Problem set 5

due Tuesday, April 19

Problem 1 Little Airlines' Lexington-Mumbai route is flown by both tourists and business travelers. Tourists (80% of all travelers) have demand $p = 30 - q$ for quality level q, while business travelers (20% of all travelers) have demand $p = 40 - q$. For the sake of simplicity, assume that it does not cost the airline anything to change the quality levels in its plane, and that capacity is not a concern; the plane used on this route is big enough to hold all travelers.

a. Currently, Little Airlines has 2 sections on its plane: coach, with quality 30, and business class, with quality 40. What prices should it set for a coach ticket and a business class ticket so that tourists buy coach tickets and business travelers buy business class tickets?

b. Demonstrate that the quality levels identified in part a. are not profit-maximizing for Little Airlines.

c. Suppose the fraction of travelers flying this route on business were to increase. What effect, if any, would this have on the optimal price of a coach ticket? Explain.

d. (**10 points extra credit**) Using either calculus or Excel, determine the profit-maximizing prices Little Airlines should set in coach and in business class, both when 80% of all travelers are tourists, and when 90% of all travelers are business travelers. If it helps, you can assume that there are 100 total travelers, and that the plane is more than large enough to hold all 100. If you do this problem, turn it in directly to me separately from the rest of your homework. Show all work, including, if necessary, a printout of any Excel sheets. Do not turn in anything unless you feel confident you have fundamentally the right approach, and don't waste time on this problem if you are not confident you have a firm grasp on the rest of this homework.

Problem 2 Two bills are being considered in Congress (bill A, which would reinstitute the Volstead Act, and bill B, which would prohibit anyone of Canadian origin from owning property). Here are the payoffs to Congress and the president depending upon which laws are passed:

Outcome	Congress	President
Bill A only	8	-1
Bill B only	-1	9
Both bills	5	5
Neither bill	0	0

a. Suppose that Congress first decides which of the four options to select. The president can then either sign or *veto*, in which case no law is passed. Which bills become laws in the equilibrium of this sequential game? Explain, with aid of a diagram.

b. Now suppose that the president has a *line-item veto*, so that if Congress passes both bills, he can choose to sign bill A or bill B only. However, he cannot enact laws that Congress does not pass. Which bills become laws in the equilibrium of this game? Explain.

c. It is often suggested that giving the president a line-item veto would be a good way to make government work more efficiently, as then he would not have to veto entire bills just because he felt one provision of the bill would make a bad law. In light of this question, what do you think of this suggestion?

Problem 3 Consider the following game played between a taxpayer and the IRS:

		IRS: Audit	IRS: Don't audit
Taxpayer	Cheat on taxes	-60,60	-5,5
	Don't Cheat	-30,25	-30,30

The game has no pure strategy Nash equilibria, but has one mixed strategy Nash equilibrium. Find it.

Problem 4 Ocelots are, from birth, either hawkish or dovish. Hawkish ocelots are more likely to have hawkish babies, and dovish ocelots are more likely to have dovish babies, though there is, of course, some chance of a parent of one type having a child of the other. Several times a day, an ocelot comes across another ocelot, and both ocelots benefit/are harmed by the interaction as follows:

		ocelot 2: Hawk	ocelot 2: Dove
ocelot 1	Hawk	-20,-20	8,0
	Dove	0,8	6,6

Think of the payoffs here as gain/loss to reproductive fitness. High payoffs are correlated with high fertility, low payoffs with low fertility.

a. Suppose most ocelots are hawks. Will hawks or doves reproduce more?

b. Suppose most ocelots are doves. Will hawks or doves reproduce more?

c. Solve for the cutoff between parts a and b, where hawks and doves reproduce at the same rate.

d. As the ocelot population evolves, what fraction of hawkish ocelots will evolution produce in the long run?

e. Suppose that over time, Ocelots evolve shorter teeth and claws, so that the payoffs in the (Hawk, Hawk) box change from $(-20, -20)$ to $(-5, -5)$. All other payoffs are the same. Is this adaptation likely to benefit or harm the ocelot population? (Hint: is the average fitness of an ocelot higher or lower once a new equilibrium between hawks and doves evolves?)

Problem 5 This problem demonstrates a seeming peculiarity about mixed strategy Nash equilibria. Consider the following game between the Chicago Bears' offense and the Green Bay Packers' defense. Payoffs are the number of yards advanced (positive yards for Chicago are negative yards for Green Bay).

		Green Bay: run defense	Green Bay: pass defense
Chicago	run	-5,5	7,-7
	pass	12,-12	0,0

a. Find the mixed-strategy Nash equilibrium of the game.

b. Now suppose that the Bears improve their run game by bringing Bo Jackson out of retirement:

		Green Bay: run defense	Green Bay: pass defense
Chicago	run	-5,5	10,-10
	pass	12,-12	0,0

Find the mixed-strategy Nash equilibrium of the new game.

c. When running the football becomes a more attractive option for the Bears, do they run more often, or pass more often? Can you explain why?