

考試科目	經濟學	系所別	商學院共同科	考試時間	2月2日(五)第一節
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### 一、Multiple Choice (1 point each)

Identify the letter of the choice that best completes the statement or answers the question.

1. Beef is a normal good. You observe that both the equilibrium price and quantity of beef have fallen over time. Which of the following explanations would be most consistent with this observation?

A. Consumers have experienced an increase in income, and beef-production technology has improved.

B. The price of chicken has risen, and the price of steak sauce has fallen.

C. New medical evidence has been released that indicates a negative correlation between a person's beef consumption and life expectancy.

D. Beef producers, concerned about the health of their customers, decided to produce relatively less beef.

2. Suppose a tax of \$4 per unit is imposed on a good, and the tax causes the equilibrium quantity of the good to decrease from 2,000 units to 1,700 units. The tax decreases consumer surplus by \$3,000 and decreases producer surplus by \$4,400. The deadweight loss of the tax is

A. \$ 200.

B. \$ 400.

C. \$ 600.

D. \$ 1,200.

3. When a tax is levied on sellers of tea, buyers of a good bear the larger share of the tax burden when the

(i) supply is more elastic than the demand for the product.

(ii) demand is more elastic than the supply for the product.

(iii) tax is placed on the sellers of the product.

(iv) tax is placed on the buyers of the product.

A. (i) only

B. (ii) only

C. (i) and (iii) only

D. (i) and (iv) only

備註

一、作答於試題上者，不予計分。  
二、試題請隨卷繳交。

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<p>4. The substitution effect of an increase in the interest rate will result in an increase in</p> <p>A. consumption when young and increase in savings when young.  B. consumption when old and an increase in savings when young.  C. consumption when young and an increase in savings when old.  D. savings when old and an increase in consumption when old.</p> <p>5. Assume that goods X and Y are not Giffen goods. If the price of good X falls, a consumer will definitely</p> <p>A. consume more of good X because her budget constraint has rotated outward.  B. consume more of good X because her budget constraint has shifted outward.  C. consume more of good Y because her budget constraint has rotated outward.  D. consume more of good Y because her budget constraint has shifted outward.</p> <p>6. Thirsty Thelma owns and operates a small lemonade stand. When Thelma is producing a small quantity of lemonade she has few workers and her equipment is not being fully utilized. Because she can easily put her idle resources to use,</p> <p>A. the marginal cost of an extra worker is large.  B. the marginal product of an extra worker is small.  C. The marginal cost of one more glass of lemonade is small.  D. Her lemonade stand is likely to be crowded with workers.</p> <p>7. When total revenue is less than total variable cost, a firm in a competitive market will</p> <p>A. shut down.  B. continue to operate as long as average revenue exceeds marginal cost.  C. continue to operate as long as average revenue exceeds average fixed costs.  D. always exit the industry.</p> <p>8. In a competitive market, a firm's supply curve dictates the amount it will supply. In a monopoly market</p> <p>A. the same is true.  B. the decision about how much to supply is impossible to separate from the demand curve it faces.</p>					
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- C. the supply curve conceptually makes sense, but in practice is never used.  
 D. the supply curve will have limited predictive capacity.
9. Equilibrium quantity in markets characterized by oligopoly are  
 A. lower than in monopoly markets and higher than in perfectly competitive markets.  
 B. lower than in monopoly markets and lower than in perfectly competitive markets.  
 C. higher than in monopoly markets and higher than in perfectly competitive markets.  
 D. higher than in monopoly markets and lower than in perfectly competitive markets.
10. In the long run, a profit-maximizing firm in a monopolistically competitive market operates at  
 A. efficient scale.  
 B. the point where demand equals marginal cost.  
 C. the point where revenue is also maximized.  
 D. some point along the downward sloping portion of its average total cost curve.
11. Which of the following statements is correct if a country has adopted fixed exchange rate regime?  
 A. If the currency is overvalued with respect to the fixed parity, the central bank has to intervene e.g. by increasing the interest rate.  
 B. The central bank has to offset the effects of capital outflow on the exchange rate e.g. by buying domestic currency and paying with foreign reserves.  
 C. If, in order to reduce excess supply of the domestic currency, the central bank buys domestic currency at the target exchange rate, this will necessarily cause inflation in the home country.  
 D. Measures taken by the central bank to keep the exchange rate fixed will not affect the domestic interest rate.
12. Take a graph with the unemployment rate on the horizontal axis and the inflation rate on the vertical axis. Which of the following will shift the Phillips curve towards the northeast?  
 A. A positive aggregate demand shock  
 B. Contractionary monetary policy  
 C. A negative aggregate supply shock  
 D. A decrease in expected inflation

備

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<p>13. Which of the following statements is necessarily false:</p> <p>A. Monetary policy can be conducted through open market operations, setting the minimum reserve requirement and through changing the refinancing rate at which banks can borrow money from the central bank.</p> <p>B. In the short run, an increase in money supply causes a proportional increase in prices. Over time the latter decrease again.</p> <p>C. Unemployment benefits are automatic stabilizers.</p> <p>D. The positive effect of expansionary fiscal policy on production is reduced by crowding out.</p> <p>14. According to the theory of sticky wages:</p> <p>A. prices adjust slowly to a decrease in nominal wages. Firms face lower wages and since prices stay high they increase the level of production and thus employment. This results in higher aggregate supply.</p> <p>B. wages adjust slowly to a decrease in prices. Firms face lower prices and since the costs of production stay high they have to decrease production and thus employment. This decreases aggregate supply.</p> <p>C. not all firms immediately adjust their prices in reaction to a decrease in the price level. These firms face higher prices and thus they increase production, which increases aggregate supply.</p> <p>D. prices react more than proportionally to increases in nominal wages. Producers face higher wages, but since prices increase more than wages they want to increase production. This results in higher aggregate supply.</p> <p>15. According to the AS-AD model an increase of public investment</p> <p>A. might decrease GDP in the short run because of crowding out.</p> <p>B. decreases prices in the short run which stimulates an economic recovery.</p> <p>C. does not change long run aggregate supply.</p> <p>D. increases aggregate supply which is depicted as a shift of the AS curve to the right.</p> <p>16. Which of the following is the most important variable for judging an economy's long-run performance?</p> <p>A. growth in nominal GDP</p> <p>B. growth in real GDP</p>					
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C. growth in real GDP per capita

D. growth in potential GDP

17. Assume that the currency-deposit ratio is 32%, the required reserve-deposit ratio is 7%, the excess reserve-deposit ratio is 1%, and total money supply is \$1,320 billion. What is the amount of high-powered money?

A. \$132 billion

B. \$165 billion

C. \$330 billion

D. \$400 billion

18. When the central bank intervenes in the foreign exchange market by purchasing foreign currency, it also routinely engages in open market sales of government securities. Why?

A. it has to sell securities to acquire the necessary funds

B. to avoid a recession that may be caused by the reduction in money supply resulting from the purchase of foreign currency

C. to prevent its intervention in the foreign exchange market from having a direct effect upon the domestic money supply

D. it wants to isolate the domestic economy from foreign competition

19. According to the Baumol-Tobin transaction demand model, money demand for transactions

A. depends only on the level of income

B. depends only on the cost of illiquidity

C. varies inversely with both the interest rate and the level of income

D. increases as the interest rate decreases or income increases

20. Which are the three channels by which the Central Bank can reduce money supply?

A. buy government securities, lower reserve requirements, and lower the discount rate

B. buy government securities, raise reserve requirements, and raise the discount rate

C. buy government securities, lower reserve requirements, and raise the discount rate

D. sell government securities, raise reserve requirements, and raise the discount rate

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## 二、Problems and Short-essay Questions

Please answer the following questions IN SEQUENCE. All questions may be answered in either Chinese or English.

1. Suppose there is a railway that runs coal-burning steam locomotives through a farming area and caused fires in the crop fields at harvest time. The crop damage from each train run is \$200. To run trains, the railway company incurs a private marginal cost of  $\$100n$ , where  $n$  denotes the number of train runs. For simplicity, assume there are no fixed costs. The revenue from a train run is \$400.

A. (4 points) What is the socially optimal number of train runs?

B. (4 points) How many trains would the railway company run if no compensation is required for crop damage and the transaction cost is high enough to prevent the parties from bargaining? How much profit does the company make?

C. (6 points) How many trains would the railway company run if no compensation is required for crop damage but the negotiations between the company and the farmers are free of any transaction costs? How much profit does the company make?

D. (6 points) Now assume the railway company is legally liable for the damage caused. That is, it is required to pay the farmer \$200 for each train run. How many trains would the company run? How much profit does it make?

2. There are two large countries  $H$  and  $F$ . Each country can choose its trade policy between free trade and protection. If both countries choose free trade, the welfare is (welfare of  $H$ , welfare of  $F$ ) = (20, 20). If  $H$  chooses free trade but  $F$  chooses protection, according to the optimal tariff theory,  $F$  can obtain more gains from trade at the expense of  $H$ , so that (welfare of  $H$ , welfare of  $F$ ) = (-20, 30). On the contrary if  $H$  chooses protection while  $F$  chooses free trade, the welfare is (welfare of  $H$ , welfare of  $F$ ) = (30, -20). However, if both countries choose protection, the welfare level moves down toward that near autarky. Therefore, (welfare of  $H$ , welfare of  $F$ ) = (-10, -10). Answer the following questions.

A. (10 points) If two countries choose trade policy simultaneously, what is the possible policy combination they will choose?

B. (10 points) What is the value of a bilateral trade agreement?

備

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3. Consider an economy with the following aggregate demand and aggregate supply functions:

$$\begin{cases} \text{Aggregate Demand function: } Y = 100 + 0.5 \times \frac{M}{P}, \\ \text{Aggregate Supply function: } Y = \bar{Y} + 25 \times (P - P^e), \end{cases}$$

where  $Y$  represents the output,  $\bar{Y}$  is the potential output,  $P$  is the price level,  $P^e$  is the expected price level,  $M$  is the nominal money supply. Furthermore, assume that  $M = 400$  and  $\bar{Y} = 200$ .

A. (6 points) Compute the equilibrium price and the equilibrium output, given that the expected price level is exactly equal to the actual price level.

B. (7 points) Suppose that the central bank dramatically increases the nominal money supply to 750 while the general public maintains exactly the same expected price level, what would be the new equilibrium price and the new equilibrium output?

C. (7 points) Compute the equilibrium price and the equilibrium output if the aforementioned expansionary monetary policy of the central bank is fully anticipated by the public.

4. Consider the following structural macroeconomic model:

- Production function:  $Y = F(N, K)$ ;  $F_N > 0$ ,  $F_K > 0$ .
- Labor demand:  $\frac{W}{P} = F_N(N, K)$ ;  $F_{NN} < 0$ ,  $F_{KK} < 0$ .
- Consumption:  $C = C(Y - T, r)$ ;  $1 > C_y > 0$ ,  $C_r < 0$ .
- Investment:  $I = I(r, y)$ ;  $I_y > 0$ ,  $I_r < 0$ .
- Goods market equilibrium:  $Y = C + I + G$ .
- Money market equilibrium:  $\frac{M}{P} = m(r, y)$ ;  $m_r < 0$ ,  $m_y > 0$ .

The terms  $Y$  (nominal GDP),  $y$  (real GDP),  $N$  (employment level),  $P$  (price level),  $C$  (consumption),  $r$  (interest rate),  $I$  (investment) are endogenous variables while  $K$  (capital stock),  $W$  (nominal wage),  $T$  (tax),  $G$  (government purchase),  $M$  (money supply) are exogenous variables.

A. (6 points) Is there an equilibrium in this model? If so, is it unique?

B. (7 points) Is there a stable equilibrium? If instability is possible, what is the sufficient condition for instability? (7%)

C. (7 points) What are the effects of an increase in government spending on  $y$ ,  $r$  and  $P$ ? What are the effects of an increase in money supply on  $y$ ,  $r$  and  $P$ ? (7%)

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I. Explain the following term briefly (24 points, each 4 points)

1. Tax shield by debt financing
2. A stock's beta
3. Aggressive stocks
4. Cyclical industries
5. Value stocks
6. Real rates of return

II. Computational Questions (30 points, each 5 points)

1. A firm has 12,000 shares of common stock outstanding with a book value of \$20 per share and a market value of \$39. There are 5,000 shares of preferred stock with a book value of \$22 and a market value of \$26. There is a \$400,000 face value bond issue outstanding that is selling at 87% of par. What weight should be placed on the preferred stock when computing the firm's WACC?

2. What is the minimum cash flow that could be received at the end of year 3 to make the following project "acceptable"? Initial cost = \$100,000; cash flows at end of years 1 and 2 = \$35,000; opportunity cost of capital = 10%.

3. A company owns a tract of timber that will keep growing for a number of years. It calculates that the timber's value less the cost of harvesting is currently \$50,000 and that this figure will grow by 10% in the next year and by 5% in the following year. If the cost of capital is 8%, when should the company harvest the timber?

4. If a 4-year bond with a 7% coupon and a 10% yield to maturity is currently worth \$904.90, how much will it be worth 1 year from now if interest rates are constant?

5. What would you estimate as the cost of equity if a stock sells for \$40, pays a \$4.25 dividend, and is expected to grow at a constant rate of 5%?

6. What is the standard deviation of the market portfolio if the standard deviation of a well-diversified portfolio with a beta of 1.25 equals 20%?

III. Short Answer Questions (12 points, each 6 points)

1. Compare straight-line depreciation with accelerated depreciation briefly. Why is accelerated depreciation often favored for the corporation's set of tax books?



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2. Explain financial leverage and operating leverage briefly. Why a firm with high financial leverage or high operating leverage is considered riskier?

IV. Questions (34 points)

1. BCCI has outstanding 1 million shares with a total market value of \$20 million. The firm expected to pay \$1 million of dividend next year, and thereafter the amount paid out is expected to grow 5% a year perpetuity. Thus the expected dividend is \$1.05 million in year 2, \$1.105 million in year 3, and so on. However, the company has heard that the value of a share depends on the flow of dividends, and therefore it announces that next year's dividend will be increase to \$2 million and that the extra cash will be raised immediately by an issue of shares. After that, the total amount paid out each year will be as previously forecasted, that is, \$1.05 million in year 2 and increasing by 5% in each subsequent year.

- At what price will the new shares be issued in year 1? (6 points)
- How many shares will the firm need to issue? (4 points)
- What will be the expected dividend payments on these new shares, and what therefore will be paid to the old shareholders after year 1? (6 points)
- What is the present value of the cash flows to the old shareholders? (6 points)

2. The Granite Paving Company plan to have a debt equity ratio of 1.5. The before-tax cost of debt is 11% and the unlevered equity is 14%. (12 points, each 6 points)

- Calculate the weighted average cost of capital for the firm when its debt equity ratio moves from 0 to 1.5, given the tax rate is 30%.
- Currently it is an unlevered (all equity) firm with a beta of 1.1. What will be the beta of the firm if it goes through the capital restructuring process and attains the target debt-to-equity ratio, 1.5? Assume a tax rate of 30%.

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Single choice questions (4 points each, 100 points in total) 選擇題請在答案卡上作答，否則不予計分。

- Which of the following variables is interval-scaled?
  - Jersey numbers of soccer players
  - Phone numbers
  - Temperature
  - None of the above
- Below are summary statistics of the commissions earned (in thousand) by a sample of 15 salespersons at Super Company.

min	Q1	Q2	mean	Q3	max
20	24	31	34	41	55

- Which of the following is *not* a statistic?
- mean = 34
  - median = 31
  - $(\max + \min) / 2 = 37.5$
  - None of the above.
- Consider the experiment of rolling a fair die. The possible outcomes are  $\{1, 2, 3, 4, 5, 6\}$ . Consider the events  $A = \{1, 3, 5\}$ ,  $B = \{4, 6\}$ ,  $C = \{1, 2\}$ . Which of the following statements is correct?
    - Events  $A$  and  $C$  are mutually exclusive.
    - Events  $A$  and  $B$  are collectively exhaustive.
    - Events  $A$  and  $C$  are dependent.
    - None of the above.
  - The manager of a toy store found that 70% of its customers shopped online and 30% shopped in physical stores. The manager also found that 60% of the online shoppers are female, and that 80% of the shoppers in physical stores are female. What is the probability that a randomly selected customer is a female who shops online?
    - 6/25
    - 7/11
    - 3/5
    - None of the above.
  - The Business Bureau conducts a survey of the quality of service offered by a sample of 155 hedge fund managers in Emerald City. The results on Service and Gender are summarized in the following table.

Gender	Service		
	Fair	Good	Excellent
female	19	21	25
male	32	28	30

- Use a  $\chi^2$  statistic to test whether Service and Gender are independent. At  $\alpha = 0.05$ , the critical value and test statistic are
- critical value =  $\chi^2_{2,0.05}$ ; test statistic is 0.76
  - critical value =  $\chi^2_{2,0.025}$ ; test statistic is 0.76
  - critical value =  $\chi^2_{2,0.05}$ ; test statistic is 1.25
  - critical value =  $\chi^2_{2,0.025}$ ; test statistic is 1.25
- A random variable  $X$  is said to follow Lognormal( $\mu, \sigma^2$ ) if  $\log_e(X)$  follows  $N(\mu, \sigma^2)$  distribution. The probability density function of Lognormal( $\mu, \sigma^2$ ) is
    - $\frac{x}{\sqrt{2\pi}\sigma} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$
    - $\frac{1}{\sqrt{2\pi}\sigma x} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$
    - $\frac{x}{\sqrt{2\pi}\sigma} \exp\left(-\frac{(\log_e(x)-\mu)^2}{2\sigma^2}\right)$
    - $\frac{1}{\sqrt{2\pi}\sigma x} \exp\left(-\frac{(\log_e(x)-\mu)^2}{2\sigma^2}\right)$
    - None of the above.

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7. Let the joint probability density function of  $(X, Y)$  be  $f(x, y) = ce^{-y/2}$ ,  $0 < x < y < \infty$ . What is the value of  $c$ ?
- (a) 2  
(b) 1  
(c) 1/2  
(d) 1/4  
(e) None of the above.
8. (cont'd) Obtain  $f(x|y)$ , the conditional probability density of  $X$  given  $Y$ .
- (a)  $\frac{1}{2}e^{-x/2}$ ,  $x > 0$ .  
(b)  $\frac{1}{2}e^{-(y-x)/2}$ ,  $0 < x < y < \infty$ .  
(c)  $\frac{1}{y}$ ,  $0 < x < y < \infty$ .  
(d) None of the above.
9. Super Mobile wishes to set a minimum life guarantee on its new adapter. Quality testing on 10,000 randomly selected items shows that 50 are not working at all, and the time to failure for the remaining items follows an exponential distribution with a mean of 5,000 hours. Super Mobile wants to set a warranty period such that only 5% of the adapter fail during that period. The warranty period should be set as
- (a)  $-5000 * \log_e(0.055)$   
(b)  $-5000 * \log_e(0.045)$   
(c)  $-5000 * \log_e(0.945)$   
(d)  $-5000 * \log_e(0.955)$   
(e) None of the above.
10. The manager of a shoe store designed an incentive plan for salespeople. To test whether the incentive plan helps to increase the salesperson's mean weekly income, 20 salespeople were randomly selected and their weekly incomes before and after the plan were recorded. Let  $X_1, \dots, X_{20}$  be the incomes before the plan and  $Y_1, \dots, Y_{20}$  be the incomes after the plan. Let  $D_i = X_i - Y_i$  for  $i = 1, \dots, 20$ . What assumptions are needed to conduct a paired  $t$ -test?
- (a)  $X_i$ 's are i.i.d.  $N(\mu_x, \sigma_x^2)$  and  $Y_i$ 's are i.i.d.  $N(\mu_y, \sigma_y^2)$ .  
(b)  $X_i$ 's are i.i.d.  $N(\mu_x, \sigma^2)$  and  $Y_i$ 's are i.i.d.  $N(\mu_y, \sigma^2)$ .  
(c)  $D_i$ 's are i.i.d.  $N(\mu_d, \sigma_d^2)$ .  
(d) None of the above.
11. The owner of Super Call Center wants to investigate whether the mean waiting times (in seconds) at stores A, B and C are the same. Suppose that the waiting times at A, B and C are independent and follow  $N(\mu_a, \sigma^2)$ ,  $N(\mu_b, \sigma^2)$ , and  $N(\mu_c, \sigma^2)$ . The results of a random sample of 12 customers are below. What are the test statistic and critical value at level  $\alpha$ ?
- |   |    |    |    |    |
|---|----|----|----|----|
| A | 10 | 9  | 14 | 11 |
| B | 11 | 21 | 12 | 16 |
| C | 12 | 16 | 11 | 13 |
- (a) test statistic is  $F$ ; critical value is  $F_{\frac{\alpha}{2}, 2, 9}$ .  
(b) test statistic is  $F$ ; critical value is  $F_{\alpha, 2, 9}$ .  
(c) test statistic is  $\chi^2$ ; critical value is  $\chi_{\frac{\alpha}{2}, 6}^2$ .  
(d) test statistic is  $\chi^2$ ; critical value is  $\chi_{\alpha, 6}^2$ .
12. (cont'd) The observed test statistic is
- (a) 1.6  
(b) 1.78  
(c) 2.5  
(d) 3.68  
(e) None of the above.

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13. (cont'd) The estimate of  $\sigma^2$  is
- 10
  - 3.16
  - 2.5
  - 0.35
  - None of the above.
14. Super Software purchases DVDs from DVD Global. They have agreed that the acceptable quality level is 1% defectives and the unacceptable level is 4%. They have also decided to sample 100 DVDs at random from each large batch and to reject the batch if more than 2 defectives are found. Let  $\pi$  be the true defective rate and  $X$  be the number of defective DVDs found in the 100 DVDs.
- The producer's risk is  $P(X \geq 2 | \pi = 0.01)$ .
  - The consumer's risk is  $P(X \geq 2 | \pi = 0.01)$ .
  - The producer's risk is Type II Error.
  - None of the above.
15. The Department of Labor reports that the median monthly salary of new college graduates is 25,000 NTD. A group of recent graduates believe this amount is too low. To conduct a statistical test, they take a random sample of 200 new college graduates and find that 112 began with a monthly salary of more than 25,000 NTD, four with exactly 25,000 NTD. Which of the following statements is correct?
- $H_0$ : median = 25,000 vs  $H_1$ : median < 25,000
  - The observed test statistic is  $z = \frac{112 - 98 + 0.5}{0.5 \cdot \sqrt{196}}$ .
  - The observed test statistic is  $z = \frac{112 - 100 - 0.5}{0.5 \cdot \sqrt{200}}$ .
  - None of the above.
16. The manager of a large coffee shop chain studied the relation between sales ( $y$ ) and the following variables:  $x_1$  = population of the region,  $x_2$  = advertising expense,  $x_3$  = number of competitors in the region,  $x_4$  = average income of the region. Consider the regression model:  $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + e$ , where  $e \sim N(0, \sigma^2)$ . Part of the regression output based on a random sample of 25 stores is given below. The manager also found that the sum of squares due to regression is 124, and the sum of squares due to residuals is 40. What is the regression equation?

	Coef	SE Coef	t
Intercept		7.15	9.80
$x_1$		0.02	6.50
$x_2$		0.58	2.50
$x_3$	-0.12	0.07	
$x_4$	1.84	0.60	

- $\hat{y} = 70.07 + 0.13x_1 + 1.45x_2 - 1.71x_3 + 3.06x_4$
  - $\hat{y} = 70.07 + 0.13x_1 + 1.45x_2 - 0.12x_3 + 1.84x_4$
  - $\hat{y} = 9.80 + 6.50x_1 + 2.50x_2 - 1.71x_3 + 3.06x_4$
  - $\hat{y} = 7.15 + 0.02x_1 + 0.58x_2 + 0.07x_3 + 0.60x_4$
  - None of the above.
17. (cont'd) We want to test whether  $\beta_1$  is greater than zero. At  $\alpha = 0.01$ , what is the critical value of this test?
- $t_{0.01, 20}$
  - $t_{0.01, 24}$
  - $t_{0.005, 20}$
  - $t_{0.005, 24}$
  - None of the above.
18. (cont'd) Consider  $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$  vs  $H_1$ : not all  $\beta_i$ 's are zero. The  $p$ -value and observed test statistic are
- $p\text{-value} = P(F_{5, 20} > F_{\text{obs}})$  with  $F_{\text{obs}} = 12.4$
  - $p\text{-value} = P(F_{4, 20} > F_{\text{obs}})$  with  $F_{\text{obs}} = 15.5$
  - $p\text{-value} = 2P(F_{5, 20} > F_{\text{obs}})$  with  $F_{\text{obs}} = 12.4$
  - $p\text{-value} = 2P(F_{4, 20} > F_{\text{obs}})$  with  $F_{\text{obs}} = 15.5$
  - None of the above.

備

註

一、作答於試題上者，不予計分。  
二、試題請隨卷繳交。

考試科目	統計學 A	系所別	金融學 金融管理組	考試時間	2月2日(五)第三節
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19. (cont'd) What is the proportion of variation in sales that can be explained by the four explanatory variables?
- (a) 0.34  
(b) 0.65  
(c) 0.86  
(d) None of the above.
20. A smartphone manufacturer would like to study the relation between sales ( $y$ ) and seasons (Q1, Q2, Q3, and Q4), where  $Q_i$  represents the  $i$ th quarter. Which of the following model specifications is appropriate?
- (a)  $y = \beta_0 + \beta_1x + e$ , where  $x = 1, 2, 3, 4$  for Q1, Q2, Q3, and Q4, respectively  
(b)  $y = \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + e$ , where (1)  $x_1 = 1$  for Q1, and 0 otherwise, (2)  $x_2 = 1$  for Q2, and 0 otherwise, (3)  $x_3 = 1$  for Q3, and 0 otherwise.  
(c)  $y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + e$ , where (1)  $x_1 = 1$  for Q2, and 0 otherwise, (2)  $x_2 = 1$  for Q3, and 0 otherwise, (3)  $x_3 = 1$  for Q4, and 0 otherwise.  
(d)  $y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 + e$ , where (1)  $x_1 = 1$  for Q1, and 0 otherwise, (2)  $x_2 = 1$  for Q2, and 0 otherwise, (3)  $x_3 = 1$  for Q3, and 0 otherwise, (4)  $x_4 = 1$  for Q4, and 0 otherwise.

21. The manager of an Internet company wants to conduct A/B testing to increase the amount of time users spend on their website. The team created a modified version of the original page. Then, the original webpage and the modified one (called A and B, respectively) are shown to similar users. The manager would like to test whether the modified version keeps users on the website longer. The following table shows the amount of time (in seconds) a random sample of 24 users spend on their website. Are these two samples independent or paired?

A (original)	320	290	421	510	210	402	625	560	360	431	506	505
B (modified)	340	285	475	510	210	500	631	560	365	431	525	619

- (a) independent  
(b) paired
22. (cont'd) Assume that the two populations are normally distributed. The sample standard deviations for these two samples are  $s_a = 120$  and  $s_b = 131$ , respectively. Suppose that we are to test whether there is a significant difference in the variances of the two populations; that is,  $H_0: \sigma_a = \sigma_b$  vs  $H_1: \sigma_a \neq \sigma_b$ . The observed test statistic is  $F_{obs} = s_b^2/s_a^2 = 1.19$ . At  $\alpha = 0.05$ , which of the following statements is correct?
- (a) Reject  $H_0$  if  $\{F_{obs} > F_{0.975, 11, 11}\}$ .  
(b) Reject  $H_0$  if  $\{F_{obs} < F_{0.025, 11, 11}\}$ .  
(c) Reject  $H_0$  if  $\{F_{obs} > F_{0.95, 11, 11}\}$ .  
(d) Reject  $H_0$  if  $\{F_{obs} > F_{0.975, 2, 22}\}$ .  
(e) Reject  $H_0$  if  $\{F_{obs} < F_{0.025, 2, 22}\}$ .
23. (cont'd) Now we construct an one-way ANOVA table for this data. What is the computed F value?
- (a) 0.25  
(b) 0.58  
(c) 0.95  
(d) 1.65
24. (cont'd) For this one-way ANOVA table, what hypothesis testing is this F value for?
- (a)  $H_0: \sigma_a = \sigma_b$  vs  $H_1: \sigma_a \neq \sigma_b$   
(b)  $H_0: \sigma_a \leq \sigma_b$  vs  $H_1: \sigma_a > \sigma_b$   
(c)  $H_0: \mu_a = \mu_b$  vs  $H_1: \mu_a \neq \mu_b$   
(d)  $H_0: \mu_a \leq \mu_b$  vs  $H_1: \mu_a > \mu_b$
25. The table below shows the actual sales (\$ million) in 2017 and the Seasonal Index of the sales based on the past 5 years for DVD Global. Which of the following statements is correct?

Quarter	Q1	Q2	Q3	Q4
2017 sales	5.9	7.2	10.3	8.5
Seasonal Index	0.70	0.98	1.41	0.91

- (a) The deseasonalized sales for Q1 of 2017 is  $5.9+0.7 (=6.6)$ .  
(b) The deseasonalized sales for Q1 of 2017 is  $5.9-0.7 (=5.2)$ .  
(c) The deseasonalized sales for Q1 of 2017 is  $5.9*0.7 (=4.13)$ .  
(d) The deseasonalized sales for Q1 of 2017 is  $5.9/0.7 (\approx 8.43)$ .

備註

- 一、作答於試題上者，不予計分。  
二、試題請隨卷繳交。

考試科目	統計學 B	所別	金融學系 財務工程與金融 科技組	考試時間	2 月 2 日(五)第二節
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1. Consider a probability space  $(\Omega, F, P)$  with  $\Omega = \{1, 2, 3, 4\}$ ,  $F = \sigma(\{1\}, \{2\}, \{3\}, \{4\})$ , and

$$P(\{1\}) = \frac{1}{3}, P(\{2\}) = \frac{1}{6}, P(\{3\}) = \frac{1}{4}, P(\{4\}) = \frac{1}{4}$$

Define three random variables,  $X$  and  $Y$ , by

$$X(1) = 1, X(2) = 1, X(3) = -1, X(4) = -1$$

$$Y(1) = 1, Y(2) = -1, Y(3) = 1, Y(4) = -1$$

- (1) List the sets in  $\sigma(X)$ . (5%)
- (2) Please find  $P(Y|X)$  and  $E(Y|X)$ . (10%)
- (3) Let  $B = \{1, 2, 4\}$ . For  $A \in F$ , find  $P(A|B)$ . (10%)

2. (1). Please describe the assumptions of the Black-Scholes option pricing formula. (5%)

(2). Under physical probability measure  $\mathcal{P}$ , given the dynamics of the stock price

$$dS_t = \mu S_t dt + \sigma S_t dW_t^{\mathcal{P}} \tag{1}$$

where  $dS_t$  denotes the stock change at instantaneous time,  $\mu$  presents the expected return of the stock at instantaneous time,  $dt$  is the instantaneous time,  $\sigma$  means the standard deviation (volatility) of the stock return, and  $dW_t^{\mathcal{P}}$  is the change of the Brownian Motion at instantaneous time under  $\mathcal{P}$ .

Please derive the Black-Scholes pricing formula at time 0 for European call option with the strike  $K$ , the maturity  $T$  and the risk-free interest rate  $r$  by your known method. (20%)

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。
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考試科目	統計學 B	所別	金融學系 財務工程與金融 科技組	考試時間	2 月 2 日(五)第二節
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(3). Based on Equation (1), the function  $f = \ln S_t$ , and Ito's Lemma, find the solution of the stochastic

differential Equation (1)  $S_T = S_0 e^{(\mu - \frac{1}{2}\sigma^2)T + \sigma W_T^P}$  from 0 to T. (10%)

(4). According to the data of the return at the stock every day,  $\{r_1, r_2, \dots, r_n\}$ , how to estimate the parameters  $\mu$  and  $\sigma^2$ . (10%)

(5). The answer of the problem (2) is the pricing formula of the European call option, where the option price has five parameters, and we have one option market price C, please find which parameter is unknown and obtained by the Black-Scholes option pricing formula and the option market price, and what it is called. (10%)

(6). From the answers of the problem (4) and the problem (5), we obtain two volatilities. Please explain what is the meaning for that two volatilities. (10%)

(7). Under the risk-neutral measure  $\mathcal{Q}$ , given the dynamics of the stock price

$$dS_t = rS_t dt + \sigma S_t dW_t^{\mathcal{Q}} \quad (2)$$

where  $r$  presents the risk-neutral interest rate at instantaneous time, and  $dW_t^{\mathcal{Q}}$  is the change of the Brownian Motion at instantaneous time under the risk-neutral measure  $\mathcal{Q}$ .

Please give the meaning of the risk-neutral measure  $\mathcal{Q}$  and how to find the change measure by Givsanov Theorem. (10%)

備註	二、作答於試題上者，不予計分。 二、試題請隨卷繳交。
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