Feedback — Quiz 4: Sections 9-10

You submitted this quiz on **Sat 17 Nov 2012 8:18 PM PST**. You got a score of **10.00** out of **10.00**.

Welcome to the latest quiz!

On this one we're asking questions about the Diversity and Innovation section, which covers landscapes with local and global optima. You'll also see some questions about heuristics.

There's also quite a bit here on Markov Processes. This is a topic we'll come back to again and again in this course (it's such a helpful model), so be sure to brush up if you're feeling shaky about the assumptions and implications of the model.

As always, we wish you good luck.

Question 1

Larry and Susan both encode a problem as a checkerboard. Larry's heuristic is to search to the North, South, East, and West. Susan searches to the North, South, East, and West as well, but she also learned to search to the Northeast. Who will likely have fewer local optima? (Think carefully on this one!)

Your Answer		Score	Explanation
Susan	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

Susan has fewer local optima because she searches more points. In 9.2, we learned that better perspectives have fewer local optima. For example, Larry could have a local optimum at a point where the N,S,E, and W have lower values, but the point to the Northeast - which Larry doesn't see - has a higher value.

[See 9.2, "Perspectives and Innovation"]

Question 2

We learned a Theorem in Section 9 that states the following:

Unless you know something about the problem being solved, no algorithm or heuristic performs better than any other.

What Theorem is this?

You entered:

No Free Lunch Theorem

Your Answer		Score	Explanation
No Free Lunch Theorem	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

The formal definition of the No Free Lunch Theorem is that "All algorithms that search the same number of points with the goal of locating the maximum value of a function defined on a finite set perform exactly the same when averaged over all possible functions." In simple English, this means that across the set of all possible contexts, no particular heuristic performs better than any other. Or in other words, we must know something about the problem being solved in order to determine which heuristic or algorithm will be most useful to us.

[See 9.3, "Heuristics"]

Question 3

There exist three problem solvers, all solving the same problem. Each solver has five local optima. If we listed all of these local optima, what is the largest possible number of distinct (non-overlapping) local optima? (Hint: assume each problem solver correctly identifies the global optimum).

Your Answer		Score	Explanation
13	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

Let X be the global optimum. X has to be a local optima for each problem solver.

The other local optima for each person can be unique.

Person 1 could have A,B,C,D, and X.

Person 2 could have E,F,G,H, and X.

Person 3 could have I,J, K, L, and X.

Remember - we're looking for the $maximum\ possible$ distinct local optima.

There's a total of 13: A,B,C,D,E,F,G,H,I,J,K,L, and X.

Note that the only place that all solvers could get stuck in this example would be the global optimum.

[See 9.4, "Teams and Problem Solving"]

Question 4

If you have seven heuristics, how many pairs of two heuristics do you have?

You entered:

21

Your Answer		Score	Explanation
21	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

There are seven ways to pick the first heuristic and six ways to pick the second. That gives 42 heuristics. However, if you pick A then B, that's the same as picking B and then A, so we have to divide by 2. So the answer is 21.

$$\frac{7*6}{2} = 21$$

[See 9.5, "Recombination"]

Question 5

In Profession A, two people constantly rely on one another for help solving problems. In Profession B, on the other hand, two people rarely need to ask one another for assistance. Which profession is more likely to be currently enjoying the benefits of Recombination?

Your Answer		Score	Explanation
Profession A	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

In Profession B, there is some reason why workers don't ask each other for help. Assuming that our workers are not merely enemies, or simply selfish, we can say that these workers probably share the same tools for solving problems - which is why one cannot provide much help to the other.

In Profession A, on the other hand, there are many opportunities for help - likely because the two people have different perspectives or heuristics. It is in these contexts - contexts in which different people approach a problem with different perspectives and heuristics - that recombination can unlock rich innovations and opportunities for growth.

[See 9.5, "Recombination"]

Question 6

What kind of equilibrium does a Markov process produce?

Your Answer		Score	Explanation
Statistical Equilibrium: Percentage of people in each 'type' remains constant, but there is	✓	1.00	

movement of individuals.

Total	1.00 / 1.00

Question Explanation

In a Markov Process, the transition probabilities remain fixed as people - or other entities - move from state to state. This means that in equilibrium, the percentage of people in each 'type' will remain constant, even though there is movement of individuals between states.

[See 10.2, "A Simple Markov Model"]

Question 7

A local gym has 200 members. 60% of members who go to the gym one day, will go again the next day. 40% of members who don't go to the gym one day, will go the next day. In equilibrium, how many members will be at the gym?

Your Answer		Score	Explanation
100	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

This is a Markov Process.

60% who go today will also go tomorrow and 40% will not go tomorrow;

40% who didn't go today $will$ go tomorrow and 60% also won't go tomorrow.

To find the equilibrium percentage of people at the gym, solve for p:

$.6p + .4(1-p) = p$; This means that $p = .5$ or 50%.

50% of the members will be at the gym in equilibrium. 50% of 200 = $.5(200) = 100$

[See 10.2: "A Simple Markov Model"]

Question 8

Let's assume there are three possible states of economies: Solvent, Brink (on the brink of bankruptcy) and Bankrupt. The transition probabilities are:

85% of Solvent stay Solvent; 15% of Solvent become Brink; 0% of Solvent become Bankrupt.

40% of Brink become Solvent; 35% of Brink stay Brink; 25% Brink go Bankrupt.

0% of Bankrupt become Solvent; 70% of Bankrupt become Brink; 30% of Bankrupt stay Bankrupt.

In equilibrium, what percentage of economies are $Solvent$? (Hint: This is a 3x3 markov matrix. Solve for p, q, and 1-p-q).

Your Answer		Score	Explanation
64	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

This is a 3x3 markov matrix.

We need to solve two equations for two unknowns (p=percentage solvent; q=percentage brink; 1-p-q=percentage bankrupt).

$.85p + .4q + 0(1 - p - q) = p$;

$0p + .25q + .3(1 - p - q) = 1 - p - q$.

You should get $\frac{8}{3}q = p$ from the first equation.

Plug this result into the second equation. You should get $q = .2485$

Substitute that back into $\frac{8}{3}q = p$ to get $p = .6627$ and $1 - p - q = .0888$.

The question asks for percentage solvent, which is $p = .66$, or 66%.

[See 10.3, "Markov Model of Democratization"]

Question 9

Currently, 80% of people living above the poverty line will remain above next year, and 20% will be below the poverty line next year.

25% of the people living below with poverty line this year will be above the poverty line next year, and 75% will remain below the poverty line next year.

In equilibrium, the percentage of people with incomes above the poverty line is only 55.56%.

A social planner would like to change the transition probabilities in order to achieve an equilibrium in which at least 70% of people have incomes above the poverty line.

Which of the following transition possibilities would allow the social planner to achieve her goal?

Your Answer		Score	Explanation
Next year, 85% of those above the poverty line will remain above, while 15% will drop below the poverty line; 45% of those below the poverty line will be above the poverty line next year, while 55% will still have incomes below the poverty line.	✓	1.00	
Total		1.00 / 1.00	

Question Explanation

Since you're given $p = .7$ (and $1 - p = .3$), you know the percentages you're looking for in equilibrium.

Set up transition matrices for each of the options and solve to see which set "works" for achieving the desired equilibrium percentages.

[See 10.4, "Markov Convergence Theorem"]

Question 10

Which of the following is evidence that your mood is NOT a Markov Process? That is, which of the following scenarios does not satisfy the assumptions of the Markov Convergence Theorem? (Assume that periods last one day).

Your Answer		Score	Explanation
☑ You're always happy on Saturdays.	✓	0.33	
☐ Your moods resemble those of W.B. Yeats, who wrote "Being Irish, I have an abiding sense of tragedy which sustains me through temporary periods of joy."	✓	0.33	
☐ Your mood jumps around a lot.	✓	0.33	
Total		1.00 / 1.00	

Question Explanation

If your mood is a Markov process, then it could jump around a lot.

Yeats' quote also strongly suggests a Markov process: his mood could be mostly bleak but every once in a while jump into a happy state and then quickly jump out.

You could not, though, always be happy on Saturdays: even at equilibrium, it is transition probabilities that remain fixed, not states.

[See 10.4, "Markov Convergence Theorem"]