Micro Comp **(Second attempt)** **June 25, 2018**

This exam is organized into four sections, one for each quarter. Each section includes a short answer question and a longer, in-depth question.

1 Part A: Consumer and Producer Theory. (Pape)

1. Jim is an economics graduate student who eats mac & cheese six times a week (one box per day). Once a week, he likes to go to *Five Guys* to eat a burger. One day he goes to Weis and is shocked to learn that mac & cheese has become more expensive. "I guess I can't afford as many trips to *Five Guys*," he says to himself, and proceeds to buy seven boxes of mac & cheese for the week ahead.

   Claim: Mac & cheese must be an inferior good for Jim. True/False/Uncertain and Justify.

2. Suppose there is an economy with three goods: x, y, and z. The prices of these goods are p_x, p_y, and p_z. There are two firms: Firm X and Firm Y. They have different production technologies:

   - Firm X produces z from x, according to the production function $z_X = f_X(x) = x^\alpha$, and
   - Firm Y produces z from y, according to the production function $z_Y = f_Y(y) = y^\alpha$

   where $\alpha \in (0, 1)$.

   (a) Find how much z is produced by each firm, and the amount of x demanded by Firm X and the amount of y demanded by Firm Y. Can you determine firm produces more z as a function of parameters of the problem?

   (b) Suppose α increases marginally. Does the profit of firm X go up or down? Does the profit of firm Y go up or down? Which changes more?

   (c) Suppose that the two firms are owned by single owner who chooses to maximize joint profit. How do the amount of x and y demanded change, if at all? Explain.

2 Part B: Game Theory. (Pape)

3. **Riding the elephant.** Everyone wants to ride the elephant. Riding the elephant is worth 6, not riding the elephant is worth 2, but *trying* to ride the elephant but failing is worth 0 because you sometimes get stepped on by the elephant when you fall off!

   All N people have to decide at the same time whether to Try to ride the elephant or Sit out and don't try to ride the elephant. Only one person who tries to ride the elephant, chosen randomly among those who try, succeeds (earning 6). All the others fail (earning 0), except for those who Sit out who, of course, earn 2.

   (a) Is there a Nash equilibrium in which no one Tries to ride the elephant? Why or why not?

   (b) Is there a Nash equilibrium in which exactly one person Tries to ride the elephant? Why or why not?

   (c) Find a symmetric Nash equilibrium of this game with three players. (If you cannot solve explictly describe it.)

4. Consider the Prisoner's Dilemma depicted in Table 1.

	C	D
C	3,3	0,4
D	4,0	1, 1

Table 1: The Prisoner's Dilemma

Suppose there are two types of agents $\theta = \{\theta_L, \theta_H\}$. Suppose the probability that any agent is of type θ_H is γ. Moreover, suppose that $\theta_L > \gamma > \theta_H$. Suppose $\gamma = \frac{1}{3}$.

Suppose each agent's discount rate (usually denoted δ) is equal to her type.

At the beginning of the game, as usual, Nature assigns types by the aforementioned probability and, as usual, types are private information.

Find a SPNE in which at least one type begins play by cooperating, and continues to cooperate so long as her opponent does; or show why such an SPNE doesn't exist. In this equilibrium, does the cooperating type end up cooperating in the long run with opponents of her own type, opponents of the other type, both, or neither? Do the types learn what their opponents' types are?

3 Part C: Information economics. (Tonguc)

5. Consider a three point outcome space $S = \{A, B, C\}$, with outcome A preferred to outcome B preferred to outcome C. There are four lotteries, described with the triplet (p_A, p_B, p_C) where p_i is the probability of outcome $i = A, B, C$:

$$L_1 = (0, 1/3, 2/3)$$

$$L_2 = (1/2, 0, 1/2)$$

$$L_3 = (1/6, 0, 5/6)$$

$$L_4 = (1/3, 1/3, 1/3)$$

If you were told that an expected utility decision maker preferred lottery L_1 to L_3, how should the same decision maker rank lotteries L_2 and L_4? Why?

6. Consider a firm that is hiring a worker. A worker's productivity, α, is private information and $\alpha \in \{1, 2\}$. The probability that a worker is high productivity (i.e. $\alpha = 2$) is $\lambda \in [0, 1]$. A worker is assigned a task $t \geq 0$. A hired worker's utility depends on the assigned task, her wage and productivity, and has the form

$$u(t, w, \alpha) = w - \frac{t^2}{2\alpha}$$

If a worker is not hired, she has utility zero, regardless of her productivity. The firm's profits are given by

$$\pi(t, w, \alpha) = \alpha t - w$$

   (a) Show that the worker's utility function satisfies the single crossing property.
   (b) If the worker's productivity is not private information, what are the profit maximizing contracts offered by the firm?
   (c) If the worker's productivity is private information, what are the profit maximizing contracts offered by the firm? How do they depend on λ?

4 Part D: General Equilibrium. (Tonguc)

7. Draw an Edgeworth box example with an infinite number of prices that are Walrasian equilbria.

8. Consider an exchange economy with two consumers, A and B and two goods, x and y. The utility of consumer B depends not only on his own consumption of goods x and y, but also by consumer A's consumption of good x. Specifically, suppose that the preferences of the two consumers are represented by the following utility functions:

$$u_A(x_A, y_A) = \left(10x_A - \frac{x_A^2}{2}\right) + y_A$$
$$u_B(x_B, y_B, x_A) = \left((10 + \gamma x_A)\, x_B - \frac{x_B^2}{2}\right) + y_B$$

where $\gamma \in \mathbb{R}$. Also suppose that $\omega_A = (1, 2)$ and $\omega_B = (2, 1)$.

(a) Explain the role of the parameter γ. What does it mean if γ is (i) zero, (ii) positive and (iii) negative?

(b) By normalizing the price of good y to 1, find the Walrasian Equilibrium (equilibria if there are multiple solutions).

(c) How does consumer B's consumption of good x depend on γ? What is the intuition behind this result?

(d) Find the Pareto optimal allocations. Are the Walrasian equilibrium allocations you have found in part (b) Pareto optimal?