Feedback — Final Exam: Sections 11-20

You submitted this exam on **Fri 23 Nov 2012 11:49 PM PST**. You got a score of **11.00** out of **11.00**.

Question 1

People learn from others about which policies to support. Three policies are currently proposed: raising taxes, lowering taxes, and keeping taxes the same.

In October, 10% prefer cutting taxes, 30% prefer raising taxes, and 60% prefer keeping taxes the same.

In November, 25% prefer cutting taxes, 0% prefer raising taxes, and 75% prefer keeping taxes the same.

Darwin Charles, a political commentator, argues using replicator dynamics that this data proves that everyone will soon want tax cuts. Imagine a replicator model that supports his conclusions by giving each policy a fitness. Which one of the following set of fitness levels supports Charles' argument? While calculating, round all calculations to the nearest hundredths place (i.e. if your calculator shows 0.346, round to 0.35).

Your Answer		Score	Explanation
◉ Fitness for cutting taxes = 2; Fitness for same taxes = 1; Fitness for raising taxes = 0.	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

Remember our replicator equation: $Pr_{t+1}(i) = \frac{Pr_t(i)\pi(i)}{\sum_{j=1}^{N} Pr_t(j)\pi(j)}$

In words, this means that the probability of being type i at time $t+1$ is equal to the weight of type i at time t divided by the total weight of all types at time t.

Make an educated guess of the fitness levels (given the options) and see if they fit. We'll just demonstrate the correct answer. Multiply the proportions in October by the fitness levels to find weights:

Weight (cutting taxes): $0.10 * 2 = 0.20$

Weight (raising taxes): $0.30 * 0 = 0$

Weight (same taxes): $0.60 * 1 = 0.60$

So the total weight for all policies is $0.20 + 0 + 0.60 = 0.80$

The proportion in favor of cutting taxes at $t+1$ will be $\frac{0.20}{0.80} = 0.25$

The proportion in favor of raising taxes at $t+1$ will be $\frac{0}{0.80} = 0$

The proportion in favor of keeping taxes the same will be $\frac{0.60}{0.80} = 0.75$

These proportions match those given for November. If we run this operation several times, we find that the proportion of people in favor of cutting taxes continues to increase. After about 10 time periods, effectively 100% of people will be in favor of cutting taxes.

In each of the incorrect options, the fitness for raising taxes is greater than the fitness of cutting taxes. In such a scenario, we would never reach a time at which all people favor cutting taxes.

[See 19.2, "The Replicator Equation"]

Question 2

The City of Ann Arbor opened a new dog park. If D equals the number of dogs that are at the park, then happiness per dog (at the park) equals 30 - D. This holds so long as there are more than 10 dogs at the park. If there are 10 dogs or fewer in the park, happiness per dog equals 9. Any dogs not at the park have a happiness of 4 in either scenario. Assume there are 90 dogs in Ann Arbor. If there are 12 dogs at the park, what is the total happiness?

Your Answer		Score	Explanation
◉ 528	✓	1.00	

Total	1.00 / 1.00

Question Explanation

Consider this a public access or common pool resource problem.

Simply do the math:

$12(30-12)+(78*4)=216+312=528$. So the total happiness of all the dogs in Ann Arbor is 528.

[See 17.4, "Collective Action and Common Pool Resource Problems"]

Question 3

True or False:

Coordination tends to be a measurable difference - in which no one is better off not coordinating - whereas Standing Ovation tends to be more psychological - in which there may be some personal reason not to do what most others are doing.

Your Answer		Score	Explanation
◉ True	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

True.

In a Pure Coordination Game, all players are better off when they are all doing the same action.

In a Standing Ovation, however, there might be a threshold or a percentage of people standing required before an individual adopts an action. If the threshold or required percentage isn't met, the individual prefers not to stand even if a majority of people are standing.

[See 12.3, "Pure Coordination Game"]

Question 4

A small group of revolutionaries are fighting against their current colonial government. The revolutionaries have 415 troops. The government has 750 troops. What is the $minimum$ number of fronts required for the revolutionaries to have any chance of winning the war? Winning the war is defined as winning more than 50% of fronts. Assume that the government always distributes its troops as evenly as possible across all fronts, and that the revolutionaries are strategic.

Your Answer		Score	Explanation
◉ 11	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

Let's start with 3 fronts. The government would allocate Front 1=250, Front 2=250, Front 3=250. Therefore, the Revolutionaries would need $251 + 251 = 502$ troops to beat the government on 2 of 3 fronts and thus win the war. They only have 415, so it's not possible. The revolutionaries could win one front by allocating at least 251 troops, but that leaves them with only $415 - 251 = 164$ for the other two fronts.

At this point, we're pretty far off the mark. So let's fast forward to seven fronts.

The government's allocation would be 107 troops on six of seven fronts, and 108 troops on the other. So the revolutionaries need $108 + 108 + 108 + 108 = 432$ to beat the government on 4 of 7 fronts and thus win the war. They have 415 troops, so we're still pretty far off.

How about 11 fronts? The government would allocate 68 troops on 9 fronts, and 69 on the other 2. The revolutionaries need $69 * 6 = 414$ troops to win. Since they have 415 troops, the revolutionaries can win on 6 out of 11 fronts, and thus win the war. This is the minimum number of fronts required for the revolutionaries to win. [See 16.4, "Blotto: Troop Advantages"]

Question 5

Natalie is bidding in a sealed bid auction. If she and her opponents are rational, what should she bid?

Your Answer		Score	Explanation
◉ She should bid half of her value.	✓	1.00	

Total	1.00 / 1.00

Question Explanation

Using some math, we can show that the optimal strategy in a sealed bid auction is to bid half of your value. Professor Page discusses this in the "Auctions" video. Here are the essentials:

V = Value

B = Bid

(V-B) = surplus

B = probability of winning

Given these variables, winnings = B(V-B). We want to maximize this equation in order to achieve maximum profit.

Do some algebra:

Expected winnings = $B(V-B) = BV - B^2$

Set derivative = 0 to get a maximum for this equation.

$V - 2B = 0$

Optimal Bid = $B = \frac{V}{2}$

This means that the highest value bidder will win at half her value.

For further investigation, you can draw a uniform distribution of values, in which all values are between 0 and 1. If you are the highest value bidder, the expected value of the other bids is halfway between 0 and your value. Let's say your value is 0.6 - then the expected value of other bids will be 0.3, which is half of your value.

[See 18.3, "Auctions"]

Question 6

There are three predictions: 105, 125, 190. The actual value is 145. Which of the following values is closest to the crowd (squared) error?

Your Answer		Score	Explanation
◉ 25	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

$Step\ 1$: Calculate the average prediction:

$\frac{105+125+190}{3} = 140;$

$Step\ 2$: Calculate each individual squared error and then the average error:

$(105-145)^2 = 1,600; (125-145)^2 = 400; (190-145)^2 = 2,025.$

Average error = $\frac{1,600+400+2,025}{3} = 1,341.67$

$Step\ 3$: Calculate each individual diversity and then the crowd diversity:

$(105-140)^2 = 1,225; (125-140)^2 = 225; (190-140)^2 = 2,500.$

Crowd Diversity = $\frac{1,225+225+2,500}{3} = 1,316.67.$

$Step\ 4$: Calculate crowd error:

Crowd Error = Average Error - Diversity

$1,341.67 - 1,316.67 = 25$

So the crowd (squared) error is 25.

[See 20.3, "Diversity Prediction Theorem"]

Question 7

At Ohio University, students get randomly assigned to dorm rooms for a one-week orientation period. At the end of the week, two students can switch rooms with one another so long as both of them approve the switch. These are single rooms, meaning there is only one student per room. Assume a small cost of switching and no major externalities. Will this process of switching stop?

Your Answer		Score	Explanation
Yes	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

This is a Lyapunov Process.

Remember our 'chairs and offices' example from the Lyapunov video? There, we

found that it would be effective for workers in an office to trade chairs until some limit was reached such that happiness could no longer increase with more trades.

The same assumptions hold for this dorm room example. Roommates will switch until some maximum happiness is reached such that any further improvement in happiness is not worth the cost of switching. So switching stops. Of course, there may be externalities (can you think of any?) but we're assuming here that they're not so great so as to prevent this Lyapunov function from reaching its limit.

[See 11.5, "Lyapunov: Fun and Deep"]

Question 8

A law firm has favorable outcomes in 92% of cases that go to court. They have repeated this feat for many, many years. They recruit the top talent and have some of the top lawyers in the country as partners. If we were to use the Skill vs. Luck Model to determine how much of the law firm's success derives from skill, and how much derives from luck, would we expect the variable a to be closer to 0 or to 1?

Your Answer		Score	Explanation
◉ 0	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

The model tells us that Outcome = $a * Luck + (1 - a) * Skill$.

If a is close to 1, it means that outcomes are heavily influenced by luck.

If a is close to 0, it means that luck does not play a great role, indicating the influence of skill.

In this case, we expect a to be close to 0, because the question tells us that the law firm's success derives mostly from skill. There are several hints that tell us this: the law firm is successful over a sustained period of time ("many, many years"), and they have some of the "top lawyers" in the country. [See 15.3, "Skill and Luck"]

Question 9

You are given the following information about a network:

It has an average path length of about 4,

An average degree of about 2.5,

And a mid-range clustering coefficient.

Which one of the following scenarios best fits this network structure?

For this question, use your reasoning rather than trying to set up each network and do all of the math.

Your Answer		Score	Explanation
◉ European Union geographic network (nodes = countries, edges = shared boundaries)	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

Let's use a process of elimination for this one:

Path length from node A to node B denotes the minimal number of edges that must be traversed to get from node A to node B. The average path length of a network is the average path length between all pairs of nodes. So which of the options could have an average path length of about 4? The EU countries network is a good fit - here, the path length denotes that you must traverse an average of four countries to get from any one EU country to any other. We can't rule out loans or friend networks either, as those are not defined in much depth and could have this average path length. We can't rule out the flight network either, because 4 seems a reasonable path length, depending on the airline. Next is degree. Degree is the number of edges connected to a node. The degree of a network is the average degree across all nodes. A high degree network is one in which nodes are very interconnected, and a low degree network is one in which there are few connections between nodes. Which of the options are likely to have an average degree of about 2.5? Airline network is out, because we expect almost any airport to have flights to more than 2 or 3 other airports. Friendship network is out as well because most people have more than 2 or 3 friends. In terms of a lending network, it seems reasonable enough that people have loaned to or been loaned from an average of 2.5 others. This average degree also works for the EU geographic network, because it would indicate that countries in the EU, on average, border 2.5 other countries.

Finally, Clustering Coefficient is the percentage of triples of nodes that have edges between all three nodes. In other words, it's the percentage of all possible

triangles in a network that are realized. A loaning network is likely to have a low clustering coefficient, because there aren't many scenarios in which Person A would loan money to Person B, who would then loan money to Person C, who would then loan money to Person A. It's also hard to imagine a scenario in which Person A loans money to Person B and Person C, and then Person B and Person C loan between each other. So we don't expect many lending triangles. The EU geographic network, on the other hand, has a mid-range clustering coefficient. Some peripheral countries (England, Sweden, Cyprus) have very low clustering coefficients, while countries in the middle (Germany, Austria) share many borders with one another, creating triangles. When we take the average clustering coefficient, we expect it to be somewhere in the middle.

So the EU geographic network is the only one that exhibits all three properties.

[See 14.2, "The Structure of Networks"]

Question 10

What is the primary reason that the number and combination of public projects in existence might be a path dependent outcome?

Your Answer		Score	Explanation
◉ Externalities	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

Externalities. Investment in public projects might yield some calculated benefit, but the choice to invest in an additional public works project may yield costs or benefits beyond that of each of the individual projects - these are a type of externality which may affect the decision to invest in additional public projects, and the order of that investment decision can thus greatly affect whether a road gets built, or an airport and a road, or a landfill and a road and an airport.

[See 13.5, "Path Dependence and Increasing Returns"]

Question 11

What are the three classes of outcomes - other than equilibrium - that a model can produce?

Your Answer		Score	Explanation
◉ Complex, periodic, chaotic	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

We have discussed four possible classes of outcomes in this class: equilibrium, complexity, periodic (cyclic), and chaos.