Name: **Key**

Econ 304—Bethany College

**Exam 01**

* There are 110 possible points on this exam. The test is out of 100.
* You have one hour to complete this exam, but you should be able to complete it in less than that
* Please turn off all cell phones and other electronic equipment.
* You are allowed a calculator for the exam. This calculator cannot be capable of storing equations. This calculator cannot double as a cell phone.
* Be sure to read all instructions and questions carefully.
* Remember to show all your work.
* Recall basic logic. “Water is wet” is a true statement. “Water is wet and leopards have stripes” is a false statement.
* *Please print clearly and neatly.*

**Part I: Multiple Choice.** *Choose the best answer to the following.*

4 points each.

1. In November 2012, Apple made an agreement with cell phone maker HTC to stop suing each other for patent violation. That agreement immediately terminated all patent litigation pending against each other and the two agreed to a 10-year cross-licensing agreement. For the next decade, HTC is free to use any Apple patents and vice versa without charge. This creates an opportunity for either company to invest less in R&D and simply free ride off the inventions of the other firm. Why ***wouldn’t*** either company do this? (HINT: This is a prisoner’s dilemma set up; recall repeated play solves the dilemma.)
	1. **Because they’ll negotiate a new agreement in ten years and no one wants to share with someone who doesn’t contribute.**
	2. Because technology is really important to making a profit.
	3. Because both parties are risk-averse: cheating will surely lead to a punishment as cooperating will lead to a reward.
	4. B & C
	5. None of the above

*The ten-year time limit is an example of repeated play, meaning both parties know they will play again. It’s reasonable to assume there’s some sort of trigger strategy in place (most likely grim) so that incentivizes both parties not to cheat. While this is similar to option (C), it does not require risk aversion as the option suggests.*

1. Consider a hypothetical case where, during poor weather conditions, someone drove off a small cliff from a little-used road. The driver sues the county for damages. Suppose judge estimates that putting guardrails along the road would cost $1,000, the probability of an accident is 3%, and the cost the driver suffered (including car repairs and medical bills) is $30,000. Based on the Learned Hand Rule and the information presented, how would the judge rule in this case?
	1. For the county, because B < pL
	2. **For the county, because B > pL**
	3. For the driver, because B < pL
	4. For the driver, because B > pL
	5. There is not enough information to answer this question

*The expected cost of the accident is $30,000 times 3%, or $900. That is less than the burden, B, that the county must spend to avoid so the court would rule for the county. Note this explains why you don’t see guardrails as much as you might think there should be when you’re driving.*

1. Which of the following possibilities for the missing payoffs would make this game one of contributory negligence?

|  |  |
| --- | --- |
|  | *Pedestrian* |
| Due Care | No Care |
| *Motorist* | Due Care | -10,-20 | ???,??? |
| No Care | 0,-110 | 0,-100 |

* 1. -10,-100
	2. 0,-110
	3. -10,-10
	4. None of these would work but there are some that could.
	5. **There is no way to make this a game of contributory negligence.**

*If this is a game which could get contributory negligence, then both taking Due Care would be Nash equilibrium. But it’s not: the Motorist would have an incentive to take No Care.*

1. Consider the game below. What could X be to ensure there are no Nash equilibrium? (Note there are two Xs, meaning the payoff for each X would have to be the same.)

|  |  |
| --- | --- |
|  | **Mitt Romney** |
| *Defense* | *Attack* |
| **Newt Gingrich** | *Defense* | X, 3 | 7, 4 |
| *Attack* | 2, 4 | 8, X |

1. 1
2. **3**
3. 5
4. A & C
5. None of the above

*If you choose 1, Newt won’t want to* Defend *if Mitt* Defends*. If you choose 5, Mitt won’t want to* Defend *if Newt* Attacks*. Either way, you’ll get a Nash Equilibrium, but you won’t if you choose 3.*

1. Suppose all strategies for all players in a simultaneous-move game are weakly dominant. What must be true about the game?
	1. All payoffs in the game are the same
	2. There is no Nash equilibrium
	3. At least two strategies (one per player) are strictly dominant
	4. A & C
	5. **None of the above**

*While A may be true, it is not necessarily true. It is possible one player gets a payoff no matter what she does and another player gets a different payoff no matter what he does. Thus we have two payoffs. I’d give you partial credit if you wrote A.*

1. Describe a dominant strategy for this game (concerning the Northwest Passage).

|  |  |
| --- | --- |
|  | **Russia** |
| *Sovereignty* | *Compromise* | *Cede Rights* |
| **Canada** | *Sovereignty* | 2,2 | 5,1 | 6,0 |
| *Compromise* | 1,5 | 3,3 | 5,1 |
| *Cede Rights* | 0,6 | 1,5 | 0,0 |

* 1. *Claim Sovereignty* for both Canada and Russia is weakly dominant.
	2. ***Claim Sovereignty* for both Canada and Russia is strictly dominant.**
	3. *Compromise* for both Canada and Russia is weakly dominant.
	4. There are no dominant strategies, weak or strict.
	5. None of the above

*For both countries, the payoffs are always highest by playing* Sovereignty. *The payoff is never equal to the payoff received by playing another strategy so the result is strict dominance.*

1. Which of the following environmental issues describes a stag hunt rather than a prisoner’s dilemma? Ignore institutional incentives (e.g. fines).
	1. Littering on a public beach
	2. Roommates playing loud music
	3. Polluting a long river
	4. A & C
	5. **None of the above**

*Recall that a stag hunt is when cooperation between the two players is Nash Equilibrium. In other words, moving to defection (litter, playing the music loudly, or polluting) when both are cooperating means the defecting player loses something (or rather loses more than he gains). Assuming the benefits of water/beach/noise pollution exceeds the costs, the player will always want to defect. Indeed, this is why we have fines for pollution and roommate agreements/RAs: the incentive to defect is strong. As a side note, you may argue option (B) doesn’t work because the walls are probably not sound proof but such an observation isn’t necessary. Though option (B) is ultimately closer to a chicken game: if you both play loud music, you’re just going to get a bunch of noise.*

1. Which of the following is a tit-for-tat strategy?
2. “An eye for an eye, a tooth for a tooth”
3. Issuing a fine each time someone litters.
4. Taking steroids gets you permanently banned from official competitions
5. **A & B**
6. None of the above

*In both cases, punishment occurs only once per violation, allowing normal cooperation to resume.*

**Part II: True/False.** *Answer true or false, and justify your answer.*

10 points each.

1. If each player has a strictly dominant strategy, the game has exactly one Nash Equilibrium.

*True. If a strategy is strictly dominant then no player would want to choose another strategy. If this is true for both players, then the resulting combination is Nash Equilibrium.*

1. It makes more sense to tax dog barking and excrement than it is to create a tradable allowance. (The externality here is that dogs bark at night and poop in places where people might step in it.)

*Either true or false works here; it’s all in how you justify it.*

*If you go with true, then it’s because the size of the externality is relatively stable and known. That’s probably true with stepping to dog poo—everyone is disgusted to about the same amount—and a little less so with dog barking—while people have different tolerances for barking dogs, there are definitely times when everyone finds it more annoying (late at night) and one could argue at those times, everyone is equally annoyed.*

*If you go with false, then it’s because the tolerable amount of barking and excrement is well known. That’s likely true with barking—it would be derived from burglaries, fires, and other emergencies when drawing attention to it is worth the annoyance or lack of sleep. The optimal amount of excrement is trickier, however, since it depends where it is and so that optimal amount changes based on location (heavily trafficked areas or areas with few out-of-the-way places should have near zero poo while a rural front yard could tolerably have much more).*

*None of this discusses how practical it is to charge an owner every time her dog barks or to keep track of how many times her dog barks. One can imagine a system of when you encounter dog poop, you have it tested and the appropriate action take place but regardless, practicality wasn’t the point of this question.*

1. The chicken game shows why cartels have difficulty being successful.

*False. The chicken game has two Nash Equilibria, no dominant strategies, and results in an outcome where both players can’t be better off. The prisoner’s dilemma illustrates the difficulty of cartels.*

**Part III: Short Answer.** *Answer the following.*

16 points each.

1. Below is a standard prisoner’s dilemma game. At what interest rate would Jack be willing to cheat once if Jill followed a tit-for-tat trigger strategy? What would be the interest rate if she followed a grim strategy? Be sure to show your work.

|  |  |
| --- | --- |
|  | **Jill** |
| *High* | *Low* |
| **Jack** | *High* | 100,100 | 0,195 |
| *Low* | 195, 0 | 99,99 |

*Tit-for-tat*

*If Jack goes Low, he’ll gain 95 and then he’ll lose 100 the following turn. He will go Low if:*

*95 > 100 / (1+r)*

*1+r > 100/95*

*1+r > 1.0526, or r > 0.0526 (5.26%)*

*Grim*

*If Jack goes Law, he’ll gain 95 and then he’ll lose 1 (99 rather than 100) forever. Recalling the infinite series, he will go Low if:*

*95 > 1/r*

*r > 0.0105 (1.05%)*

1. In the game below, find the mixed strategy equilibrium. Remember to show your work. Diagram the result.

|  |  |
| --- | --- |
|  | **Mario** |
| *Move Right* | *Move Left* |
| **Bowser** | *Move Right* | 3, -3 | -2, 2 |
| *Move Left* | -5, 5 | 1, -1 |

*Let p = probability of Bowser* Moving Right*. To make Mario indifferent, Bowser’s p-mix must be:*

*3p + -5(1 – p) = -2p + 1(1 – p)*

*3p + -5 + 5p = -2p + 1 – p*

*11p = 6*

*p = 0.545*

*Let q = probability of Mario* Moving Right*. Mario’s q-mix is:*

*-3q + 2(1 – q) = 5q + -1(1 – q)*

*-3q + 2 – 2q = 5q – 1 + q*

*-11q = -3*

*q = 0.273*

1

1

p

q

0.545

**Mario**

0.273

**Bowser**

1. Using the game below, determine if there is a first-mover advantage, second-mover advantage, or no mover advantage. Remember to show your work.

Joker

Batman

Batman

10, 30

5, 40

20, 20

0, 10

Banter

Attack

Attack

Attack

Monologue

Banter

*First, we use backward induction to determine the rollback equilibrium.*

Joker

Batman

Batman

10, 30

5, 40

20, 20

0, 10

Banter

Attack

Attack

Attack

Monologue

Banter

*Now let’s reverse the game…*

Joker

Batman

30, 10

20, 20

40, 5

10, 0

Attack

Monologue

Banter

Attack

Monologue

Attack

Joker

*…and play it again.*

Joker

Batman

30, 10

20, 20

40, 5

10, 0

Attack

Monologue

Banter

Attack

Monologue

Attack

Joker

*As the 1st mover Batman gets 40 and as the 2nd mover he gets 20.*

*At the 1st mover Joker gets 20 and as the 2nd mover he gets 5.*

*In both cases, moving first results in a higher payoff than moving second. There is a first mover advantage.*