

**UCSD**  
**Economics 170B**  
**Midterm**

May 24, 2001  
Professor J. Betts

DO NOT BEGIN OR TURN THE PAGE UNTIL TOLD TO

Please print:            Name: \_\_\_\_\_  
                                 Student # \_\_\_\_\_

1. You may use pencil instead of pen if you wish, but exams cannot be submitted for re-marking unless you used pen. If you resubmit your test for regrading we reserve the right to regrade the entire test. You must resubmit your test by the class after the test is handed back at the latest should you choose to do this.
2. You must hand in all materials, including paper used for rough work.
3. Show all of your work.

There is a total of 66 points on this test. You have one hour twenty minutes to finish the quiz.

Good luck!

For graders' use:

Question		Out of a Total of:
1		16
2		20
3		20
4		10
<b>TOTAL</b>		<b>/66</b>

1. **(16 points)** Two firms compete in a local market. Each firm does better if it chooses product characteristics (hi-tech or low-tech) that differ from the other firm. The firms compete only once. Here is the payoff table:

		Firm 2	
		Hi	Lo
Firm 1	Hi	0	6
	Lo	9	-3

a) **(4)** Is there a pure strategy Nash equilibrium to this game? Explain why or why not.

b) **(8)** Derive the mixed-strategy equilibrium to this game. Show your work and explain what you are doing in each step.

c) **(4)** Verify that you have obtained a mixed strategy equilibrium by proving that either firm is now indifferent between which strategy it chooses.

2. **(20 points)** Disappointed by his election loss, Al Gore decides to go to Vermont, where he buys a farm and goes into the maple syrup business. Hearing this, President Bush's family builds a coal-fired electricity plant nearby, which produces acid rain and reduces Al Gore's maple syrup crop.

The Bushes' cost of generating electricity in quantity  $X$  is  $X^2$ . They can sell all they want at \$40 per unit.

Al Gore can produce syrup in quantity  $S$  at a cost of  $(S^2 + 0.5X)$ , and can sell syrup at a price of \$10 per unit.

a) What is the profit-maximizing quantity of syrup that Al Gore produces, and the profit-maximizing quantity of electricity  $X$  that the Bushes produce? Show your work and confirm that you have derived the profit-maximizing quantities. What are profits of Gore and the Bushes? (6)

b) What is the optimal per unit tax that the government should impose on the electricity plant? (We can suppose that the taxes generated are given to Al Gore's tree farm and so increase his profits while decreasing profits of the electricity plant.) What are the profit maximizing levels of output  $X$  and  $S$ , and profits of the two companies, after taking into account the transfer of the tax revenues from the electricity plant to Al Gore's tree farm? (Check that these are profit maximums.) What is the sum of profits? Show your work.  
(8)

c) Another way of “internalizing the externality” would be for the Bush family and Al Gore to agree to merge their two companies. Suppose that this happened and that there is no tax on the electricity plant. Calculate the profit-maximizing level of X and Y for the combined maple-syrup-electricity company, Gored-Bushes Inc. How does the level of output and the combined profit compare to what results under the optimal tax in b? (6)

3. (20 points) A company is about to launch a new product. Based on past experience, it believes that the probability is 0.5 that the product will generate profits of 20 and 0.5 that profits will be  $-10$ . It really depends on consumers' psychological reaction to the new product.

a) What is the expected profit? Show your work. (3)

b) The company can spend on consumer focus groups in which consumers are shown a sample of the new product. After these interviews, there is a 50-50 chance that the focus group will like or hate the new product. Based on past experience, the firm knows that if the focus group likes the product, there is a 100% chance that it will succeed with profits of 20 (before the cost of the focus group). If the focus group hates the product, then there is an 80% chance that the product will fail, with profits of  $-10$  before the cost of the focus group and a 20% chance that the product will succeed, with profits of 20 before the cost of the focus group. If the company spends on a focus group, it can decide whether to go ahead with the product or cancel it after hearing the results of the focus group.

Create a decision tree to calculate the expected profit (ignoring the cost of the focus group) (Show the path or paths that the firm should not choose by writing a “//” across the branches of the decision tree that are not followed. Also calculate the expected profit overall, and from each branch, as you have seen in the textbook.) (Hint: you might prefer to do a rough draft on the back of this page first. Also, the first part of the tree, on the left, is an event node where the focus group results come in. This is followed by decision nodes where the firm has to decide whether to launch the product or not to launch the product.) (16)

c) What is the economic value of the information provided by a focus group? (1)

4. **(10 points)** Your company has a product that you believe has the probability 0.2 of being a success (S) and 0.8 of being a failure (F).

a) A marketing firm offers to test your product for you before you decide whether to launch the product. The marketer provides evidence that in past testing of similar products, it has found a positive test result (P) 10% of the time and a negative test result (N) 90% of the time. Moreover, 40% of successful products receive positive test results

from the marketer. If you get a positive test result, calculate the new probability that you should assign to a successful release. (4)

b) Suppose instead that the marketing firm tells you that it has found a positive test result (P) 10% of the time and a negative test result 90% of the time. Moreover, 10% of successful products receive positive test results from the marketer. If you get a positive test result, calculate the new probability that you should assign to a successful release. If the marketer charges \$10,000 for this service should you buy marketer's service? Why or why not? (6)