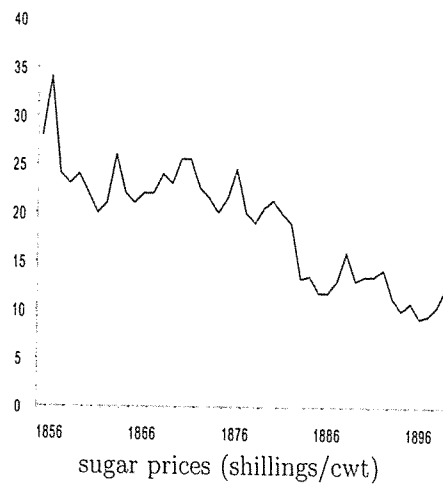
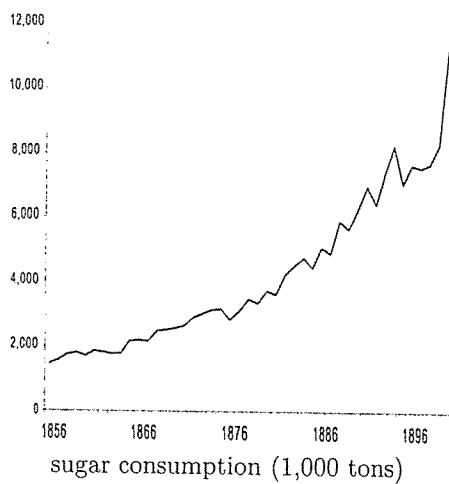


題目有兩大部分：複選題與計算問答題；各50分。請依題號依序作答。

I. 複選題9小題，每小題全對才得分；不需附說明。請於試卷內之「選擇題作答區」依序作答。

1. (5 points) The following two figures show sugar consumed in the world and sugar prices (in London) in the second half of the 19th century.



What changes over time in the sugar market can we infer from these two figures?

- (A) demand increased
 - (B) demand decreased
 - (C) supply increased
 - (D) supply decreased
 - (E) none of the above
2. (5 points) Consider the normal form of a two-person game in which the row player has 2 pure strategies, s_1 and s_2 ; and the column player has 3 pure strategies, t_1 , t_2 and t_3 . In a payoff vector, the first element is the row player's payoff and the second element is the column player's payoff.

	t_1	t_2	t_3
s_1	1,2	4,3	2,1
s_2	3,2	-1,1	0,0

Please point out all the Nash equilibrium (equilibria) in the following strategy profiles.

- (A) (s_1, t_1)
- (B) (s_1, t_2)

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(C) (s_2, t_1) (D) (s_2, t_2) (E) (s_2, t_3)

3. (5 points) Reconsider the normal form above. Suppose the row player uses a mixed strategy and chooses s_1 with probability p , and the column player uses a mixed strategy and chooses t_1 with probability q and t_2 with probability r . In a Nash equilibrium with the mixed strategies, how will these two players play the game?

(A) $p = 1/3$ (B) $p = 1/2$ (C) $q + r = 1$ (D) $q = 2/7$ (E) $q = 5/7$

Please answer problems 4 to 6 based on the following information. Product X is provided by a competitive industry that in the long run, suppliers are free to enter or exit; and every supplier is a price taker with the same production function:

$$q = (lk)^{1/4},$$

where q denotes the output, l denotes units of labor and k denotes units of capital. The price to hire a unit of labor is \$1, and the price to hire a unit of capital is \$25. Besides that, a manufacturer needs to pay an annual license fee of \$250. The annual market demand is:

$$Q = 1,000 - p,$$

where Q is quantity demanded and p is the market price of product X.

4. (5 points) What is a supplier's expansion path?

(A) $k = l$ (B) $k = l/5$ (C) $k = l/20$ (D) $k = l/25$

(E) none of the above

5. (7 points) A supplier's long-run total cost function is:

$$c(q) = 250 + 10q^2.$$

Let n denote number of suppliers in the market. What happens in the long-run equilibrium?

(A) $p = 50$ (B) $p = 100$

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(C) $p = 250$

(D) $n = 100$

(E) $n = 250$

6. (8 points) The market now reaches its long-run equilibrium. One week after a supplier pays his license fee and the rental of his capital which is a fixed factor for one year, the unit price of labor increases unexpectedly from \$1 to \$2. What is now this supplier's short-run supply of product X?

(A) $q = \sqrt{p}$

(B) $q = \sqrt{p/2}$

(C) $q = (p/2)^{1/3}$

(D) $q = (5p/8)^{1/3}$

(E) none of the above

7. (5 points) A monopolist faces two types of customers: adults and children. The market demand for adults is:

$$q_a = 100 - p_a;$$

and the market demand for children is:

$$q_c = 80 - p_c,$$

where q_a and q_c denote the quantities and p_a and p_c denote the prices. The cost function of this monopolist is:

$$c(q) = q^2,$$

where q is the total output, i.e. $q = q_a + q_c$. If the monopolist charges a single price, p , to two markets ($p_a = p_c = p$), how should he set the price to maximize profit, and how many units shall he sell in each market?

(A) $p = 70$

(B) $p = 60$

(C) $p = 50$

(D) $q_a = 25$

(E) $q_b = 5$

8. (5 points) If the monopolist in the previous problem decides to practice the third-degree price discrimination, and charges different prices to adults and children, how should he set prices to maximize profit?

(A) $p_a = 70$

(B) $p_a = 60$

(C) $p_c = 50$

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- (D) $p_c = 40$
- (E) none of the above

9. (5 points) 關於 Uber, 下列敘述何者為真?

- (A) 它是住房短租服務; 通常出租住房房間擁擠, 又不安全
- (B) 租房價格比旅館便宜
- (C) 它是叫車服務
- (D) 價格比計程車便宜
- (E) 計程車業者對 Uber 抗議

II. 計算問答題3小題, 必須說明理由或推導過程, 否則不予計分。

1. (20 points) Please read the following article from *The Economist* (December 6, 2014) and answer questions by reference to the information mentioned in this article.

THIS year's Christmas parade in Lindsay, in the heart of Oklahoma's oil country, featured the Stars and Stripes every ten yards, 11 horses with riders in Santa hats and a rifle salute by veterans. But the highlight was a thundering, bright red oil tanker covered in fairy lights and owned by Hamm & Phillips, an oil-services firm with local roots that has ridden the shale boom in the state and across America.

That energy revolution is the envy of the business world. Abundant oil and gas have been extracted from underground rocks by blasting them with a mixture of water, chemicals and sand—"fracking", in the jargon. As well as festive spirit, the firms responsible embody an all-American formula of maverick engineers, bold entrepreneurs and risk-hungry capital markets that no country can match.

Yet now that oil prices have fallen by almost 40% in six months, these firms' mettle is being tested. Across America shale-shocked executives will spend Christmas overhauling their strategies to cope with life at \$70 per barrel, even as investors dump their firms' shares and bonds. Executives at Lukoil, a big Russian firm, now sniff that shale is like the dotcom bubble—a mania that is being cruelly exposed.

Oil-price slumps usually lead to cuts in energy firms' investments. Production eventually falls, helping prices to stabilise. In 1999, after the Asian crisis, global investment in oil and gas production dropped by 20%. A decade later, after the financial crisis, investment fell by 10%, then recovered.

This time some of the pain will be taken by the big integrated energy firms, such as Exxon Mobil and Shell. After a decade of throwing shareholders' cash at prospects in the Arctic and deep tropical waters to little effect, they began cutting budgets in 2013. Long-term projects equivalent to about 3% of global output have been deferred or cancelled, says Oswald Clint of Sanford C. Bernstein, a research firm. Most "majors" assume an oil price of \$80 when making plans, so deeper cuts are likely.

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But much of the burden of adjustment will fall on America's shale industry. It has been a big swing factor in supply, with output rising from 0.5% of the global total in 2008 to 3.7% today. That has required hefty spending: shale accounted for at least 20% of global investment in oil production last year. Saudi Arabia, the leading member of OPEC, has made clear it will tolerate lower prices in order to do to shale firms' finances what fracking does to rocks.

Even the gods of shale disagree about the industry's resilience. The boss of Continental Resources, Harold Hamm (whose fortune has dropped by \$11 billion since July), has said he can cope as long as the oil price is above \$50. Stephen Chazen, who runs Occidental Petroleum, has said the industry is "not healthy" below \$70. The uncertainty reflects the diversity of activity. Wells produce different mixes of oil and gas (which sells for less). Transport costs vary: it is cheap to pipe oil from the Eagle Ford play, in Texas, but expensive to shift it by train out of the Bakken formation, in North Dakota. Firms use different engineering techniques to pare costs.

Two generalisations can still be made. First, in the very near term, the industry's economics are good at almost any price. Wells that are producing oil or gas are extraordinarily profitable, because most of the costs are sunk. Taking a sample of eight big independent firms, average operating costs in 2013 were \$10-20 per barrel of oil (or equivalent unit of gas) produced—so no shale firm will curtail current production. But the output of shale wells declines rapidly, by 60-70% in their first year, so within a couple of years this oil will stop flowing.

Second, it is far less clear if, at \$70 a barrel, the industry can profitably invest in new wells to maintain or boost production. Wood Mackenzie, a research consultancy, estimates that the "break-even price" of American projects is clustered around \$65-70, suggesting many are vulnerable (these calculations exclude some sunk costs, such as building roads). If the oil price stays at \$70, it estimates investment will be cut by 20% and production growth for America could slow to 10% a year. At \$60, investment could drop by as much as half and production growth grind to a halt. ...

- (A) Suppose that the oil price stays at \$40 from now on. What can you predict about the output level in the shale industry in the very near term? What about the output level in the long term?
- (B) Saudi Arabia will tolerate lower prices in order to do to shale firms' finances what fracking does to rocks. How would Saudi Arabia do to tolerate lower prices? Why would Saudi Arabia want to tolerate lower prices?
- (C) Is the average cost function of drilling a shale well to produce oil typically a strictly increasing function of output level in the long term? Why or why not?
- (D) Would all shale firms in the U.S. earn a zero profit in the long term equilibrium of this industry? Why or why not?
2. (15 points) Consider a society with N individuals. For each individual, the probability of being infected by influenza virus is $(1 - x)^2$ if the individual does not receive flu vaccine, where x is the proportion of people receiving flu vaccine in the society. An individual can incur a cost of

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c to receive flu vaccine, which includes the price of the vaccine and the time spent on receiving it. When an individual receives flu vaccine, the probability of being infected by the virus is zero. The cost of being infected by influenza virus is \$1 for each individual. Assume that flu vaccine is provided in a competitive market so that the price of receiving flu vaccine is equal to the marginal cost of producing it. Assume that c is a constant number for all individuals and $0 < c < 1$.

- (A) What is the proportion x^* in a Nash equilibrium?
- (B) What is the socially optimal proportion x^0 ?
- (C) If the government wants the Nash-equilibrium outcome to achieve the socially optimal proportion x^0 , how much does the government need to subsidize (or tax) on flu vaccine for each individual?

3. (15 points) There are 1000 male consumers and 1000 female consumers on an island. Every consumer has the same income of \$6000 to purchase two goods, X and Y . The utility function of each male consumer is $u_m(x, y) = x^{1/2} + y$ when consuming x units of X and y units of Y . The utility function of each female consumer is $u_f(x, y) = x^{2/3} + y$ when consuming x units of X and y units of Y . Assume that Y is produced by a perfectly competitive industry and the price of Y is fixed at $p_y = 1$.

- (A) What is the demand function for X for a male consumer?
- (B) What is the market demand function for X on the island?
- (C) You are the monopolistic seller of X on the island. There is entry barrier for others to sell X on the island. A consumer cannot resell your product to any other consumer. The total cost of producing x units of the product is $TC(x) = 30 + 10x + 2x^{3/2}$. In order to maximize your profit, you decide to charge a price of p_m for male consumers and a price of p_f for female consumers. Is $p_m > p_f$, $p_m = p_f$, or $p_m < p_f$? Why?

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