Math 10 Extra Credit Final Review
20 points due at start of Final Exam

1. Determine maximin mixed-strategies producing a Nash equilibrium for the tennis-shot game given by the table below.

Success %	DL	CC
DL	(40,60)	(80,20)
CC	(70,30)	(20,80)

2. Use best-reply analysis to find all Nash equilibria of mixed-strategies for the *Battle of the Buddies* given by the table below.

Satisfaction	Starbucks	Peet's
Starbucks	(4,1)	(0,0)
Peet's	(0,0)	(1,4)

3. What is the strategic effect of allowing the row player to send a single text message to the column player prior to game play in the *Battle of the Buddies* given in problem 2?

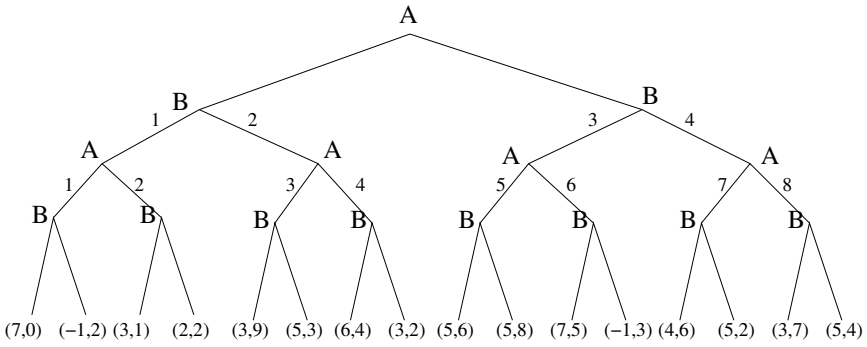
4. Suppose actors come in two types: good and bad. Both types of actors can get media hype if the studios promote them by using a public relations (PR) firm, but media hype is more costly to obtain for bad actors since they require more promotion. Suppose that studios have to spend C dollars on PR to get media hype for good actors, and $20C$ dollars on PR to get media hype for bad actors. Actors with media hype profit the studios \$50,000,000. Actors without media hype profit the studios \$6,000,000. What is the range of C values for which studios will choose to generate media hype for good actors, but not for bad actors?

5. Suppose that the drug company Merck has an scientific problem which, if solved, will increase Merck's profits by \$72 million. Merck wishes to outsource solving the problem to the bioinformatics company Gene Network Sciences (GNS). GNS charges \$12 million for standard analysis, for which GNS makes a profit of \$4 million. GNS charges \$18 million for exhaustive analysis, for which GNS makes a profit of \$8 million. Notice that if GNS charges for exhaustive analysis, but provides only standard analysis, then GNS makes a profit of \$10 million. In a project proposal to Merck, GNS estimates that standard analysis has a 50% chance of solving the scientific problem, and exhaustive analysis has an 75% chance of solving the scientific problem.

   (a) Show that a principal-agent problem arises if Merck hires GNS and pays a flat fee up-front for service.

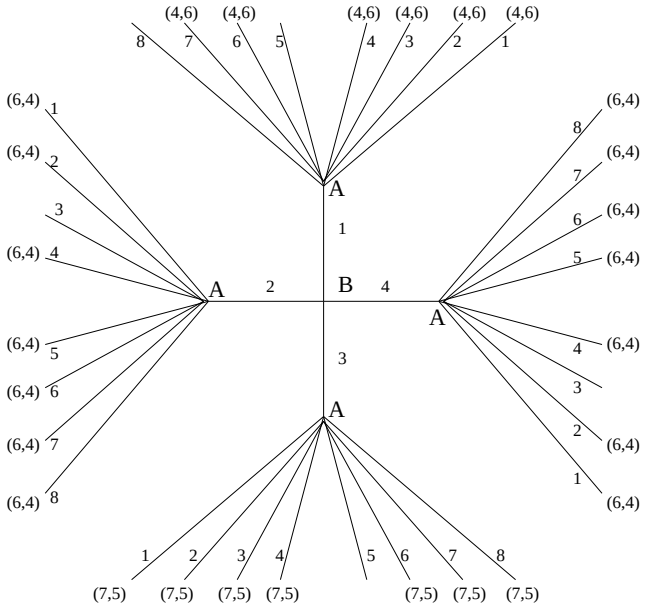
   (b) Consider the bonus-incentive contract wherein GNS provides up-front \$6 million of noncompensated work to Merck and earns a \$30 million bonus if and only if the scientific problem is solved. Does this bonus-incentive contract resolve the principal-agent problem in part (a)?

6. Consider the game tree below.



Suppose B can make a single advance commitment regarding their first move followed by A making a single advance commitment regarding their second move.

(a) Determine the missing payoffs at the terminal nodes of the advance commitment game tree diagrammed below.



(b) Find a Nash equilibrium of commitments for the advance commitment game above.

(c) Classify the commitments you found in part (b) above as threats or promises.

7. Consider the Petfood Store Cartel Game given by the game table

Profit in \$1000s	D	C
D	(\$140,\$140)	(\$180,\$100)
C	(\$100,\$180)	(\$160,\$160)

(a) Demonstrate that the Petfood Cartel Game is a Prisoner's Dilemma.

(b) Suppose that the stores sign a contract promising cooperation (i.e. promising to play row and column C), and that the penalty for deviating (i.e. playing row or column D) is incurring an immediate fine. Determine if the fine resolves the prisoner's dilemma for each of the amounts \$13,000, \$25,000, and \$45,000.

(c) Suppose that litigation is risky and expensive. In particular, suppose that *lawyer's fees* are \$75,000 for each firm and that the loser of a lawsuit pays all lawyer's fees. In the event of a conviction, assume the court will award the plaintiff the *actual damages* of \$60,000 and *punitive damages* of \$30,000. Lastly, suppose that the firms believe that there is a 70% chance of winning a lawsuit over breach-of-contract due to a defection from the cartel. Does a contract promising cooperation solve this prisoner's dilemma?

8. Allegra and Basil are to fight a three stage duel with toy suction-cup guns. In stage 1, each gun is loaded with a single suction-cup, and they are positioned 20 feet apart. Either may fire his or her gun. In stage 2, they advance to be 10 feet apart. Either may fire his or her gun, if they have a suction-cup remaining. In stage 3, they advance to be 0 feet apart. Either may fire his or her gun, if they have a suction-cup remaining. The duel ends either when at least one player is hit or if neither fires at the end of the 0 ft stage.

   When they are 20 feet apart, each has a 3/7 chance of successfully hitting the other. When they are 10 feet apart, each has a 5/7 chance of successfully hitting the other. When they are 0 feet apart, each has a 100% chance of successfully hitting the other.

   Each player gets a payoff of -1 if he/she is hit while the other is not hit. Each player gets a payoff of +1 if he/she is not hit, while the other is hit. Each player gets a payoff of 0 if both are hit or neither is hit.

   Find a Nash equilibrium of pure-strategies for the duel specifying in each stage whether the player waits or shoots.

9. Suppose that ATT and Borizon are two cell phone service providers that can charge either Low or High prices for service, and that their monthly profits are given by the Cell Price Game table below.

Profit in $1000s	Low	High
Low	(288,288)	(360,216)
High	(216,360)	(324,324)

   Notice that the Cell Price Game is a prisoner's dilemma. Suppose that the interest rate is 5% and that Borizon in on the verge of bankruptcy; in fact, each month the chance that Borizon will go out-of-business is $\frac{3}{8}$. Assuming that Borizon follows the Tit-for-Tat price strategy, determine which of the following ATT price strategies is the best: (a) Never defect, (b) Defect only once, (c) Defect forever.