Experimental Economics I: Behavioral Game Theory Homework (18S)

For BGT2

Part A: Find the Nash Equilibrium for the Following Simultaneous Games:

1. **Public Goods Game:** There are N players, and each choose to invest c_i from their personal endowment e_i. Total investment, c_{all} = sum of c_i, is then multiplied by m and divided among all players. In other words, payoffs are e_i - c_i + m * c_{all} / N.

2. **Prisoner's Dilemma:** (T>H>L>S)

	C	D
C	H, H	S, T
D	T, S	L, L

Part B: Find the SPE for the Following Sequential Games:

1. **Dictator Game:** Paul and Rachael are to divide 10 dollars. Paul proposes how to split the money, and the money is divided accordingly.

2. **Trust Game:** Ian the Investor has 50 dollars, and has to decide how much to invest in the new business project of Tracy the Trustee. Ian can invest any amount $X, between 0 and 50. After Ian's investment of $X, the project succeeds and $X is multiplied by a factor of m. Now, Tracy has to decide how much to repay Ian. Tracy can repay any amount $Y, between 0 and mX.

Part C: The Sleeping Game

Read the (abridged) article below and answer the following questions:

1. Consider the following game played between the two sleepy pilots: Each pilot chooses to either sleep or stay awake. Falling asleep gives the sleepy pilot some rest, which is worth NT$2,000 to each pilot. The plane flies safely if at least one pilot to stay awake, which is worth NT$10,000 to each pilot. If both pilots fall asleep, the plane would be in danger, which would cost the pilot NT$100,000 each. Draw the game matrix (assuming each pilot only cares about the sum of their own monetary payoffs).

2. Is it consistent with equilibrium for both pilots to stay awake? Why or why not?

3. Solve for all of the pure and mixed Nash equilibrium of this game.

4. Which equilibrium could result in the case described in the news below where both pilots fall asleep despite FAA forbidding pilots sleeping? Which equilibrium corresponds to the case where one pilot tells the other s/he is going to rest for a while? Which one has a higher monetary payoff for the pilots?

5. How did different rules (across countries) select different equilibrium? Do you think the experts rightly blame the FAA for this "accident"? Why or why not?

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6. Now consider the case where the two pilots are altruistic and have the same utility function. Assume the pilots discount the payoffs of others by a factor of α.

   a. Write down a utility function to represent the pilots' altruistic preferences and draw the new payoff matrix.

   b. Solve for all of the pure and mixed Nash equilibrium of this game.

   c. Can this explain both the outcome in the US (where both pilots occasionally fell asleep) and that in Taiwan (where one pilot asks the other to cover him when he is taking a nap)? Why or why not?

7. Now consider the case where the two pilots are inequality averse in the sense of Fehr and Schmidt (1999) and have the same utility function. Assume the pilots dislike earning less than the other player by a factor of α, but feel guilty about earn more by a factor of β.

   a. Write down a utility function to represent the pilots' inequality-averse preferences and draw the new payoff matrix.

   b. Solve for all of the pure and mixed Nash equilibrium of this game.

   c. For what parameter values can this explain the intended outcome of the FAA (where both pilots always stay awake) and the outcome in Taiwan (where one pilot asks the other to cover him when he is taking a nap)? Why or why not?

8. Which model of pilot's preferences do you think is more realistic and explains more empirical facts? Justify your answer.

Hint: Consider the following two utility functions:

C6: $U_i(X) = x_i + \alpha x_{-i}$

C7: $U_i(X) = x_i - \dfrac{\alpha}{n-1} \sum_{k \neq i} \max(x_k - x_i, 0) - \dfrac{\beta}{n-1} \sum_{k \neq i} \max(x_i - x_k, 0)$

美客機「睡」過頭 怪ＦＡＡ不人道　　　2009/10/26 中國時報【劉屏／華盛頓廿五日電】

　　兩位客機駕駛員都睡著了。誰的錯？美國聯邦民航總署（ＦＡＡ）成為眾矢之的。專家說，ＦＡＡ不把駕駛員當人，不准他們輪流小睡，才導致這種緊急事件。

　　美國西北航空班機日前在明尼亞波利斯市上空過門不入，多飛了二百四十餘公里才降落。其間地面航管呼叫，但得不到回應，以為發生劫機，遂請軍方派遣戰鬥機升空。最後是空服員從客艙內打機內電話給駕駛員，才結束這場烏龍。兩位駕駛說是因為討論公司的政策太專心，以致忘了降落。…(中略)…專家普遍認為，最可能的解釋是「兩位駕駛員都睡著了」。…(中略)…迄今為止，沒有任何專家指責兩位駕駛，反倒頗多同情之詞，把矛頭指向ＦＡＡ。飛安專家、退休客機駕駛約翰.南斯接受ＡＢＣ主播吉布遜訪問時說，發生這種事，是因為「多年來，ＦＡＡ不承認駕駛員是人，不承認他們會睏，不准許駕駛在駕駛艙裡睡覺」。

　　由於ＦＡＡ不准睡，有的駕駛心想，「既然同伴不會睡，我小睡一下應無妨」，說不定兩人都這麼想，就都睡著了。專家說，很多國家准許駕駛在嚴格的前提小睡一會兒，這些前提包括啟動自動駕駛儀、不能離開駕駛座、告知空服員等。這種作法的立論基礎是：一位擺明了要睡，另一位就絕不敢睡，反而比較安全。就像據傳台灣曾有客機駕駛告訴同僚，「我要在座位上打坐一會兒」，另一位於是格外專心，倒也平安。