Exercise Session 4 (PS3 Solutions)

Principles of Economics I

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PS3 Solutions

Here is my suggested answer, it is not the only correct answer.

Grade based on completeness of the answer.

Q1a

Lucy was lying about her intentions to split. She preferred having the whole pot.

Tony expressed his intentions to split the pot, but it is unclear whether he actually meant it. He eventually picked “steal” and justified his action by claiming that Lucy was clearly lying and going to steal too. Maybe he valued fairness and decided to punish Lucy for stealing. Maybe he also preferred having the whole pot, but he just did not want to look bad during the interview.

Q1a

In this matrix of payoffs, you can also use (x, 2x, 0) or (1, 2, 0), or anything that makes sense.

		Tony	
		SPLIT	STEAL
Lucy	SPLIT	33.5k; 33.5k	0; 67k
	STEAL	67k; 0	0; 0

Q1b

Steve: he really wanted the money (he thought half of the jackpot was plenty) and felt that it was fair to share. He also claimed people would judge him negatively if he chose “steal”.

Sarah: she claimed she was going to share, but eventually chose “steal”. She was surprised that Steve had been truthful because she was expecting him to be lying.

Q1c

No need to draw the matrix, although you should describe how part of the game matrix is no longer relevant.

		Nick	
		SPLIT	STEAL
Ibrahim	SPLIT	6.8k; 6.8k	0; 13.6k → Nick's promise → 6.8k; 6.8k
	STEAL	13.6k; 0	0; 0

Q1c

“Steal” was not a dominant strategy for Ibrahim anymore, as he knew that Nick would never pick “split”.

Ibrahim had the option of either choosing “steal”, which for sure would end up in him getting no money at all, or choosing “split”, which might end up with him getting half of the money, if Nick kept his promise of sharing afterwards. If Ibrahim trusted Nick just a tiny bit, “Split” is the dominant strategy.

-> The power of (credible) signaling in game theory

		Nick	
		SPLIT	STEAL
Ibrahim	SPLIT	6.8k; 6.8k	0; 13.6k → Nick's promise → 6.8k 6.8k
	STEAL	13.6k; 0	0; 0

Q2a

The same reasoning can be applied to any Nash equilibrium of the game.

WLOG, we assume that (A_1, B_1) is a Nash equilibrium of the simultaneous game (no ties). Player A gets a_{11} in this case.

When having the first-mover advantage, what should play A choose and is player A's payoff at least as large as a_{11}?

		B	
		B_1	B_2
A	A_1	(a_{11}, b_{11})	(a_{12}, b_{21})
	A_2	(a_{21}, b_{12})	(a_{22}, b_{22})

Q2a

If player A chooses A_1, player B would choose B_1 as it is player B's only best response (because (A_1, B_1) is a Nash equilibrium of the simultaneous game, and there are no ties) -> Player A gets a_{11} if choosing A_1

If player A chooses A_2, player A knows for sure how player B will respond (deduce from the matrix). If player A ends up with a payoff less than a_{11}, it does not make sense for player A to choose A_2. -> Player A chooses A_2 only if player A gets at least a_{11}.

-> Player A always gets at least a_{11}

		B	
		B_1	B_2
A	A_1	(a_{11}, b_{11})	(a_{12}, b_{21})
	A_2	(a_{21}, b_{12})	(a_{22}, b_{22})

Q2b

Any correct alternative examples are accepted.

In this example, A moves first. When A chooses A_1 or A_2, player B chooses the corresponding best response (B_1 or B_2 respectively). Player A always gets 1, Player B always gets 2.

		B	
		B_1	B_2
A	A_1	(1,2)	(2,1)
	A_2	(2,1)	(1,2)

Q2c

A dominant strategy is the best response to all strategies of the opponent. Therefore, if a player are the second mover, given any choice of the first mover, he plays the dominant strategy as in the simultaneous game.

		B	
		B_1	B_2
A	A_1	(3,1)	(2,2)
	A_2	(2.5,2)	(1,1)

Q2c

However, if a player is the first mover, he does not necessarily play the dominant strategy in the simultaneous game.

As in the example below, A_1 is player A's dominant strategy in the simultenous game. However, if player A moves first, he plays A_2 to get 2.5 instead of playing A_1 and getting 2.

		B	
		B_1	B_2
A	A_1	(3,1)	(2,2)
	A_2	(2.5,2)	(1,1)

Q2c

The first mover anticipates how the second mover best-respond. Therefore, part of the payoff matrix is no longer relevant to the first mover. In this example, player A only compares the payoff from (A_2, B_1) and (A_1, B_2).

		B	
		B_1	B_2
A	A_1	(3,1)	(2,2)
	A_2	(2.5,2)	(1,1)

Q3a

The game matrix

		Government	
		No Police	Police
Criminal	No crime	(0,0)	(0,-c)
	Crime	(g,-d)	(-p,-c+b)

Q3b

This game does not have dominant strategies. For the criminal, the best response to “No police” is “Crime”, and the best response to “Police” is “No crime”. For the government, the best response to “No crime” is “No Police”, and the best response to “Crime” is “Police”.

There are no Nash equilibria since there are no states where neither player can deviate to be better off.

		Government	
		No Police	Police
Criminal	No crime	(0,0)	(0,-c)
	Crime	(g,-d)	(-p,-c+b)

Q3c

For the criminal, the best response to “No police” is “Crime”, and the best response to “Police” is “No crime”.

If government moves first and choose “No police”, they get –d. If government moves first and choose “Police”, they get –c. If $d \geq c$, government chooses “Police” and if $c \geq d$, government chooses “No police”

		Government	
		No Police	Police
Criminal	No crime	(0,0)	(0,-c)
	Crime	(g,-d)	(-p,-c+b)

Q4a

Sitting with people supporting the same team is more joyful. (No need to draw matrix)

For example, we can think of a game in which one player is you and the other player is the fan club. Both players have 2 strategies to choose from: sitting in stand A or stand B. You get payoff of 1 when you sit with the fan club. If the fan club has reserved seats in stand A, it is similar to the game with them moving first. You can choose accordingly to maximize your (and also the club's) payoff.

		Fan club	
		A	B
You	A	(1,1)	(0,0)
	B	(0,0)	(1,1)

Q4b

Zoning and other building and maintenance restrictions aim to address externalities.

The game is similar to the previous one with stadium seating. However, in this case, being close together is not good for a residential building and an industrial building. For example, a factory emits pollution that is unhealthy to people living nearby.

Zoning and other building and maintenance restrictions make sure that residential buildings and industrial buildings are not in the same area.

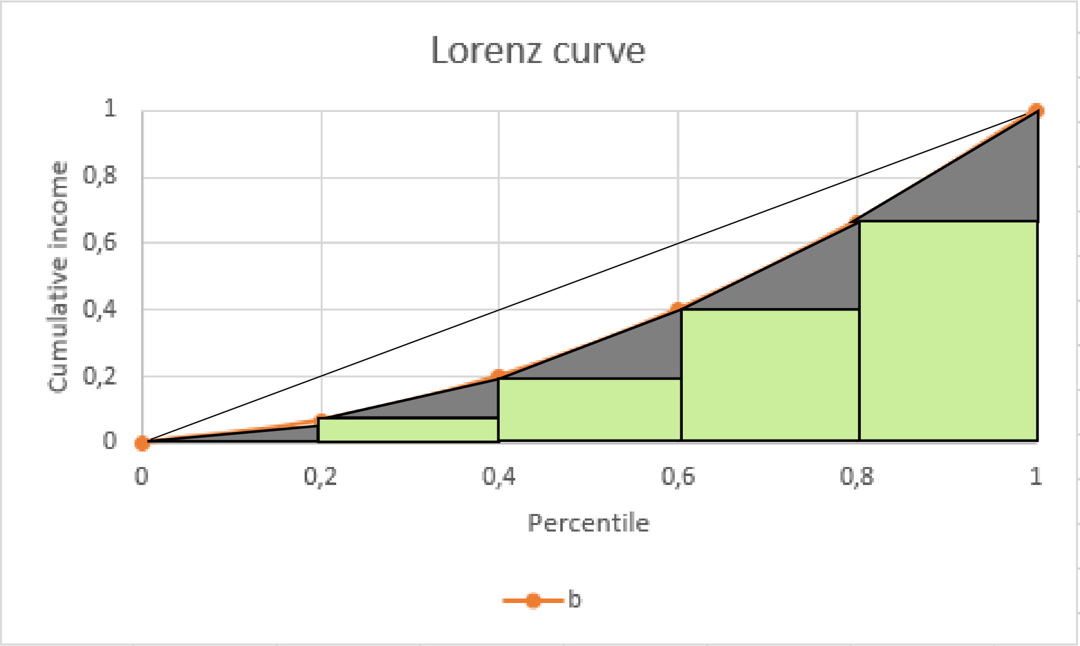
Q4c

A society benefits from a high literacy rate because it is associated with a well-functioning society, lower crime rate, higher growth. However, some individuals might be better off without education. Therefore, without a mandate, those individuals would drop out, and the country would not have the positive externality of high literacy rate.

Q5

Review of how to approximate Gini: the ratio of the area between the perfect equality line and the Lorenz curve divided by the total area under the perfect equality line.

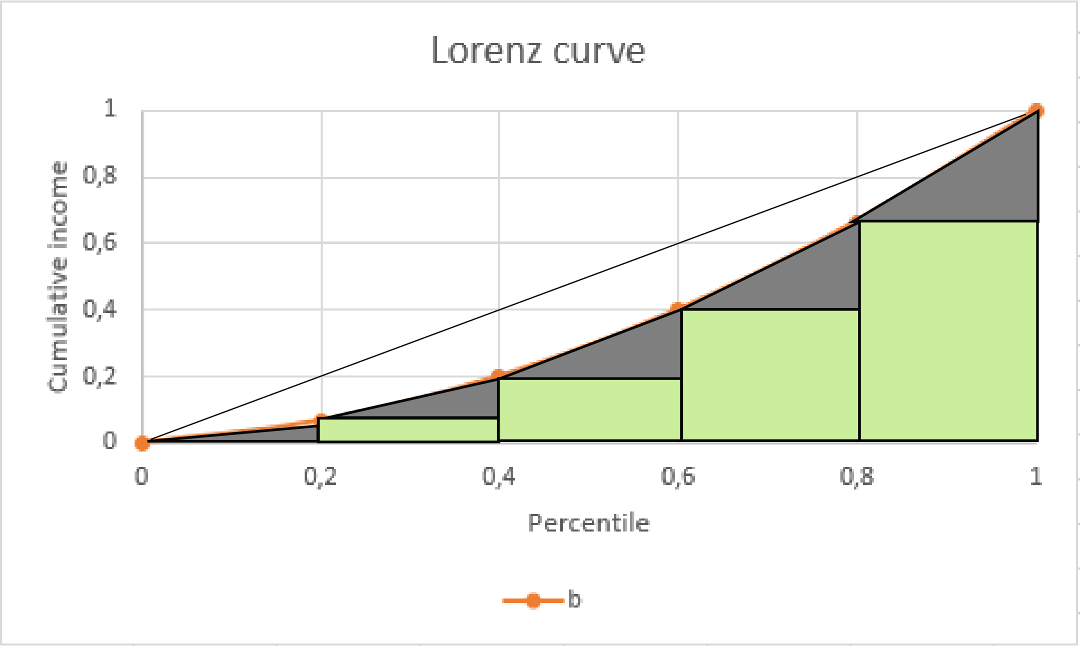
Below is just an example for teaching purposes, not the answer to Q4.



Q5

Total area under the perfect equality line in this case: 0.5. Areas under the Lorenz curve: add the areas of the 5 grey triangles and the areas of the 4 green rectangles. ->x

Gini=(0.5-x)/0.5



Q5

a) Gini coefficient = (0.5-0.42)/0.5=0.16

b) A “Robin Hood Transfer” from group j to group i with an amount of $\Delta < y_i - y_{i-1}$ will not change the order of the groups.

The Lorenz curve of this economy is made up of 6 points (0,0), $A_1(0.2, \dots)$, $A_2(0.4, \dots)$, $A_3(0.6, \dots)$, $A_4(0.8, \dots)$, (1,1)

After the transfer, points $A_j, A_{j+1}, \dots$ remain unchanged (because $y_i + y_j$ remains unchanged). Points $A_i, A_{i+1}, \dots, A_{j-1}$ moves up (because y_i is higher).

Therefore, the area between the perfect equality line and the Lorenz curve is smaller -> Smaller Gini coefficient.

Accept the answer of transferring money from the rich to the poor decreases gini coefficient.