual, MC is likely to be greater than the private MB even if MC is less than or equal to the social marginal benefit.

Possible solutions: Subsidize those who are "tough" graders; mandate a curve; limit channels for student complaints; move to a rank only system (i.e., where students are graded ordinally but not cardinally), etc. Basically, you want to either increase the private benefit to the tough teacher to bring it closer to the social/group benefit or you want to reduce the private cost.