複選題（答案可能有一個或一個以上），每題分數如標示，全對得滿分，只錯一個選項可得一半分數，錯二個以上為零分。

1. (8%) Which of the following statements is (are) not correct?

   A. The demand curve of a normal good must be downward sloping.

   B. The Engel curve of a neutral good must be upward sloping.

   C. The demand curve of a Veblen good must be downward sloping.

   D. The Engel curve of an inferior good must be upward sloping.

   E. A Giffen good must be an inferior good.

2. (8%) Mary, a utility-maximizing consumer, chooses between x and y with the utility function $u(x, y) = \sqrt{x} + y$. Her income is 10. The price of x is 3 and the price of y is 2. Which of the following statements is (are) correct?

   A. Her optimal consumption for x is $\frac{1}{9}$.

   B. x for her is a neutral good.

   C. Her optimal consumption for y is $\frac{29}{6}$.

   D. y for her is a normal good.

   E. Her optimal consumption basket could be a corner solution given any price of x and y.

3. (8%) [**Continuation of 2.**] Suppose the price of y increases from 2 to 5 and the price of x remains at the same level.

   Under the Hicksian definition, which of the following statements is (are) correct?

   A. The substitution effect on her consumption of y is $\frac{-1}{2}$.

   B. The substitution effect on her consumption of x must be negative.

   C. The income effect on her consumption of y is $\frac{-31}{12}$.

   D. The income effect on her consumption of x must be negative.

   E. None of the above.

4. (8%) Consider a firm with a production function $q = L^{\frac{1}{2}} K^{\frac{1}{3}}$, where L is labor input and K is capital input. Suppose the firm aims to produce 10 units. The wage rate is w and the interest rate is 1.

   Which of the following statements is (are) correct?

   A. The production function exhibits decreasing returns to scale.

   B. The elasticity of substitution for this production function is $\frac{2}{3}$.

   C. When the firm's cost is minimized, the labor demand function is $L^* = (15/w)^{2/3}$.

   D. Diseconomies of scale occur during the production process.

   E. None of the above.

5. (8%) Suppose Taiwan's rice market is perfectly competitive. A typical farmer's short-run total cost function is

$$TC = 0.1q^3 + 10q^2 + 400q + 520,$$

where 520 is the sunk cost.

Since Taiwan's fertile lands are limited, new farmers entering the rice market have to cultivate on infertile lands, increasing the total cost of a typical farmer. Assume that there is no technological progress of rice production in the long run.

Which of the following statements is (are) correct?

A. The average fixed cost curve is strictly decreasing as q increases.

B. The average variable cost curve is strictly decreasing as q increases.

C. If a typical farmer cultivates, the marginal cost curve is strictly increasing as q increases.

D. In the short run, the shutdown price for a typical firm is 50.

E. The long-run supply curve for Taiwan's rice market is upward sloping.

6. (10%) Consider a closed economy with two individuals (Mary and Charles) and two goods (x, y). Mary's

utility function is $u_m = x_m + 2y_m$, where $(x_m, y_m) = (\frac{3}{4}, \frac{1}{4})$. Charles's utility function is $u_c = \min\{x_c, y_c\}$,

where $(x_c, y_c) = (\frac{1}{4}, \frac{3}{4})$. Mary and Charles can only exchange (including as a gift) between x and y.

Which of the following statements is (are) correct?

A. Mary sees x and y as perfect complements.

B. For Charles, giving out x to Mary could be a Pareto improvement.

C. The contract curve for this economy is $x_m = y_m$, where $\frac{1}{4} \leq x_m \leq \frac{7}{12}$.

D. There is only one possible competitive equilibrium for this economy.

E. None of the above.

7. (10%) Apple is a monopoly in two markets. The inverse demand curve for the first market is $p = 100 - 2q$ and is $p = 55 - q$ for the second. Suppose that Apple cannot discriminate markets by price and has to set the same price across two markets. Further, assume that Apple's cost function is

$$c(q) = \frac{1}{2}q^2.$$

Which of the following statements is (are) correct?
A. Apple will sell its goods in only one market.
B. Apple will sell its goods in both markets.
C. Apple will set the price at $p = 40$.
D. Apple will set the price at $p = 55$.
E. None of the above.

8. (8%) There are two types of drivers: "Cautious", who has a probability of 1/3 of having an accident, while the other, "Reckless", has a probability of 2/3 of having an accident. Each driver has a wealth level of 100 dollars as an endowment and will lose all his endowments if an accident occurs. Suppose each driver's utility function is

$$u(w) = \ln w,$$

where w denotes the wealth level.

A risk-neutral insurance company offers insurance. However, it cannot tell drivers' types before selling the insurance. It then offers the following two policies in the hope that each type can voluntarily purchase the right kind of insurance appropriately:

- Policy I: the insurance company will cover 20 dollars of loss if the insured buys 10 dollars amount of insurance.
- Policy II: the insurance company will cover 35 dollars of loss if the insured buys 70 dollars amount of insurance.

Which of the following statements is (are) correct?
A. Every type of driver will purchase insurance.
B. The insurance firm will run a deficit in profit.
C. Cautious type will purchase Policy I.
D. Reckless type will purchase Policy II.
E. None of the above.

9. (8%) Firms A, B, and C consider investments in research. Let g_A, g_B, and g_C represent the amounts of research invested by A, B, and C, respectively. Given the investment g_A, g_B, and g_C, firm A's profit is

$$\pi_A = 5\ln(g_A + g_B + 1) - g_A;$$

Firm B's is

$$\pi_B = 5\ln(g_A + g_B + g_C + 1) - g_B;$$

Firm C's is

$$\pi_C = 5\ln(g_B + g_C + 1) - g_C.$$

The social welfare is defined to be $\pi_A + \pi_B + \pi_C$.
Which of the following statements is (are) correct?
A. There is no Nash equilibrium.
B. There are multiple Nash equilibria.
C. There is a Nash equilibrium, which is socially optimal.
D. All Nash equilibria are socially optimal.
E. None of the above.

10. (8%) Tea makers A and B engage in a Cournot competition, facing an inverse demand curve $p = 18 - 2q$. Suppose that A's cost function is $2q_A$ and B's cost function is q_B, where q_A is the quantity produced by A, and q_B is the quantity produced by B.
Which of the following statements is (are) correct?
A. The producers' surplus for A is larger than that for B.
B. The producers' surplus for B is larger than that for A.
C. The consumers' surplus is larger than $50.
D. The consumers' surplus is smaller than $50.
E. The social surplus is maximized in the equilibrium.

11. (8%) [**Continuation of 10.**] Now, suppose the government acquires tea maker A. The government-owned enterprise will care about its own producer's surplus and the totality of consumers' surplus in the market. Tea maker B remains a private firm, and therefore, it maximizes its producer's surplus only.

Which of the following statements is (are) correct if B and the government-owned A engage in the Cournot competition?

A. The equilibrium price is above $5.

B. The equilibrium price is below $5.

C. The consumers' surplus is larger than $50.

D. The consumers' surplus is smaller than $50.

E. The social surplus is maximized in the equilibrium.

12. (8%) Consider a scenario where there is a single train traveling from Taichung to Taipei, making a brief stop at Hsinchu. A passenger intending to cover the entire journey requires two tickets: one from Taichung to Hsinchu and another from Hsinchu to Taipei. Let the price of travel, denoted by p, represent the sum of these two ticket prices.

The number of passengers traveling from Taichung to Taipei is given by

$$q = 120 - 4p,$$

where q is the number of passengers. Consider the following two scenarios:

- Scenario I: there are two competing monopolists; one of them decides the ticket price from Taichung to Hsinchu, and the other one decides the ticket price from Hsinchu to Taipei.

- Scenario II: there is one monopolist, who decides both the ticket prices from Taichung to Hsinchu and from Hsinchu to Taipei.

Assume the operation cost is zero for monopolists in both scenarios. Which of the following statements is (are) correct?

A. The consumers are strictly better in Scenario I comparing Scenario II.

B. The consumers are strictly better in Scenario II comparing Scenario I.

C. The price of travel is strictly lower in Scenario I comparing Scenario II.

D. The price of travel is strictly lower in Scenario II comparing Scenario I.

E. None of the above.

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