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### I. Multiple Choice (1 points each)

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

- Suppose the introduction of new tariffs on imported ovens not only raises the prices of imported ovens but also those of domestic ovens. We can conclude that imported and domestic ovens are
  - substitutes.
  - complements.
  - unrelated.
  - None of the above is correct.
- According to consumer theory, "if consumers do not buy less of a commodity when their incomes rise, they will
  - surely buy less when the price of the commodity rises."
  - surely buy more when the price of the commodity rises."
  - surely buy less when the price of the commodity falls."
  - either buy more or less when the price of the commodity rises."
- People with hidden health problems are more likely to buy health insurance than are other people. This is an example of
  - moral hazard and makes the cost of health insurance higher than otherwise.
  - moral hazard and makes the cost of health insurance lower than otherwise.
  - adverse selection and makes the cost of health insurance higher than otherwise.
  - adverse selection and makes the cost of health insurance lower than otherwise.
- Ben has a concave utility function  $U(W) = W^{0.5}$ , where  $W$  denotes his wealth. His only asset is shares in a start-up company. Tomorrow he will learn the stock's value. He believes that it is worth \$144 with probability  $\frac{1}{2}$  and \$100 with probability  $\frac{1}{2}$ . What is the risk premium he would pay to avoid bearing this risk?
  - 1
  - 2
  - 10
  - 12
- Which of the following demonstrates the law of demand?
  - Ashlyn buys more apples at \$3 per pound than at \$5 per pound, other things equal.
  - Brian buys fewer croissants at \$1 per croissant than at \$2 per croissant, other things equal.
  - After Charles got a raise at work, he bought more pretzels at \$2 per pretzel than he did before his raise.

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- 作答於試題上者，不予計分。
- 試題請隨卷繳交。

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- D. Danny buys fewer Snickers at \$1.5 per bar after the price of Skittles falls to \$1 per bag.
6. In the long run, the toothpaste market is monopolistically competitive, and WhiteMan is one of the firms. WhiteMan's long-run cost function is  $c(q) = q^3 - xq^2 + 14q$ . The firm faces demand  $q = 5 - \frac{1}{2}p$ . What is  $x$ ?
- A. 3  
B. 4  
C. 5  
D. 6
7. There are four residents  $i = 1, 2, 3$ , and 4 in a small village. If resident  $i$  donates  $d_i$  dollars, total public funding is  $D = \sum_{i=1}^4 d_i$ . Resident  $i$ 's utility is  $U_i = m_i - d_i + i \cdot \ln(D)$ , where  $m_i$  is the money resident  $i$  has and  $m_i > 6$  for all  $i$ . What is the socially optimal level of  $D$ ?
- A. 8  
B. 10  
C. 12  
D. 14
8. Demand for bubble tea is  $q_d = 42 - 2p$ , and supply is  $q_s = 0.5p - 2$ . Consumption causes an obesity external cost  $c_s = 3q^2$ . Which policy achieves the social optimum?
- A. Close the bubble tea market.  
B. For every bubble tea consumed, the customer pays the bubble store 12 dollars more.  
C. For every bubble tea produced, the bubble store pays 12 dollars to the government.  
D. Set a quota equal to  $q = 3$ .
9. Consider the game in the payoff matrix.

		Player 2	
		B	T
Player 1	B	(2, 1)	(0, 0)
	T	(0, 0)	(1, 2)

Which the following description is wrong?

- A. There are 3 Nash equilibria.  
B. In the mixed-strategy Nash equilibrium, all players get less than 1.  
C. If player 1 moves first, (2, 1) can be the Nash equilibrium payoff.  
D. If player 2 moves first, (2, 1) cannot be a Nash equilibrium payoff.

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10. Regarding the “tragedy of the commons,” which statement is incorrect?
- Rivalry in the use of the resource is the main cause of the problem.
  - It is an example of the prisoner’s dilemma.
  - Limiting access to the common resource can alleviate the problem.
  - The government may use a cap-and-trade policy to address the problem.
11. In the base year, consumers buy mostly beef. In the current year, beef prices rise sharply, so consumers switch to chicken (which did not rise in price). Assume the CPI is calculated using a fixed basket, while GDP deflator uses current quantities. Which statement is MOST likely true?
- CPI and GDP deflator both overstate inflation equally.
  - CPI overstates inflation more than GDP deflator.
  - GDP deflator overstates inflation more than CPI.
  - Both CPI and GDP deflator correctly measure inflation.
12. A country imports most of its consumer electronics. Due to a global chip shortage, import prices of electronics rise by 30%, while domestically produced goods barely change in price. No major change occurs in quantities produced. What happens?
- CPI rises significantly; GDP deflator rises little.
  - GDP deflator rises significantly; CPI rises little.
  - Both rise significantly.
  - Neither rises significantly.
13. In the simple Keynesian cross model with exogenous investment, the government requires households to deposit part of their income into restricted mutual-fund accounts for their children, and these funds are not used to finance any current domestic physical investment (they are held purely as financial assets for future use). What happens to current output?
- Current output rises because higher saving leads to higher investment.
  - Current output falls because consumption decreases and investment is exogenous.
  - Current output does not change because only government spending matters.
  - Current output rises because mutual-fund purchases count as investment in GDP.
14. U.S. inflation this year is 5%, and Taiwan’s inflation is 2%. Assume relative PPP holds, so the real exchange rate remains constant. What should happen to the nominal exchange rate? Let the exchange rate be quoted as NT dollars per U.S. dollar (NTD/USD).
- NTD/USD should rise by about 3%.
  - NTD/USD should fall by about 3%.
  - NTD/USD should not change.
  - The direction cannot be determined.

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15. Consider a small open economy with free capital mobility and a floating exchange rate. If the government increases its budget deficit (holding everything else constant), what is the most likely effect on the interest rate, net capital flows, and the real exchange rate?

- A. Domestic interest rate rises; capital inflow increases; domestic currency appreciates.
- B. Domestic interest rate rises; capital outflow increases; domestic currency depreciates.
- C. Domestic interest rate remains unchanged; capital inflow increases; domestic currency appreciates.
- D. Domestic interest rate remains unchanged; capital outflow increases; domestic currency depreciates.

16. Which of the following definitions is correct?

- A. Labor force = number of employed.
- B. Labor force = population - number of unemployed.
- C. Unemployment Rate = (number of unemployed ÷ adult population) × 100.
- D. Unemployment Rate = (number of unemployed ÷ [number of employed + number of unemployed]) × 100.

17. People will want to hold more money if the price level

- A. or the interest rate increases.
- B. or the interest rate decreases.
- C. increases or the interest rate decreases.
- D. decreases or the interest rate increases.

18. The Fisher equation states the long-run relationship between nominal interest rate, real interest rate, and the inflation rate. Suppose that the Fisher equation holds and that monetary policy is neutral in the sense that it has no impact on the real interest rate in the long run. Then given that the real interest rate is fixed over time, if the central bank increases the nominal interest rate target, how will the inflation rate respond in the long run?

- A. Increase
- B. Decrease
- C. Unchanged
- D. Uncertain

19. An increase in expected inflation shifts

- A. the long-run Phillips curve right.
- B. the short-run Phillips curve right.
- C. neither the short-run nor long-run Phillips curve right.
- D. both the short-run and long-run Phillips curve right.

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20. If the Fed conducts open-market operations and sells short-term government bonds, the money supply

- A. increases and aggregate demand shifts right.
- B. increases and aggregate demand shifts left.
- C. decreases and aggregate demand shifts right.
- D. decreases and aggregate demand shifts left.

## II. Problems and Short-essay Questions

1. Suppose that the inverse demand function is  $p = 10 - Q$  and the inverse supply function is  $p = 1 + 2Q$ .

- a. (8 points) Calculate the incidence of a specific tax of \$1 per unit falling on consumers.
- b. (8 points) What are the corresponding price elasticities of demand and supply in the pre-tax equilibrium?
- c. (4 points) Now suppose that the inverse demand function is given by  $p = 10 - bQ$  and the inverse supply function is  $p = 1 + dQ$ . Calculate the incidence of a specific tax of \$1 per unit falling on consumers as a function of  $b$  and  $d$ .

2. A monopolist firm has two identical factories, 1 and 2. Each factory has cost  $q_i^2$ , where  $q_i$  stands for factory  $i$ 's output,  $i = 1, 2$ . If a factory produces any positive output, the firm must pay a fixed tax of \$2 for that factory. Let total output be  $Q = q_1 + q_2$ .

- a. (10 points) What is the cost function of the firm?
- b. (10 points) Suppose the firm can identify two isolated markets,  $A$  and  $B$ , with demand functions

$$P_A = 5 - Q_A,$$

$$P_B = 5 - \frac{1}{2}Q_B.$$

Please calculate the equilibrium price and quantity in each market.

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3. Consider an open economy described by the following equations:

$$Y = C + I + G + NX$$

$$C = 180 + 0.65(Y - T)$$

$$I = 350 - 40r$$

$$G = 200$$

$$T = 150$$

$$NX = 120 - 0.1Y + 15q$$

where  $Y$  is GDP,  $C$  is consumption,  $I$  is investment,  $G$  is government purchases,  $T$  is taxes,  $r$  is the interest rate,  $NX$  is net exports, and  $q$  is the real exchange rate (an increase in  $q$  means a depreciation). Suppose the full-employment level of GDP is  $Y^* = 2000$ .

a. (10 points) Suppose the central bank keeps the interest rate fixed at  $r = 4$  and the real exchange rate is  $q = 1$ . Solve for equilibrium GDP. Is the economy above or below full employment? Please show your calculation.

b. (5 points) Assuming no change in monetary or exchange-rate policy, by how much would GDP have to change to restore full employment? Please show your calculation.

c. (5 points) Instead, suppose fiscal policy does not change. What change in the real exchange rate  $q$  would be required to restore full employment (interpret your result as appreciation or depreciation)? Please show your calculation.

4. Suppose that an economy has the Phillips curve

$$\pi_t = \pi_{t-1} - 0.5(u_t - 0.04)$$

where  $\pi_t$  is the inflation rate at time  $t$  and  $u_t$  is the unemployment rate at time  $t$ .

a. (3 points) What is the natural rate of unemployment? Briefly explain your answer.

b. (7 points) Graph the short-run and long-run relationships between inflation and unemployment implied by this Phillips curve. Clearly label: (i) the horizontal axis, (ii) the vertical axis, and (iii) the point at which the short-run Phillips curve intersects the long-run Phillips curve.

c. (5 points) Compute the sacrifice ratio in this economy. Clearly explain your calculations.

d. (5 points) Suppose the current inflation rate is 10 percent. The central bank aims to reduce inflation to 5 percent. How much cyclical unemployment is necessary to achieve this reduction in inflation? Clearly explain your calculations.

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**Part I. Multiple-Choice Questions (40 points, 4 pts each. Provide answers only, no explanations required.)**

1. You are analyzing a project and have developed the following estimates. The depreciation is \$50,000 a year, and the tax rate is 21 percent. What is the best-case Operating Cash Flow? Please note that taxes can be negative in this question.

	Base-Case	Lower Bound	Upper Bound
Unit sales	12,000	11,000	13,000
Sales price per unit	\$ 33	\$ 31	\$ 35
Variable cost per unit	\$ 37	\$ 36	\$ 38
Fixed costs	\$ 11,000	\$ 10,000	\$ 12,000

- A. -\$35,320  
 B. -\$7,670  
 C. -\$6,090  
 D. \$0  
 E. None of the above
2. Shohei Ohtani signed a 10-year, \$700 million contract with the Los Angeles Dodgers in 2023, setting the record for the largest contract in MLB history. The payments are heavily deferred: the Dodgers will pay \$2 million per year for years 1–10, and \$68 million per year for years 11–20. If Ohtani were instead paid an equal annual amount during years 1–10 only (no deferral) with the same present value, what would that annual amount be? Assume end-of-year payments and an annual discount rate of 4.43%.
- A. \$62 million  
 B. \$51 million  
 C. \$46 million  
 D. \$35 million  
 E. None of the above
3. Pick the following statement that is most likely to be correct.
- A. When an investor adds international stocks to her purely domestic stock portfolio, it will raise her risk.  
 B. A Taiwanese investor looking for effective international diversification should invest about 50% of their money in foreign stocks.  
 C. Home bias refers to the tendency to underweight investments in your home country.  
 D. When applying an international CAPM for a local Taiwanese investor, we should use the U.S. Treasury bill rate as the risk-free rate.  
 E. None of the above.

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4. Select the option that identifies all correct statements below.
- Roll's critique shows that CAPM should include more risk factors.
  - If each firm's environmental score can correctly measure its risk exposure, firms with higher environmental risks should have lower expected returns if we control for other risks.
  - Large firms may be less risky than smaller firms, other things being equal, because they are covered by more analysts, and they are more transparent.
  - A firm enjoys a higher expected return if it is well managed by a capable team, other things being equal.
- i, ii, iii, and iv
  - iii only
  - ii, iii, and iv
  - iii and iv
  - None of the above.
5. Which of the following statements is correct?
- The bond that moves from investment grade to speculative grade is likely to sell for a premium.
  - The current yield tends to understate a bond's total return when the bond sells at a discount because the bond's price will increase each year.
  - A two-year, 9% annual coupon bond with face value of \$1,000 now sells for \$980. You can sell it at the same \$980 a year later if the interest rate stays the same.
  - Convexity is a property investors dislike because bonds gain less in price when yields fall than they gain when yields rise, due to the bond's positive curvature.
  - None of the above.
6. A European call option on a stock with an exercise price of \$75 and an expiration date 1 year from now is worth \$3 today. A European put option on the same stock with the same exercise price and the same expiration date is worth \$2.50 today. The continuously compounded risk-free rate is 8%, and the stock pays no dividends. What is the stock worth today?
- \$69.73
  - \$71.69
  - \$73.12
  - \$77.25
  - None of the above.

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7. Nancy priced both a put and a call on TSLA using an option pricing software. She entered the strike prices of the options, the price of the underlying asset, an estimate of the volatility, an estimate of the risk-free rate, and the time to expiration of the option. She found that both prices calculated by the program were much higher than the observed market values of these two options. Which of the following is the most likely explanation?
- The estimate of the volatility was too high.
  - The estimate of the volatility was too low.
  - The estimate of the risk-free rate was too high.
  - The estimate of the risk-free rate was too low.
  - None of the above.
8. Assume both corporate taxes and financial distress costs apply to a firm. Given this, the static theory (a.k.a. trade-off theory) of capital structure illustrates that:
- A firm receives the greatest benefit from debt financing when its tax rate is relatively low.
  - A firm with a debt-equity ratio of 0.5 or less should issue more debt.
  - The costs of financial distress decrease the value of a firm.
  - The more debt a firm assumes, the greater the incentive to acquire even more debt until such time as the firm is financed with 100 percent debt.
  - At the optimal level of debt, a firm also optimizes its tax shield on debt.
9. Which of the following statements is correct?
- While sensitivity analysis is forward-looking, scenario analysis attempts to analyze the past.
  - The sales level at which the project NPV is zero is called the NPV break-even point.
  - Sensitivity analysis takes into consideration the interrelationships of variables.
  - A project that simply breaks even on an accounting basis recovers the nominal investment amount but does not cover the opportunity cost of the capital tied up in the project.
  - Managers who accept projects that only break even on an accounting basis are helping their shareholders.
10. Which of the following is true?
- The higher the times-interest-earned ratio, the higher the interest expense.
  - The net working capital of a firm will decrease when accrued wages are paid with cash.
  - Other things equal, an increase in accounts receivable will increase a firm's return on assets.
  - A healthy current ratio and an unhealthy quick ratio may be caused by excess inventory.
  - An asset's liquidity measures its proportion of debt financing.

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**Part II. Short-Answer Questions (60 points. Questions requiring answers are highlighted in bold.)**

1. The sustainable growth rate ( $g$ ) is the maximum rate at which a company can grow sales using only internally generated equity (retained earnings) and additional debt, while keeping the debt-equity ratio constant. The formula for  $g$  is  $g = (ROE \cdot b) / (1 - ROE \cdot b)$ .
- A. (5pts) **Show how to derive the formula for  $g$  in detail. State any necessary assumptions or conditions.** You may use (but are not limited to) the following notation:  
 $TE_0$ : total shareholders' equity at the beginning of the period.  
 $TE_1$ : total shareholders' equity at the end of the period.  
 $NI_1$ : net income earned during the period ending at time 1.  
 $b$ : retention ratio (the portion of  $NI_1$  retained in the firm).  
 $ROE$ : return on equity, defined as  $NI_1 / TE_1$  (using end-of-period equity).
- B. (5pts) The formula for the forward P/E ratio:  $P_0 / E_1 = (1 - b) / (R - g)$  is derived by using the Gordon Growth Model,  $P_0 = D_1 / (R - g)$ , and the retention ratio  $b$ .  
**Does this formula imply that a higher retention ratio  $b$  always leads to a lower forward P/E ratio? Explain.**
- C. (5pts) Consider a real-world application. To estimate the fair value of a firm, an analyst first determines the cost of equity. Use the following market data for 2025: the risk-free rate is 4.12%, Nvidia's beta is 2.27, and the market risk premium is 6%. Using Table 1 as needed, **compute Nvidia's cost of equity and discuss why the forward P/E ratio formula does not work for Nvidia in this context.**
- D. (5pts) **Using Table 1, compute Nvidia's theoretical sustainable growth rate  $g$  in 2025 using the formula in the introduction.**  
Nvidia's actual revenue growth was 114.2% in 2025. **Why are the actual and theoretical sustainable growth rates so different?**

Table 1: Nvidia's selected financial figures in USD millions

Item	FY 2024	FY 2025
Total assets	65,728	111,601
Total shareholders' equity	42,978	79,327
Total liabilities	22,750	32,274
Revenue	60,922	130,497
Net income	29,760	72,880
Addition to retained earnings	29,400	72,066

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2. Let  $i_{JPY}$  be the interest rate for the Japanese Yen,  $i_{USD}$  be the interest rate for the U.S. Dollar,  $S_t$  be the current spot exchange rate (JPY/USD),  $F_t$  be the forward exchange rate, and  $S_{t+1}$  be the future spot exchange rate at time  $t+1$ .
- A. (4 pts) The condition of “No Arbitrage” implies that Covered Interest Rate Parity holds. Using this condition, and assuming investors are risk-neutral under the Efficient Market Hypothesis, **show that the forward rate  $F_t$  is an unbiased predictor of the future spot rate ( i.e.,  $F_t = E_t [S_{t+1}]$ ).**
- B. (4 pts) Data as of the end of December 2024: spot rate ( $S_t$ ): 154.00 JPY/USD, 3-month USD interest rate ( $i_{USD}$ ): 5.40% (annualized), 3-month JPY interest rate ( $i_{JPY}$ ): 0.20% (annualized). **Calculate the theoretical 3-month (90-day) forward rate  $F_t$ .**
- C. (4 pts) If the market consensus for the spot rate in 3 months is 150.00, **how does this compare to your calculated  $F_t$ ? What does this discrepancy imply about market expectations or risk premia?**
- D. (4 pts) On March 31, 2025, the actual spot rate reached 151.00. **Calculate the total 3-month return for an investor who engaged in a carry trade (borrowing JPY to buy USD) without hedging.**
- E. (4 pts) By late 2025, the US-Japan interest rate gap narrowed (the USD interest rate dropped to 4.2%, and the JPY interest rate went up to 0.6%), yet the spot rate rose to 157.50 (i.e., a weaker Yen). **Discuss factors that may explain why the JPY weakened despite the narrower yield spread.**
3. Assume the capital market satisfies all standard CAPM assumptions. There is a risk-free asset available with a return of  $R_f = 2\%$ . Investors are analyzing two specific portfolios, Portfolio A and Portfolio B, which lie on the efficient frontier of risky assets. The parameters for these portfolios are as follows:

	Variance ( $\sigma^2$ )	Expected Return $E(R)$
Portfolio A	0.01	8%
Portfolio B	0.04	14%

Covariance: The covariance between Portfolio A and Portfolio B is 0.0025.

- A. (4 pts) Consider a portfolio constructed solely from risky assets A and B. Calculate the **weights for asset A and asset B that minimize the total portfolio variance.**
- B. (4 pts) Assume investors can borrow and lend at the risk-free rate ( $R_f = 2\%$ ). To maximize the Sharpe Ratio, **what are the optimal weights ( $W_A, W_B$ ) for the tangency portfolio?**
- C. (4 pts) Suppose that the assumptions to support this tangency portfolio as the market portfolio all hold. **Calculate the beta coefficients for Portfolio A and Portfolio B.**
- D. (4 pts) Calculate the **market risk premium** and **verify whether the expected returns of A and B satisfy the Security Market Line (SML) equation.**
- E. (4 pts) Suppose there is a third financial asset, asset C, with a beta of 0.9. You estimate its current expected return to be 11%, which is out of equilibrium. Please **describe the market process that will force asset C back to the security market line.**

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**I. Single Choice Questions (40%; 請依序作答)**

Note:  $e^{-1} = 0.3679$ ,  $e^{-2} = 0.1353$ ,  $e^{-3} = 0.0498$ ,  $e^{-4} = 0.0183$ ,  $e^{-5} = 0.0067$

- (4%) In a simple linear regression analysis, both the confidence interval for the mean response and the prediction interval for a new observation become narrower when constructed at values of the explanatory variable that are:
  - Close to the sample mean of the explanatory variable
  - Far from the sample mean of the explanatory variable
  - Close to the sample mean of the response
  - Far from the sample mean of the response
  - None of the above
- (4%) A quality control manager reported that the average processing time for customer requests is 240 seconds. Assume that processing times are normally distributed and the population standard deviation is known to be 40 seconds. If the true average processing time is 260 seconds, which of the following combinations yields the smallest Type II error probability when testing the manager's conclusion with hypotheses  $H_0: \mu = 240$  versus  $H_a: \mu \neq 240$ ?
  - $n = 25$ ,  $\alpha = 0.05$
  - $n = 64$ ,  $\alpha = 0.10$
  - $n = 64$ ,  $\alpha = 0.05$
  - $n = 80$ ,  $\alpha = 0.01$
  - None of the above
- (4%) To test the belief that sons are, on average, more than 5 cm taller than their fathers, a student randomly selects 9 fathers who have adult male children. He records the height of both the father and son, and the summary statistics are as follows. Assume that the distributions of sons' height, father's height, and differences are all normal.

	$n$	Mean	Standard deviation
Father	9	170.5	6.20
Son	9	178.5	7.00
Difference	9	8.000	6.00

(Difference = Son - Father)

Which of the following is the calculated test statistic?

- A. 1.5      B. -1.5      C. 1.28      D. 0.50      E. None of the above

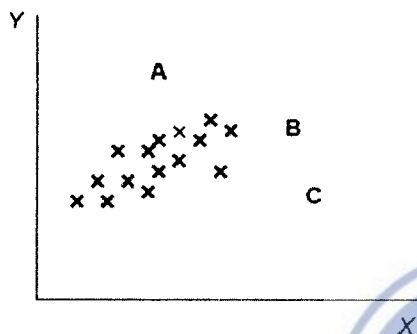
備

註

- 作答於試題上者，不予計分。
- 試題請隨卷繳交。

考 試 科 目	統計學	系 所 別	財務管理學系	考 試 時 間	2 月 6 日 (五) 第 四 節
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4. (4%) The retail price of a specific product (measured in dollars) follows a certain continuous probability distribution commonly used to model nonnegative prices. The only information known about this distribution is that its mean ( $\mu$ ) is equal to its standard deviation ( $\sigma$ ). From the information provided, the shape of the price distribution is most likely:  
A. Negatively skewed    B. Positively skewed    C. Bimodal    D. Symmetric    E. U-Shaped
5. (4%) Consider the three data points marked A, B and C in the plot below. Suppose that we fit a simple linear regression model using all the data in this plot (the points marked A, B, C and +).



- Which of the three data points marked A, B, and C are most influential for estimating the regression slope?  
A. Point A only    B. Point B only    C. Point C only    D. Points B and C    E. All three points
6. (4%) A popular restaurant receives walk-in customers throughout the day. Customers arrive randomly and independently over time. Historical data show that the restaurant receives one customer every four minutes on average. Suppose the restaurant has already waited six minutes with no customer arrival. What is the probability that it will wait more than eight additional minutes?  
A. 0.3679    B. 0.2231    C. 0.0183    D. 0.1353    E. None of the above
7. (4%) (Continuing with Question 6) Approximately how many customers are expected to arrive during a one-hour period?  
A. 4    B. 15    C. 20    D. 60    E. None of the above
8. (4%) A quantitative trading desk evaluates three automated execution strategies. Strategy A is used for half of all executed trades and results in a 90% probability of profit. Strategy B is used for 30% of trades and yields an 80% probability of profit. The remaining trades are executed using Strategy C with a 55% probability of profit. Assume all trades are independent. Suppose the desk executes six independent trades. What is the probability that exactly three trades use Strategy A, two trades use Strategy B, and one trades use Strategy C?  
A. 0.090    B. 0.120    C. 0.135    D. 0.150    E. 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。
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9. (4%) (Continuing with Question 8) A trade is randomly selected and is found to be profitable. What is the probability that the selected profitable trade was executed by Strategy B?  
 A. 0.240      B. 0.320      C. 0.400      D. 0.300      E. None of the above
10. (4%) (Continuing with Question 8) What is the probability that the first unsuccessful (non-profitable) trade occurs on the fourth trade?  
 A. 0.5120      B. 0.0819      C. 0.1280      D. 0.1024      E. 0.4096

**II. General Questions (60%; 請依序作答; 只需寫出答案, 不需計算過程。)**

Note: 相關查表請見附件;  $z_{0.025} = 1.96$ ,  $z_{0.05} = 1.645$ ,  $z_{0.10} = 1.28$ ,  $z_{0.01} = 2.33$ ,  $z_{0.005} = 2.58$

1. (5%) Consider three events  $A$ ,  $B$ , and  $C$ . Suppose that  $P(A) = 0.75$ ,  $P(B|A) = 0.9$ ,  $P(B|A^c) = 0.8$ ,  $P(C|A \cap B) = 0.8$ ,  $P(C|A \cap B^c) = 0.6$ ,  $P(C|A^c \cap B) = 0.7$ , and  $P(C|A^c \cap B^c) = 0.3$ .  
 Find  $P(A \cup B \cup C)$ . \_\_\_\_\_

2. (25%) A retail company conducted a survey based on independent random samples of customers from three store locations (A, B, C). The following data on the level of customer satisfaction were obtained.

Satisfaction	Stores		
	A	B	C
Satisfied	75	120	105
Dissatisfied	25	30	45

- (a) (5%) What is the computed test statistic to validate that the customer satisfaction proportion for store B is better than that for store C? \_\_\_\_\_
- (b) (5%) The company wants to determine whether the store location has a significant influence on the level of customer satisfaction. What is the most appropriate hypothesis test to address this question based on the sampling method described? (Answer with the name of the test) \_\_\_\_\_
- (c) (5%) Compute the test statistic and the range of corresponding p-value for the test identified in part (b).  
 Test statistic : \_\_\_\_\_ Range of p-value : \_\_\_\_\_
- (d) (5%) The company claims that exactly 90% of all customers are satisfied. Let  $X$  be the number of satisfied customers among all surveyed customers. Determine the values of  $X$  for which this claim would be rejected at 0.05 level of significance. \_\_\_\_\_
- (e) (5%) The company wants to conduct a new survey. How many customers should be surveyed if the company wishes to estimate the overall satisfaction proportion correct to within 0.02 with 80% confidence, given that the true proportion is known to be at most 0.85. \_\_\_\_\_

備

註

- 一、作答於試題上者，不予計分。  
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3. (15%) A study is conducted to compare the average monthly cellular phone costs among different cellular phone companies. Monthly costs are recorded under several experimental conditions. For each experimental condition, exactly one observation from each company is observed. The data are analyzed using a randomized block design, and the following partial ANOVA table is obtained.

Source	df	SS	MS	F
Usage level	(1)	189300	(3)	(5)
Company	3	240	80	(6)
Error	6	(2)	(4)	
Total	11	189900		

(a) (4%) Identify the blocking factor and treatment factor. Determine the number of blocks and the number of treatments involved in the design.

Blocking factor : \_\_\_\_\_ Treatment factor : \_\_\_\_\_

Number of blocks : \_\_\_\_\_ Number of treatments : \_\_\_\_\_

(b) (6%) Fill in all missing entries (1)-(6) in the ANOVA table.

(1) = \_\_\_\_\_ (2) = \_\_\_\_\_ (3) = \_\_\_\_\_

(4) = \_\_\_\_\_ (5) = \_\_\_\_\_ (6) = \_\_\_\_\_

(c) (5%) At the 0.05 level of significance, test whether there is sufficient evidence to conclude that the average monthly costs differ among the companies. State the hypotheses, test statistic, rejection rule, and your conclusion. (Hint:  $F_{0.05}(2,6) = 5.14$ ,  $F_{0.05}(3,6) = 4.76$ ,  $F_{0.05}(3,11) = 3.59$ )

Hypotheses : \_\_\_\_\_ Test statistic : \_\_\_\_\_

Rejection rule : \_\_\_\_\_ Conclusion : \_\_\_\_\_

4. (15%) A researcher investigates the relationship between the chest circumference (in inches) of bears and their body weight (in pounds). Suppose that the true regression line between chest size and weight is  $Y = -264.5 + 12.5X + \varepsilon$ , where  $\varepsilon \sim N(0, \sigma^2)$  with  $\sigma = 25$ . Answer the following questions.

(a) (5%) What is the expected change in weight associated with a 3-inch decrease in chest circumference?  
\_\_\_\_\_

(b) (5%) What is the probability that the observed weight of a bear with chest circumference 41 inches exceeds 300 pounds? \_\_\_\_\_

(c) (5%) Suppose that for one bear with chest circumference 41 inches, the observed weight is 280 pounds. If another bear also has chest circumference 41 inches, is its observed weight necessarily equal to 280 pounds? Explain your answer briefly. \_\_\_\_\_

備

註

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附件： $z_{0.025} = 1.96$     $z_{0.05} = 1.645$     $z_{0.10} = 1.28$     $z_{0.01} = 2.33$     $z_{0.005} = 2.58$

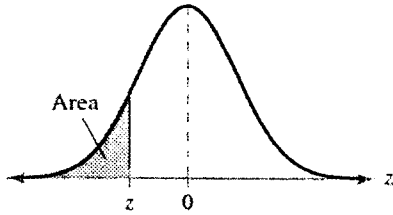


Table 4— Standard Normal Distribution

z	.09	.08	.07	.06	.05	.04	.03	.02	.01	.00
-3.4	.0002	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003
-3.3	.0003	.0004	.0004	.0004	.0004	.0004	.0004	.0005	.0005	.0005
-3.2	.0005	.0005	.0005	.0006	.0006	.0006	.0006	.0006	.0007	.0007
-3.1	.0007	.0007	.0008	.0008	.0008	.0008	.0009	.0009	.0009	.0010
-3.0	.0010	.0010	.0011	.0011	.0011	.0012	.0012	.0013	.0013	.0013
-2.9	.0014	.0014	.0015	.0015	.0016	.0016	.0017	.0018	.0018	.0019
-2.8	.0019	.0020	.0021	.0021	.0022	.0023	.0023	.0024	.0025	.0026
-2.7	.0026	.0027	.0028	.0029	.0030	.0031	.0032	.0033	.0034	.0035
-2.6	.0036	.0037	.0038	.0039	.0040	.0041	.0043	.0044	.0045	.0047
-2.5	.0048	.0049	.0051	.0052	.0054	.0055	.0057	.0059	.0060	.0062
-2.4	.0064	.0066	.0068	.0069	.0071	.0073	.0075	.0078	.0080	.0082
-2.3	.0084	.0087	.0089	.0091	.0094	.0096	.0099	.0102	.0104	.0107
-2.2	.0110	.0113	.0116	.0119	.0122	.0125	.0129	.0132	.0136	.0139
-2.1	.0143	.0146	.0150	.0154	.0158	.0162	.0166	.0170	.0174	.0179
-2.0	.0183	.0188	.0192	.0197	.0202	.0207	.0212	.0217	.0222	.0228
-1.9	.0233	.0239	.0244	.0250	.0256	.0262	.0268	.0274	.0281	.0287
-1.8	.0294	.0301	.0307	.0314	.0322	.0329	.0336	.0344	.0351	.0359
-1.7	.0367	.0375	.0384	.0392	.0401	.0409	.0418	.0427	.0436	.0446
-1.6	.0455	.0465	.0475	.0485	.0495	.0505	.0516	.0526	.0537	.0548
-1.5	.0559	.0571	.0582	.0594	.0606	.0618	.0630	.0643	.0655	.0668
-1.4	.0681	.0694	.0708	.0721	.0735	.0749	.0764	.0778	.0793	.0808
-1.3	.0823	.0838	.0853	.0869	.0885	.0901	.0918	.0934	.0951	.0968
-1.2	.0985	.1003	.1020	.1038	.1056	.1075	.1093	.1112	.1131	.1151
-1.1	.1170	.1190	.1210	.1230	.1251	.1271	.1292	.1314	.1335	.1357
-1.0	.1379	.1401	.1423	.1446	.1469	.1492	.1515	.1539	.1562	.1587
-0.9	.1611	.1635	.1660	.1685	.1711	.1736	.1762	.1788	.1814	.1841
-0.8	.1867	.1894	.1922	.1949	.1977	.2005	.2033	.2061	.2090	.2119
-0.7	.2148	.2177	.2206	.2236	.2266	.2296	.2327	.2358	.2389	.2420
-0.6	.2451	.2483	.2514	.2546	.2578	.2611	.2643	.2676	.2709	.2743
-0.5	.2776	.2810	.2843	.2877	.2912	.2946	.2981	.3015	.3050	.3085
-0.4	.3121	.3156	.3192	.3228	.3264	.3300	.3336	.3372	.3409	.3446
-0.3	.3483	.3520	.3557	.3594	.3632	.3669	.3707	.3745	.3783	.3821
-0.2	.3859	.3897	.3936	.3974	.4013	.4052	.4090	.4129	.4168	.4207
-0.1	.4247	.4286	.4325	.4364	.4404	.4443	.4483	.4522	.4562	.4602
-0.0	.4641	.4681	.4721	.4761	.4801	.4840	.4880	.4920	.4960	.5000

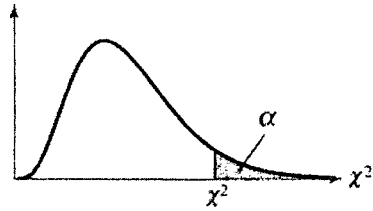
備

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附件：



Right tail

Table 6— Chi-Square Distribution

Degrees of Freedom	Area in Upper Tail									
	.995	.99	.975	.95	.90	.10	.05	.025	.01	.005
1	.000	.000	.001	.004	.016	2.706	3.841	5.024	6.635	7.879
2	.010	.020	.051	.103	.211	4.605	5.991	7.378	9.210	10.597
3	.072	.115	.216	.352	.584	6.251	7.815	9.348	11.345	12.838
4	.207	.297	.484	.711	1.064	7.779	9.488	11.143	13.277	14.860
5	.412	.554	.831	1.145	1.610	9.236	11.070	12.832	15.086	16.750
6	.676	.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.647	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	7.041	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997

備

註

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