考試科目	經濟學	系所別	商學院共同科	考試時間	2月10日(四)第二節

I. Multiple Choice (1 point each)

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

1. Suppose the demand function for a good is expressed as $Q = 200 - 4p$. If the good currently sells for \$30, then the price elasticity of demand equals
   A. -1.
   B. -1.5.
   C. -4.
   D. -6.67.

2. If Andy likes broccoli (B) but hates cabbage (C), which of the following might best represent his utility function for broccoli and cabbage?
   A. $U = B + C$
   B. $U = \min\{B, C\}$
   C. $U = U/C$
   D. $U = B^{0.5}C^{0.5}$

3. As the price of a Giffen good falls, the consumer will
   A. purchase more units.
   B. purchase fewer units.
   C. not change the amount purchased.
   D. There is not enough information to answer this question.

4. What will happen to the equilibrium price of new textbooks if more students attend college, paper becomes more expensive, textbook authors accept lower royalties, and more used textbooks are sold?
   A. Price will rise.
   B. Price will fall.
   C. Price will stay exactly the same.
   D. The price change will be ambiguous.

5. With capital on the vertical axis and labor on the horizontal axis, vertical isoquants imply that
   A. capital and labor are perfect substitutes.
   B. capital and labor must be used together in certain proportion.
   C. capital is not productive.
   D. labor is not productive.

考試科目	經濟學	系所別	商學院共同科	考試時間	2月10日(四)第二節

6. In a monopolistically competitive market, the entry of new firms will lead to the demand curve of an incumbent firm become

A. steeper.

B. flatter.

C. remain the same.

D. none of the above.

7. Which of the following statement is wrong for an oligopolistic market?

A. A firm in the market has a supply curve.

B. The market outcomes could be like a monopoly.

C. When the number of firms in the market getting large, this market will approach to a perfectly competitive market.

D. The owners of firm consider the output effect and the price effect when making production decisions.

8. Which of the following statement is wrong for a perfectly competitive market?

A. Some firms might earn profit in the long run.

B. For a firm, average revenue equals marginal revenue.

C. When the fixed cost is zero, a firm will leave the market when it earns negative profit.

D. The market long-run supply curve is always horizontal at the price.

9. Which of the following statement is wrong?

A. In a perfectly competitive market which all firms have the same cost structure, the firms will produce at the efficient scale in the long run.

B. Under the average cost pricing, a monopoly will not create deadweight losses.

C. A competitive market might not as efficient as a monopoly.

D. Price discrimination might create deadweight losses.

10. Consider the production possibilities frontier of two goods. Which of the following statement is wrong?

A. A slope of the PPF measures the opportunity cost between the two goods that producers face.

B. The production point will not lie to the right of the PPF.

C. The consumption point will not lie to the right of the PPF.

D. The production point and the consumption point could be different points.

考試科目	經濟學	系所別	商學院共同科	考試時間	2月10日(四)第二節

11. After a certain nation changed its policy from one that banned international trade in wheat to one that allowed international trade in wheat, the nation began importing wheat. As a result, total surplus in the wheat market increased by $10 million. Which of the following changes could have occurred as well?

A. The price of wheat in that nation increased with the adoption of the new policy.

B. The domestic quantity of wheat supplied increased with the adoption of the new policy.

C. Consumer surplus in the wheat market increased by $7 million and producer surplus in the wheat market increased by $3 million.

D. Consumer surplus in the wheat market increased by $15 million and producer surplus in the wheat market decreased by $5 million.

12. Which of the following events would be consistent with purchasing-power parity?

A. The price level in the United States rises more rapidly than that in Ireland and the real exchange rate defined as Irish goods per unit of U.S. goods stays the same.

B. The money supply in the United States rises more rapidly than in Egypt and the nominal exchange rate defined as Egyptian pounds per dollar falls.

C. Earl, a worldwide traveler, looks at exchange rates and worldwide breakfast prices one morning and finds that whatever country he decides to go to he can convert $15 into enough local currency to buy the same breakfast.

D. All of the above are correct.

13. According to classical macroeconomic theory, in the long run

A. monetary growth affects both real and nominal variables.

B. the only real variable affected by monetary growth is the unemployment rate.

C. a number of factors that affect unemployment are influenced by monetary growth.

D. monetary growth affects nominal but not real variables.

14. Jennifer took out a fixed-interest-rate loan when the CPI was 100. She expected the CPI to increase to 103 but it actually increased to 105. The real interest rate she paid is

A. higher than she had expected, and the real value of the loan is higher than she had expected.

B. higher than she had expected, and the real value of the loan is lower than she had expected.

C. lower than she had expected, and the real value of the loan is higher than she had expected.

D. lower then she had expected, and the real value of the loan is lower than she had expected.

考試科目	經濟學	系所別	商學院共同科	考試時間	1月10日(四)第二節

15. There is a temporary adverse supply shock. Given the effects of this shock, if the central bank chooses to return unemployment closer to its previous rate it would

A. raise the rate at which it increases the money supply. In the long run this will shift the short-run Phillips curve right.

B. raise the rate at which it increases the money supply. In the long run this will shift the short-run Phillips curve left.

C. reduce the rate at which it increases the money supply. In the long run this will shift the short-run Phillips curve right.

D. reduce the rate at which it increases the money supply. In the long run this will shift the short-run Phillips curve left.

16. Which one of the following will increase the supply of money in the economy, everything else held constant?

A. If the general public in the economy decides to hold more currency in the pockets.

B. If the banking system decides to reduce the holding of excess reserves.

C. The central bank sells bonds to the general public.

D. The central bank sells its foreign currency reserves.

17. Which one of the following is not considered to be "conventional monetary policy tool"?

A. Open market operation.

B. Reserve requirement ratio.

C. Discount rate and lending.

D. Large scale asset purchases.

18. In the December 2021 statement, the FOMC "decided to keep the target range for the federal funds rate at 0 to 1/4 percent." What is the federal funds rate?

A. The interest rate anyone needs to pay to borrow money from the government.

B. The interest rate banks receive by depositing money with the central bank.

C. The interest rate banks pay to borrow money from the central bank.

D. The interest rate banks pay to borrow money from other banks.

19. Since 2014, the ECB has adopted a negative interest rate policy. What is the rate that is negative?

A. The interest rate the ECB pays to banks for depositing money with the ECB.

B. The interest rate that the ECB lends to banks.

考試科目	經濟學	系所別	商學院共同科	考試時間	2月10日(四)第二節

C. The interest rate that the banks lend and borrow from other banks.

D. The rate of Eurodollar.

20. Everything else held constant, which of the following does not cause aggregate demand to increase?

A. An increase in consumer spending.

B. An increase in investment spending.

C. An increase in taxes.

D. An increase in exports.

Ⅱ. Problems and Short-essay Questions

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

1. Suppose that the inverse demand curve for paper is $p = 150 - Q$. Paper is produced with a constant marginal cost of 10. For simplicity, assume that there are no fixed costs. Producing paper creates pollution. Each unit of production generates an external cost of 80 to the residents who live near the paper mill(s).

A. (7 points) What are the equilibrium price, quantity and the associated deadweight loss if paper is produced by perfectly competitive firms?

B. (7 points) What are the equilibrium price, quantity and the associated deadweight loss if paper is produced by a monopoly?

C. (6 points) Suppose the residents can costlessly negotiate with the monopoly. What is the equilibrium quantity of paper produced? What is the minimum monetary transfer from the residents to the monopoly that can achieve the social optimum?

2. Assume Taiwan is a small country and imports pork under free trade. The demand and supply are all linear. The consumers of Taiwan consume 1 million kilograms of pork per year. 400,000 of those are produced domestically and 600,000 are imported.

A. (10 points) Assume due to some reasons, the international price of pork falls by 100 dollars per kilogram. The consumers now consume 1.2 million kilograms of pork per year. 1 million of them are imported. Please calculate the welfare gain and the change of the producer surplus of the economy of Taiwan.

B. (10 points) If the government sets up a quota that only allows 400,000 kilograms of pork to be imported. After this policy, the price of pork in Taiwan rises by 150 dollars. Please calculate the deadweight loss for this policy.

考試科目	經濟學	系所別	商學院共同科	考試時間	2月10日(四)第二節

3. Suppose Taiwan makes a decision to tax the import of agricultural products from abroad, but it does not decreases taxes or increases any other government spending to offset this tax revenues. Using diagrams and words, show and explain what happens to

A. (12 points) national saving, domestic investment, net capital outflow and the interest rate;

B. (4 points) the exchange rate; and

C. (4 points) the amount of exports, imports and trade balance.

4. (20 points) Please explain, in words, why did the relationship of the Phillips curve exist in the past, and then why did the relationship disappear when the government tried to use it to boost the economy?

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。

國立政治大學 111 學年度 碩士暨碩士在職專班 招生考試試題

考試科目	財務管理	系所別	金融學系金融管理組	考試時間	2 月 10 日(四) 第三節

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

1. Asset's liquidity
2. The acid-test ratio
3. The IRR
4. Sensitivity analysis
5. Defensive stocks
6. MM's proposition II

II. Computational Questions (25 points, 5 points for each)

1. Johnson's Nursery has net income of $42,500, depreciation expense of $1,800, interest expense of $900, taxes of $1,600, additions to net working capital of $2,300, and capital expenditures of $11,700. What is the amount of the free cash flow?
2. XYZ Corp. has an operating profit margin of 7%, a debt burden of .8, and has financed two-thirds of its assets through equity. What asset turnover ratio is necessary to achieve an ROE of 18%?
3. Suppose that the total value of dividends to be paid by companies in the Narnian stock market index is $100 billion. Investors expect dividends to grow over the long term by 5% annually, and they require a 10% return. Now a collapse in the economy leads investors to revise their growth estimate down to 4%. By how much should market values change?
4. Suzi owns 100 shares of AB stock. She expects to receive a $238 in dividends next year. Investors expect the stock to sell for $46 a share one year from now. What is the intrinsic value of this stock if the dividend payout ratio is 40% and the discount rate is 13.5%?
5. What is the expected rate of return to equity holders if the firm has a tax rate of 21%, the interest rate on debt is 10%, WACC is 15%, and the debt-asset ratio is 60%?

III. Short answer questions (10 points)

1. What does the existence of an upward-sloping yield curve suggest?
2. What is the purpose of a floating-rate bond?

國立政治大學 111 學年度 碩士暨碩士在職專班 招生考試試題

考試科目	財務管理	系所別	金融學系金融管理組	考試時間	2 月 10 日（四）第三節

IV. Questions (41 points)

1. Archmedes Levers is financed by a mixture of debt and equity. There are no taxes. You have the following information about its cost of capital:

$r_E = (a)$; $r_D = 12\%$; $r_A = (b)$;

$\beta_E = 1.5$; $\beta_D = (c)$; $\beta_A = (d)$;

$r_f = 10\%$; $r_m = 18\%$; $D/E = 0.5$.

Can you fill in blanks (a) to (d)? (6 points for each)

2. Suppose that the S&P 500, with a beta of 1.0, has an expected return of 10% and T-bills provide a risk-free return of 4%.
   (a) How would you construct a portfolio from those two assets with an expected return of 8%? Specifically, what will be the weights in the S&P 500 versus T-bills? (6 points)
   (b) How would you construct a portfolio from these two assets with a beta 0.4? (6 points)
   (c) Find the risk premiums of the portfolios in parts (a) and (b), and show that they are proportional to their betas. (5 points)

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	金融學系金融管理組	考試時間	2月10日(四) 第4節

Short Answer Questions

Mark the blank number and write your answer on the answer sheet. Do NOT provide any details. Each blank worths 5 points.

- The price setting decision in an economy follows geometric distribution and is independent over time periods. If the probability that a firm can update its price in one period is $1-\theta$, the average duration of the price is __(1)__ periods, and the probability that the price sustains more than three periods is __(2)__.

- Consider two random variables X, Y and one nonrandom variable $Z > 0$ such that $E(XY) = 1$ and $E(XZ) = 1$. If $Var(X) = \sigma_X^2$, $Var(Y) = \sigma_Y^2$, and the linear correlation of X and Y is ρ_{XY}, then $E(Y) =$ __(3)__, and the upper bound of $E(Y) - Z$ is __(4)__.

- Consider a random sample of size 100 drawn from the population with mean μ_X and the sample standard deviation is 2. If a test is $H_0 : \mu_X \leq 5$ against $H_1 : \mu_X > 5$ and the significance level is 5%, the decision rule of this test is __(5)__. If the true population mean is $\mu_X = 5.6$, the type-II error rate of this test is $\Pr(Z \leq q)$ where $q =$ __(6)__.

- Let *lghe* be log of hourly earnings, *female* = 1 if the person is female, *educ* be years of education, and *edufe* = *educ* × *female*. The regression results based on 200 observations of *lghe* on other variables are listed below with standard errors in parentheses. Each regression includes the intercept but its value is not reported.

	I	II	III
female	−0.166	−0.203	−0.187
	(0.054)	(0.048)	(0.089)
educ		0.102	0.090
		(0.010)	(0.013)
edufe			0.034
			(0.021)
R^2	0.019	0.202	0.207

Based on model III, the average ratio of female earnings to male earnings given twelve years of education is __(7)__, and the test statistic for the overall significance of *educ* is

考試科目	統計學A	系所別	金融學系金融管理組	考試時間	2月10日(四) 第4節

(8) (distribution and value). To test whether the sum of coefficients on *educ* and *edufe* equals 0.1 by a t-test, the regression model has to be specified as (9). On the other hand, one can infer that the regression coefficient of *educ* on *female* is (10).

- Consider a liner model $Y_i = \beta_0 + \beta_1 X_i + u_i$, $i = 1, 2, ..., n$ and $E(u_i|X_i) = 0$. However, X_i can only be observed by $\widetilde{X}_i$ where $\widetilde{X}_i = X_i + w_i$, $Cov(X_i, w_i) = 0$ and $Cov(u_i, w_i) = 0$. In the regression of $Y_i = \beta_0 + \beta_1 \widetilde{X}_i + e_i$, one can derive that $Cov\left(\widetilde{X}_i, e_i\right)$ is (11). What is the implication of this result for estimating β_1 by least square? (12).

- Consider a liner model $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k + u$ where u is the error term and Y is either zero or one. If $\Pr(Y = 1|X) = p$, then $Var(Y|X) =$ (13). What is the implication of this result for the statistical inference on β_j, $j = 1, 2, ..., k$? (14)

- Consider a random sample (X_i, u_i), $i = 1, 2, ..., n$. If $\overline{X} = (1/n)\sum_{i=1}^{n} X_i$, $E(X) = \mu_X$, and $Var(X) = \sigma_X^2$, then $(1/n)\sum_{i=1}^{n}(X_i - \overline{X})^2 \xrightarrow{p}$ (15). If $E(u_i|X_i) = 0$ and $Var(u_i|X_i) < \infty$, then $\sqrt{n}(1/n)\sum_{i=1}^{n}(X_i - \overline{X})u_i \xrightarrow{d} N(0, V)$ where $V =$ (16).

- The table below reports the performance of a model in predicting economic recessions.

	Model Yes	Model No
Actual Yes	10	30
Actual No	10	150

The accuracy rate of this model is (17), and the coordinate of this result on the ROC curve is (18).

- Consider a time series model $Y_t = \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \epsilon_t$ where ϵ_t is white noise with mean zero and variance σ_ϵ^2. What does it mean if $\phi_1 + \phi_2 = 1$? (19) What is the necessary step before doing the usual statistical analysis for this time series if $\phi_1 + \phi_2 = 1$? (20)

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。

國立政治大學 111 學年度 碩士班 招生考試試題

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 10 日（四）第三節

1. (30%) Brownian Motion

Consider a Brownian motion process $\{B(t), t \geq 0\}, B(0) = 0$ and $B(t)$ is normal with mean 0 and variance t, and $\{B(t), t \geq 0\}$ has stationary and independent increments, where $B(t_1)$, $B(t_2) - B(t_1) \ldots B(t_n) - B(t_{n-1})$ for $t_1 < \cdots < t_n$ are independent and $B(t_k) - B(t_{k-1})$ is normal with mean 0 and variance $t_k - t_{k-1}$.

(1) Please give the joint probability density function of $B(t_1)$, $B(t_2)\ldots, B(t_n)$ for $t_1 < \cdots < t_n$. (5%)

(2) Please find the covariance of $B(s)$ and $B(t)$, $Cov(B(s), B(t))$ for $s < t$. (5%)

(3) Please find the conditional distribution of $B(t)$ given $B(s) = C$, and calculate its conditional mean $\mathbb{E}(B(t)|B(s) = C)$ and conditional variance $Var(B(t)|B(s) = C)$ for $s < t$. (10%)

(4) Please find the conditional distribution of $B(t)$ given $B(s) = C$, and calculate its conditional mean $\mathbb{E}(B(t)|B(s) = C)$ and conditional variance $Var(B(t)|B(s) = C)$ for $t < s$. (10%)

2. (15%) Martingale

A martingale is a random process $X(T)$ satisfied $\mathbb{E}(|X(T)|) < \infty$ and $\mathbb{E}(X(T)|\mathcal{F}_t) = X(t)$ for $T > t$, where $\mathcal{F}_t$ is the filtration at time t.

(1) Please show that $\{Y(t), t \geq 0\}$ is a martingale where $Y(t) = B^2(t) - t$. (Hint: find $\mathbb{E}(Y(T)|\mathcal{F}_t, t < T)$). (5%)

(2) Suppose that we want to use Monte Carlo method to get the price of two-assets rainbow options, so we need to generate two Brownian motion processes $B_1(t)$ and $B_2(t)$ for $t \geq 0$, where they are correlated with correlation ρt, $\begin{pmatrix} B_1(t) \\ B_1(t) \end{pmatrix} \sim MN(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} t & \rho t \\ \rho t & t \end{pmatrix})$. Assume $Z_1(t)$ and $Z_2(t)$ are independent and identically distributed normal with mean 0 and variance t, $Z_i(t) \overset{i.i.d.}{\longrightarrow} N(0, t), i = 1,2$. Please describe in detail how to convert two independent random variables $Z_1(t)$, $Z_2(t)$ into two correlated two random variables $B_1(t)$, $B_2(t)$. (10%)

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 10日(四)第三節

3. (55%) Ito's Lemma and Black-Scholes Pricing Formula

Let $B(t)$ be a Brownian motion and $X(t)$ be an Ito drift-diffusion process which satisfies the stochastic differential equation:

$$dX(t) = \mu(X(t), t)dt + \sigma(X(t), t)dB(t)$$

where $\mu(X(t), t)$ and $\sigma(X(t), t)$ are the drift term and diffusion term, respectively.

If $f(t, X(t))$ is twice-differentiable function, then the function f follows the process

$$df = \left(\frac{\partial f}{\partial t} + \frac{\partial f}{\partial X(t)}\mu(X(t), t) + \frac{1}{2}\frac{\partial^2 f}{\partial X^2(t)}\sigma^2(X(t), t)\right)dt + \frac{\partial f}{\partial X(t)}\sigma(X(t), t)dB(t).$$

(1). Do you think what is the advantage of Ito's Lemma for the finance and mathematics? (5%)

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

$$dS_t = \mu S_t dt + \sigma S_t dB_t^{\mathcal{P}}$$

where dS_t denotes the stock price change at instantaneous time, μ presents the expected return of the stock at instantaneous time, σ means the volatility of the stock return, and $dB_t^{\mathcal{P}}$ is the change of the Brownian motion at instantaneous time under $\mathcal{P}$.

Please use Ito's lemma and show that the solution of the stochastic differential equation is

$$S_T = S_0 e^{(\mu - 0.5\sigma^2)T + \sigma\Delta B_T^{\mathcal{P}}}$$

(10%)

(3) According to the above results, we know that the stock price S_T is said to have a lognormal distribution. Please find the probability density function, the mean and the variance of the stock price S_T under $\mathcal{P}$. (10%)

(4). Please explain the difference between implied volatility and history volatility to calibration the variance of the return for the stock? (10%)?

(5) Please derive the Black-Scholes pricing formula (as you know method) at time 0 for European call option with the strike K, the maturity T, and the risk-free interest rate r. (10%)

(6) Please show that $\frac{\partial C_0}{\partial S_0} = N(d_1)$ and $\frac{\partial C_0}{\partial \sigma} = S_0\sqrt{T}\, n(d_1)$, where $n(\cdot)$ is the standard normal probability density function, $N(\cdot)$ is the standard normal cumulative density function, and $d_1 = \frac{\ln\left(\frac{S_0}{K}\right) + (r + \frac{1}{2}\sigma^2)T}{\sigma\sqrt{T}}$. (10%)

備註	一、作答於試題上者，不予計分。 三、試題請隨卷繳交。