

Midterm #2

10/27/11

Instructions: You have 75 minutes to complete this exam. Please support your answers by showing your work and writing out complete explanations for any claims you make. Good luck!

Section 1 (39 points) Please answer the following multiple choice questions, which are each worth 3 points. Clearly mark your answer. Choose the best answer.

1. Consider the following game:

		Jennings	
		Post	Slant
Rodgers	Post	10,9	8,6
	Slant	7,3	9,x

Which of the following is/are true?

- a. If $x = 2$, there are two pure strategy Nash equilibria.
 - b. If $x = 4$, there is only one pure strategy Nash equilibrium.
 - c. Rodgers has a dominant strategy.
 - d. If $x = 0$, Jennings has a dominant strategy.**
 - e. All of the above.
 - f. Both a and b.
 - g. Both b and d.
2. Which of the following is true?
- a. If an activity generates both an external cost and an external benefit, then too little of the activity will be undertaken relative to the amount that is efficient.
 - b. If society relies exclusively on private contributions to finance a public good, then too much of the good will be produced relative to the amount that is efficient.
 - c. A good is *nonexcludable* if the consumption of the good by one person does not decrease how much another person can consume.
 - d. If an activity imposes an external cost (and no external benefit), then a tax on that activity will increase the gap between the actual level of that activity and the optimal level.
 - e. Both a. and c.
 - f. Both c. and d.
 - g. None of the above.**

3. Consider the following game in which each player has three strategies:

		2		
		Rock	Paper	Scissors
1	Rock	10,10	2,2	2,2
	Paper	2,2	r,s	1,1
	Scissors	2,2	1,1	t,u

r , s , t , and u are constants that we do not know. What is the *smallest* number of pure strategy Nash equilibria that can exist in this game?

- a. 0
 - b. 1
 - c. 2
 - d. 3
 - e. 4
 - f. 5
4. Two firms, X and Y , play a game in which each has two strategies: invest or not invest. If both firms choose to invest, each gets a payoff of 10. If both firms choose to not invest, each gets a payoff of 2. If one firm invests and the other does not, the firm that invests gets a payoff of 5, while the firm that does not gets a payoff of 0. Which of the following is true:
- a. Each firm has a dominant strategy which is to invest.
 - b. A firm's best response to its opponent playing invest is to invest.
 - c. A firm's best response to its opponent playing not invest it to invest.
 - d. There is only one Nash equilibrium to this game, which is for both firms to invest.
 - e. **All of the above are true.**
 - f. None of the above are true.
5. Which of the following would *not* be a negative externality?
- a. Smelter, Inc. creates steel and pollution in Stoughton, WI.
 - b. Your friend buys a puppy that barks every night.
 - c. **You have an adverse reaction to a new medication a physician prescribed for you.**
 - d. Leslie, who occupies the apartment above you, has very loud arguments with her husband every night.
 - e. Your neighbor is dirty, causing a rat infestation in the whole neighborhood.
 - f. You drive to campus, slightly increasing traffic delays for everyone else.
 - g. At least two of the above are not negative externalities.
 - h. All of the above are negative externalities.

Questions 6 and 7 use this game:

		Texas	
		A	B
Florida	A	0,0	8,y
	B	x,8	2,2

where x and y are two numbers to be specified later.

6. What values of x and y ensure that Florida playing B and Texas playing B is a Nash equilibrium?
- a. $x < 2$ and $y < 2$
 - b. $x < 4$ and $y < 4$
 - c. $x > 0$ and $y > 0$
 - d. $x > 2$ and $y > 2$
 - e. $x < 8$ and $y < 8$
 - f. More than one of the above are correct.
 - g. None of the above are correct.**
7. What values of x and y ensure that Florida playing B and Texas playing B is a dominant strategy equilibrium?
- a. $x < 2$ and $y < 2$
 - b. $x < 4$ and $y < 4$
 - c. $x > 0$ and $y > 0$
 - d. $x > 2$ and $y > 2$
 - e. $x > 8$ and $y > 8$
 - f. More than one of the above are correct.
 - g. None of the above are correct.**
8. Which of the following is true of efficiency wages?
- a. An efficiency wage is when a firm pays a higher than normal wage so that only smarter, more educated workers will want to work for the firm.
 - b. A firm is said to pay an efficiency wage if it pays workers with more education a higher salary.
 - c. There is strong empirical support for efficiency wages being an important phenomenon.
 - d. Efficiency wages can increase long-term unemployment.**
 - e. All of the above are true.
 - f. None of the above are true.

9. For which type of job would it make the most sense for an employer to pay an efficiency wage?
- a. **Efficiency wages are more likely in jobs in which it is hard to directly monitor worker effort, to incentivize workers to exert high effort.**
 - b. Efficiency wages are more likely in jobs in which it is hard to directly monitor worker effort, as such jobs require more education, and so employers have to pay a high wage to attract an educated workforce.
 - c. Efficiency wages are more likely in jobs in which it is easy to directly monitor worker effort, as then it is easier to know which workers are doing a good job.
 - d. Efficiency wages are more likely in jobs in which it is easy to directly monitor worker effort, as these workers will be more productive.
 - e. a and b.
 - f. c and d.
 - g. none of the above.
10. Geniuses and morons look identical, but geniuses will increase a firm's revenue by 50, if hired, and morons will increase revenue by only 10. One year of education costs a genius 5, and a moron 10, but does not increase the productivity of either. Education level is observable by firms prior to hire. Which of the following is true of a separating equilibrium:
- a. **Geniuses will get 4 years of education, morons will get 0 years.**
 - b. Geniuses will get 10 years of education, and morons will get 0 years.
 - c. Both geniuses and morons will get 4 years of education.
 - d. Both geniuses and morons will get 0 years of education.
 - e. There are multiple equilibria; two or more of the above are correct.
 - f. None of the above.
11. Suppose in problem 10, the cost of one year of education to a genius increased from 5 to 6. What effect would this have on your answer?
- a. It would increase the amount of education a moron would get.
 - b. It would decrease the amount of education a moron would get.
 - c. It would increase the amount of education a genius would get.
 - d. It would decrease the amount of education a genius would get.
 - e. At least two of the above.
 - f. **None of the above.**

12. Which of the following is *not* a potential consequence of adverse selection?
- a. Rental car insurance is more likely to be purchased by reckless drivers.
 - b. Lazy workers are more likely to shirk when they aren't closely monitored.**
 - c. Less trade taking place than would be optimal.
 - d. In Major League Baseball, free agents who switch teams perform worse the following year than those who stay with their current team.
 - e. At least two of the above.
 - f. None of the above.
13. Two policymakers must agree on one of the following three policies: A , B , or C . First, policymaker 1 chooses either to enact policy C or to not do so. If he enacts C , the game ends. If he does not, policymaker 2 chooses between A and B . 1's preferred policy is B , then C , then A . 2 prefers A , then B , then C . Solving this game using backward induction, which policy is enacted?
- a. A
 - b. B
 - c. C**
 - d. There are multiple equilibria.
 - e. There is no equilibrium of this game.

Problem 2 (30 points) Consider an economy with 5 types of workers. Workers have different labor market productivities, and more productive workers have higher outside options (the money they can make working for themselves). A worker will not work for any wage below his outside option. A firm will not pay a worker a wage greater than his expected productivity. All workers look identical; firms cannot tell a worker's type when he is hired.

The following table gives productivity and outside option for each type of worker, as well as the percentage of each type over all workers:

Worker type	productivity	outside option	percentage
1	\$150,000	\$100,000	10%
2	\$120,000	\$80,000	30%
3	\$90,000	\$60,000	30%
4	\$60,000	\$40,000	15%
5	\$30,000	\$20,000	15%

a. If all workers participate in the labor market, what is the maximum wage an employer would be willing to pay?

Expected productivity is $.1 * 150,000 + .3 * 120,000 + .3 * 90,000 + .15 * 60,000 + .15 * 30,000 = \$91,500$. The highest wage a firm would be willing to pay is \$91,500.

b. At the wage you identified in part a, which, if any, workers would prefer to take their outside option?

Type 1 workers would prefer their outside option, and will leave the labor market.

c. If only types 2-5 participate in the labor market, what is the maximum wage an employer would be willing to pay?

Now, expected productivity is $120,000 * \frac{1}{3} + 90,000 * \frac{1}{3} + 60,000 * \frac{1}{6} + 30,000 * \frac{1}{6} = \$85,000$. The maximum wage a firm would pay a worker is \$85,000.

d. At the wage you identified in part c, which, if any, workers would prefer to take their outside option?

All type 2-5 workers would remain in the labor market.

e. Will there be any market unraveling in this example? Explain. What could workers who are excluded from the labor market do about this?

Yes, the market will partially unravel, in that the top 10% of all workers will leave the labor market and work from home, even though their productivity at home is \$50,000 less than what it would be in the labor market. These type 1 workers would rejoin the labor market if they could signal their ability to employers, such as by a high level of educational achievement.

Problem 3 (30 points) Velociraptors are, from birth, either hawks or doves. Hawkish velociraptors always fight other hawks and try to attack doves, while dovish velociraptors run from hawks and co-exist peacefully with other doves.

Several times a day, velociraptors encounter other members of their species, and either fight or flee. A velociraptor's payoff from such an encounter is given below:

		Velociraptor 2	
		Hawk	Dove
Velociraptor 1	Hawk	-10,-10	6,-1
	Dove	-1,6	5,5

a. Solve for the mixed-strategy equilibrium in this game. Let X be the fraction of hawkish velociraptors in the population.

In the mixed strategy equilibrium, $\frac{1}{10}$ of all raptors are hawks, and $\frac{9}{10}$ are doves.

Suppose that if the average payoff for either type of velociraptor is negative, the population of velociraptors of that type decreases over time. If the average payoff is positive, that type will increase over time.

b. Initially, 1% of all velociraptors are hawks, and 99% are doves. Explain what will happen to the population of velociraptors in the long-run.

A hawk's average payoff is $5.84 = .01 * -10 + .99 * 6$. A dove's average payoff is $-.94$. Hawks will thrive and doves will get eaten by the hawks, until the population stabilizes at the equilibrium identified in a.

c. Now suppose that initially, 30% of all velociraptors are hawks, and 70% are doves. Explain what will happen to the population of velociraptors in the long-run.

A hawk's payoff is now 1.2, while a dove's is 3.2, so doves will reproduce faster than hawks, until the population stabilizes at the equilibrium identified in a.

d. Finally, suppose that initially, 90% of all velociraptors are hawks. What will happen to the velociraptor population in the long-run?

Now, hawks get an average payoff of -8.4 , and doves an average payoff of $-.4$. Both hawks and doves will die out, and the population will either become extinct, or, if hawks die more quickly than doves, converge to the equilibrium you identified in a.

e. Extra credit (1 point): draw a picture of a velociraptor.

