Title: Game Theory and Business Strategy

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ECF5200: GAME THEORY AND BUSINESS STRATEGY

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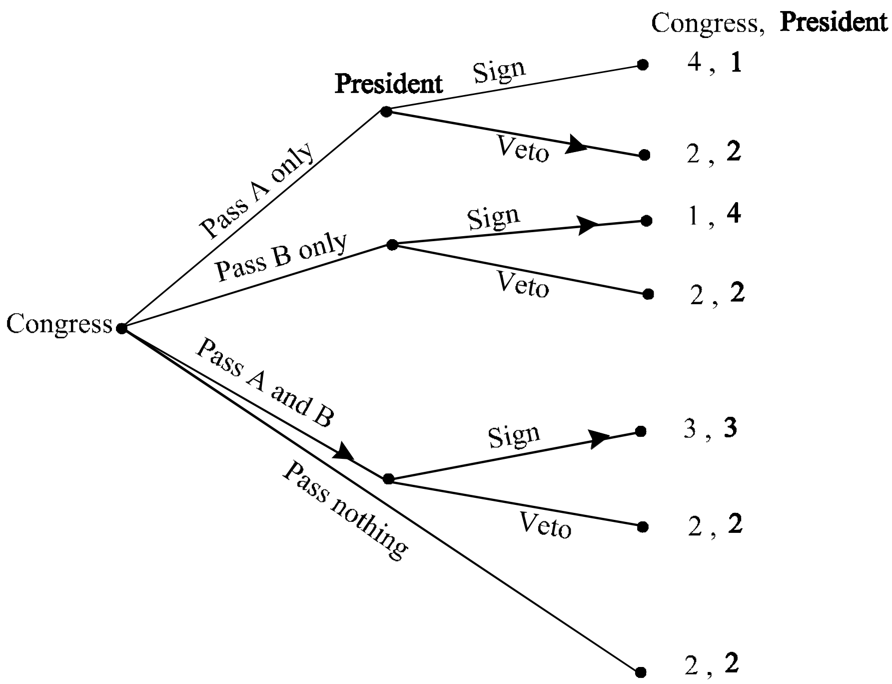
Individual Assignment

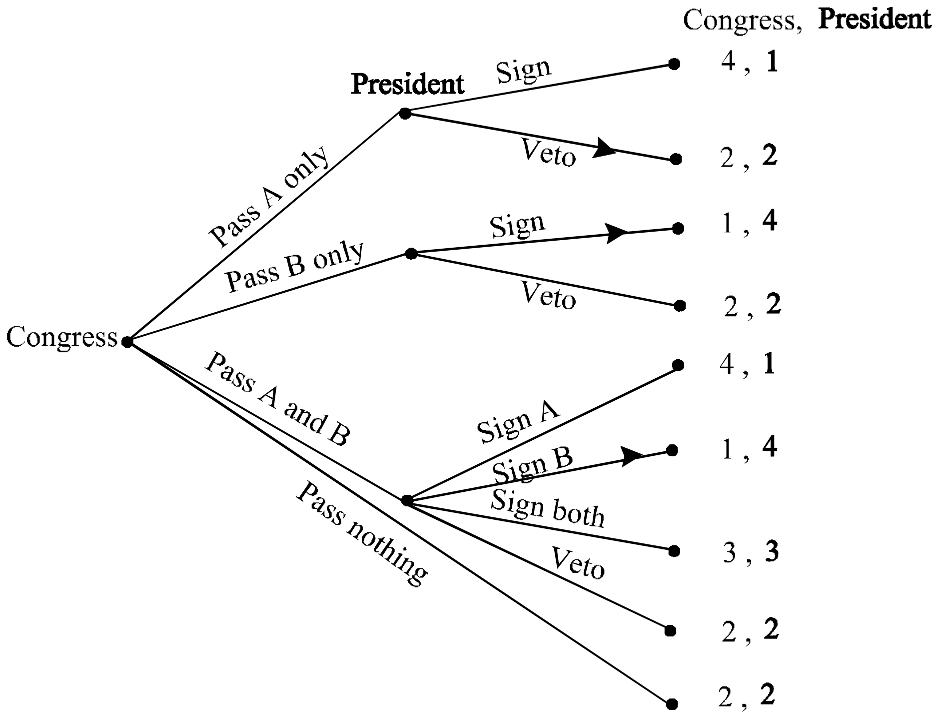
Suggested answers

Question 1

(a) Tree follows. Rollback equilibrium entails Congress passing a bill containing both proposals A and B and the president signing the bill. Payoffs are (3, 3).



(b) Tree follows. In this case, Congress will either pass a bill containing only proposal A and the president will veto it, or Congress will pass nothing. In either case, neither proposal becomes law and the payoffs are (2, 2).



(c) The president's payoff is worse when he has the line-item veto (LIV) than when he does not. This outcome arises because Congress knows that without the LIV, they can get their preferred proposal to become law by passing it in the same bill with the president's preferred proposal. Thus, both proposals become law in equilibrium with no LIV. However, when the president has the LIV, he can always guarantee that Congress's preferred proposal does not become law. In this case, Congress has no incentive to pass a proposal containing B in order to get A passed also, so they pass either A or nothing and the final equilibrium is the status quo.

Question 2

Let us work using backward induction.

Second day (Union puts itself in Management's shoes): If Union's offer is rejected, then Management receives $80 and Union receives $80 in day 3. To Management, this $80 is worth $0.9*80 = $72 in day 2 so Union's optimal offer in day 2 will be U = $72. This will be accepted by Management since we assumed that players will accept an offer if indifferent between accepting and rejecting. Let's see why this is optimal for Union. First there is no reason why Union has to offer more since $72 will be enough to make Management accept the offer. Second, if Union offers less than $72, then the offer will be rejected, which will result in Union's day 3 payoff of $80. At day 2, this is worth $72, which is less than 200 – 72 = 128, which Union could secure by making an offer of $72 in day 2. **In sum, Union's optimal offer in day 2 is U = $72.**

First day (Management puts itself in Union's shoes): Given Union's optimal offer of $72 in day 2, Management's optimal offer in day 1 is M = 0.9*(200-72) = $115.2. The right hand side, i.e. 115.2, is Union's payoff if accepting Management's offer in day 1, and the left hand side, i.e. 0.9*(200-72), is Union's payoff (discounted for one day by the factor of 0.9) if rejecting the offer to secure 200 – 72 = 128 in day 2, which we already worked out above. Why is the above offer optimal for Management? First of all, Management does not need to offer more. Second, if Management offers less and the offer is rejected, then Management will get 72 in day 2, which is worth 0.9*72 = $64.8 in day 1. By making the above offer, Management can secure 200 – 115.2 = 84.8 which is larger than $64.8. **So Management's optimal offer in day 1 is given by M = $115.2.**

Putting all these together, we can conclude that the game will be played in the following way (in equilibrium).

In day 1, Management makes an offer of M = $115.2, which is immediately accepted by Union. The resulting payoffs are $84.8 to Management and $115.2 to Union.

Question 3

	Pasta	Salmon	Filet Mignon
Pasta	6, 6	3, 7	-2, 8
Salmon	7, 3	4, 4	-1, 5
Filet Mignon	8, -2	5, -1	0, 0

(a) The payoff matrix is as shown above with the first number representing Harry's payoff. In the above table, the first column lists Harry's strategies and the first row lists Larry's strategies. The payoffs are calculated as follows:

(i) When they order the same dish, the calculation of payoffs is straightforward: they are the difference between value and price.

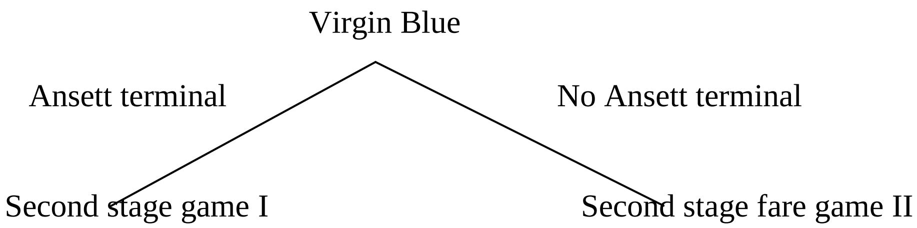
(ii) For (Pasta, Salmon) or (Salmon, Pasta), total bill is 34 so each pays 17, hence the one with Pasta has payoff 20 – 17 = 3 and the one with Salmon has payoff 24 – 17 = 7. For the other combinations, it is similar and omitted.

As can be easily checked, this is a prisoner's dilemma: Nash equilibrium (also dominant strategy equilibrium) is (Filet Mignon, Filet Mignon), although (Pasta, Pasta) and (Salmon, Salmon) are strictly better for both players.

(b) As discussed above, this is the prisoner's dilemma. There are many ways to resolve the dilemma. In essence, they can communicate and agree on how the bill will be paid. An obvious solution is to go Dutch. Alternatively they can use turn-taking; one pays today and the other pays tomorrow, etc. For this turn-taking to work, they should expect the game to be played repeatedly so that each can rely on the other's goodwill (we will discuss this later).

Question 4

The game is a mix of sequential and simultaneous moves. . In the second stage of the two-stage game, the two airlines choose airfares simultaneously. And the whole game needs to be solved using backward induction. To have 'No Ansett terminal' as an equilibrium strategy for Virgin Blue in stage 1, the second stage game should have an equilibrium where Virgin Blue has a higher payoff along the branch of the game tree 'No Ansett terminal'. The game tree would look like the following.



In what follows, (i) numbers in the payoff matrix are arbitrary proxies for the two airlines' respective payoffs, and (ii) the first number represents Virgin Blue's payoff. The numbers I use are just indicative of the payoff structure consistent with the description of the game. Any other numbers are fine as long as they satisfy the conditions: (i) the second stage fare game I has an equilibrium in dominant strategies where both choose low fare; (ii) the second stage fare game II has an equilibrium (Nash or dominant strategy) such that Virgin Blue plays low fare and Qantas plays high fare; (iii) Virgin Blue's payoff at the equilibrium of the second stage fare game II is larger than that in the second stage fare game I.

<u>Second stage fare game I (with Virgin Blue picking up the Ansett terminal):</u>

		Qantas	
		High fare	Low fare
Virgin Blue	High fare	(6, 11)	(2, 12)
	Low fare	(7, 6)	(3, 7)

The game has an equilibrium in dominant strategies (low fare, low fare) with payoffs (3, 7).

<u>Second stage fare game II (with Virgin Blue not picking up the Ansett terminal)</u>

		Qantas	
		High fare	Low fare
Virgin Blue	High fare	(3, 14)	(1, 15)
	Low fare	(4, 12)	(2, 10)

The game has a Nash equilibrium (low fare, high fare) with payoffs (4, 12).

Now work backwards. Since Virgin Blue knows that its equilibrium payoff in the second stage fare game I would be 3 and its equilibrium payoff in the second stage fare game II would be 4, it would choose not to pick up the Ansett terminal in stage 1.

In the above, I have chosen numbers that are consistent with the story given in the question. You could also work with payoff rankings instead of actual numbers.