

**INSTRUCTIONS:**

1. Answer **ONLY** the specified number of questions from the options provided in each section. Do not answer more than the required number of questions. Each section takes one hour.
2. Your answers must be on the paper provided. No more than one answer per page. Do not answer two questions on the same sheet of paper.
3. If you use more than one sheet of paper for a question, write "Page 1 of 2" and "Page 2 of 2."
4. Write **ONLY** on one side of each sheet. Use only pen. Answers in pencil will be disqualified.
5. Write ----- **END** ----- at the end of each answer.
6. Write your exam identification number in the upper right-hand corner of each sheet of paper.
7. Write the question number in the upper right-hand corner of each sheet of paper.

**Section 1: Microeconomic Theory—Answer Any Two Questions.**

**1A.** (Hajikhameneh & Rietz) Answer the following questions for a consumer with utility function  $U(x, y) = x^2 y^2$  and a budget constraint of  $g(x, y) = 2x + 4y = 40$ . You must show all of your work for full credit.

- a. What is the marginal utility of  $x$ ? of  $y$ ?
- b. In one to two sentences, define the economic meaning of the term "marginal utility."
- c. What is the marginal rate of substitution for the given utility function?
- d. In one to two sentences define the economic meaning of the term "marginal rate of substitution."
- e. Using the Lagrange multiplier method, find the (Marshallian) demand curves for  $x$  and  $y$ . Use lambda  $\lambda$  as the Lagrange multiplier.
- f. In a sentence or two, define the economic meaning of the Lagrange multiplier.

**1B.** (Hajikhameneh & Rietz)  $n$  bystanders witness a crime. Each bystander has two actions: call the police or do not call the police. If the police are called by someone, each bystander gets a value of  $v$ ; the bystanders who call the police each incur a cost of  $c$  (assume that  $v > c > 0$ ). If no one calls the police all bystanders get 0. The payoff of each bystander is value (if any) minus the cost (if any). Find the symmetric mixed-strategy Nash equilibrium as a function of  $n$ . And calculate the probability that no one calls the police in the equilibrium when  $n \rightarrow \infty$ .

(over)

1C. (Liu) Consider a consumer's demand problem:

$$\max_{x_1, x_2} U(x_1, x_2) = \alpha \ln(x_1 - c) + \beta \ln(x_2 - d)$$

subject to

$$p_1 x_1 + p_2 x_2 = m$$

where  $\alpha$ ,  $\beta$ ,  $c$ ,  $d$ ,  $p_1$ ,  $p_2$ , and  $m$  are positive constants with  $\alpha + \beta = 1$ , and moreover, with  $m > cp_1 + dp_2$ . Find the values of  $x_1$  and  $x_2$  which maximize  $U$  subject to the budgetary constraint.