Problem Set 2

Quiz, 5 questions

5/5 points (100%)



Congratulations! You passed!

Next Item



1/1 point

1.

1\2	Left	Right
Left	4,2	5,1
Right	6,0	3,3

Find a mixed strategy Nash equilibrium where player 1 randomizes over the pure strategy Left and Right with probability p for Left. What is p?



b) 3/4

a) 1/4

Correct

(b) is true.

- In a mixed strategy equilibrium in this game both players must mix and so 2 must be indifferent between Left and Right.
- ullet Left gives 2 an expected payoff: 2p+0(1-p)
- ullet Right gives 2 an expected payoff: 1p+3(1-p)
- Setting these two payoffs to be equal leads to p=3/4.

c) 1/2

d) 2/3



1/1 point

2

Problem Set 2

5/5 points (100%)

Quiz, 5	questions	Left	Right	10
	Left	<i>X</i> ,2	0,0	
	Right	0,0	2,2	

In a mixed strategy Nash equilibrium where player 1 plays Left with probability p and player 2 plays Left with probability q. How do p and q change as X is increased (X > 1)?



a) p is the same, q decreases.

Correct

(a) is true.

- In a mixed strategy equilibrium, 1 and 2 are each indifferent between Left and Right.
- For p:
- Left gives 2 an expected payoff: 2p
- Right gives 2 an expected payoff: 2(1-p)
- These two payoffs are equal, thus we have p=1/2.
- For q: setting the Left expected payoff equal to the Right leads to Xq=2(1-q), thus q=2/(X+2), which decreases in X.
- b) p increases, q increases.
- \bigcirc c) p decreases, q decreases.
- \bigcirc d) p is the same, q increases.



1/1 point

3

- There are 2 firms, each advertising an available job opening.
- Firms offer different wages: Firm 1 offers $w_1=4$ and 2 offers $w_2=6$.
- There are two unemployed workers looking for jobs. They simultaneously apply to either of the firms.
- If only one worker applies to a firm, then he/she gets the job
- If both workers apply to the same firm, the firm hires a worker at random and the other worker remains unemployed (and receives a payoff of 0).

Find a mixed strategy Nash Equilibrium where p is the probability that worker 1 applies to firm 1 and q is the probability that worker 2 applies to firm 1.

(a)
$$p = q = 1/2$$
;

Problem $\text{Set-}2_q = 1/4;$ Quiz, 5 questions

5/5 points (100%)

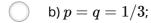
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d) p = q = 1/5.

Correct

(d) is correct.

- In a mixed strategy equilibrium, worker 1 and 2 must be indifferent between applying to firm 1 and 2.
- For a given p, worker 2's indifference condition is given by 2p + 4(1-p) = 6p + 3(1-p).
- Similarly, for a given q, worker 1's indifference condition is given by 2q+4(1-q)=6q+3(1-q).
- Both conditions are satisfied when p=q=1/5.





1/1 point

4.

- A king is deciding where to hide his treasure, while a pirate is deciding where to look for the treasure.
- The payoff to the king from successfully hiding the treasure is 5 and from having it found is 2.
- The payoff to the pirate from finding the treasure is 9 and from not finding it is 4.
- The king can hide it in location X, Y or Z.

Suppose the pirate has two pure strategies: inspect both X and Y (they are close together), or just inspect Z (it is far away). Find a mixed strategy Nash equilibrium where p is the probability the treasure is hidden in X or Y and 1-p that it is hidden in Z (treat the king as having two strategies) and q is the probability that the pirate inspects X and Y:



a)
$$p=1/2$$
, $q=1/2$;

Correct

(a) is true.

- There is no pure strategy equilibrium, so in a mixed strategy equilibrium, both players are indifferent among their strategies.
- For p:
- Inspecting X \& Y gives pirate a payoff: 9p + 4(1-p)
- Inspecting Z gives pirate a payoff: 4p + 9(1-p)
- These two payoffs are equal, thus we have p=1/2.

• For q: indifference for the king requires that 5q+2(1-q)=2q+5(1-q), thus q=1/2. Problem Set 2

Quiz, 5 questions

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b) p = 4/9, q = 2/5;

- \bigcirc c) p = 5/9, q = 3/5;
- (a) d) p = 2/5, q = 4/9;



1/1 point

5.

- A king is deciding where to hide his treasure, while a pirate is deciding where to look for the treasure.
- The payoff to the king from successfully hiding the treasure is 5 and from having it found is 2.
- The payoff to the pirate from finding the treasure is 9 and from not finding it is 4.
- The king can hide it in location X, Y or Z.

Suppose that the pirate can investigate any two locations, so has three pure strategies: inspect XY or YZ or XZ. Find a mixed strategy Nash equilibrium where the king mixes over three locations (X, Y, Z) and the pirate mixes over (XY, YZ, XZ). The following probabilities (king), (pirate) form an equilibrium:

- a) (1/3, 1/3, 1/3), (4/9, 4/9, 1/9);
- b) (4/9, 4/9, 1/9), (1/3, 1/3, 1/3);
- c) (1/3, 1/3, 1/3), (2/5, 2/5, 1/5);
- d) (1/3, 1/3, 1/3), (1/3, 1/3, 1/3);

Correct

(d) is true.

- Check (a):
- Pirate inspects (XY, YZ, XZ) with prob (4/9, 4/9, 1/9);
- Y is inspected with prob 8/9 while X (or Z) is inspected with prob 5/9;
- King prefers to hide in X or Z, which contradicts the fact that in a mixed strategy equilibrium, king should be indifferent.
- Similarly, you can verify that (b) and (c) are not equilibria in the same way.
- In (d), every place is chosen by king and inspected by pirate with equal probability and they are indifferent between all strategies.

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