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• **Note: This exam has 6 questions and the full score is 100 points. Write your answers and necessary supporting details on the answer sheet.**

1. Suppose that a lightbulb manufacturing plant produces bulbs with a mean life of 2000 hours and a standard deviation of 400 hours. An investor claims to have developed an improved process that produces bulbs with a longer mean life and the same standard deviation. The plant manager randomly selects 100 bulbs produced by the process. The manager says that she will believe the inventor's claim if the sample mean life of the bulbs is greater than 2100 hours; otherwise, she will conclude that the new process is no better than the old one. Let  $\mu$  denote the mean of the new process. Consider the null and alternative hypothesis  $H_0 : \mu = 2000$  versus  $H_1 : \mu > 2000$ . (Note: You can find a table of cumulative standard normal distribution on the last page.)

- (5%) What is the size of the plant manager's testing procedure?
- (5%) Suppose that the new process is in fact better and has a mean bulb life of 2160 hours. What is the power of the plant manager's testing procedure?
- (5%) What testing procedure should the plant manager use if she wants the size of her test to be 5%?

2. Let the joint probability density function (pdf) of two random variables be:

$$f(x, y) = \frac{1}{2\pi} \exp \left[ -\frac{1}{2} (x^2 + y^2) \right] \left\{ 1 + xy \exp \left[ -\frac{1}{2} (x^2 + y^2 - 2) \right] \right\},$$

where  $-\infty < x < \infty$ ,  $-\infty < y < \infty$ .

- (10%) Find the marginal pdf of  $x$  and  $y$ , respectively.
- (5%) "If each marginal pdf is normal, then the joint pdf must be bivariate normal." Comment on this statement based on your results in (a) and the given form of  $f(x, y)$ .

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3. Researchers are interested in the relationship between a mother's education and the birthweight of her child. They have collected a sample of data on birthweight (measured in grams) and education (years of schooling). Below are some descriptive statistics of the data. Use the given information to answer the following questions.

Mean of Birthweight	3200
Standard Deviation of Birthweight	200
Mean of Education	12
Variance of Education	4
Covariance of Birthweight and Education	160
Number of Observations	26

- (a) (5%) Consider the population model  $y_i = \beta_0 + \beta_1 x_i + u_i$  where  $y$  is birthweight and  $x$  is education. Find the least square estimates  $\hat{\beta}_0$  and  $\hat{\beta}_1$ , respectively.
- (b) (5%) Interpret your estimated coefficient  $\hat{\beta}_1$  in words.
- (c) (5%) Calculate the  $R^2$  of this regression.
- (d) (10%) Calculate the standard error of  $\hat{\beta}_1$ .

4. Let  $x_1, x_2, \dots, x_n$  be a random sample from the probability distribution  $f(x) = e^{-(x-\theta)}$ ,  $\theta \leq x < \infty$ ,  $-\infty < \theta < \infty$ .

- (a) (10%) Find the estimator  $\hat{\theta}_{MM}$  for  $\theta$  by the method of moments.
- (b) (5%) Is  $\hat{\theta}_{MM}$  consistent? Prove your answer.

5. Consider a linear model  $y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + u_i$ ,  $i = 1, 2, \dots, n$ .

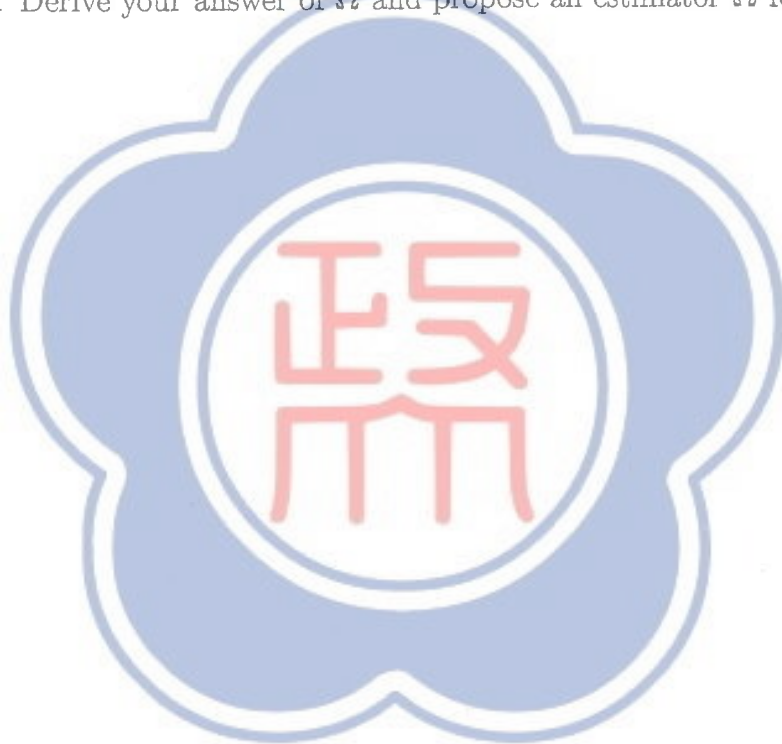
- (a) (5%) Transform the above model so that you can use a t-statistic to test the hypothesis  $\beta_1 + \beta_2 = 1$ .
- (b) (10%) Suppose that data on  $x_{2i}$  are not available and the model is estimated without  $x_{2i}$ . In addition, suppose that  $x_{1i}$  and  $x_{2i}$  are uncorrelated. Is the usual ordinary least square (OLS) estimator  $\hat{\beta}_1$  consistent? Prove your answer.

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6. Consider the random variable  $y$  with density  $f(y) = \lambda \exp(-\lambda y)$ , where  $y > 0$ ,  $\lambda > 0$ . Assume that the parameter  $\lambda$  depends on regressors according to  $\lambda_i = \exp(\mathbf{x}_i' \boldsymbol{\beta})$ , where  $\mathbf{x}_i$  and  $\boldsymbol{\beta}$  are  $k \times 1$  vectors. Here  $y_i | \mathbf{x}_i$  is i.i.d. with the preceding density, and this parameterization implies that  $E(y_i | \mathbf{x}_i) = \exp(-\mathbf{x}_i' \boldsymbol{\beta})$ . By definition, the maximum likelihood estimator (MLE) for  $\boldsymbol{\beta}$  maximizes an objective function  $Q_n(\boldsymbol{\beta})$ .

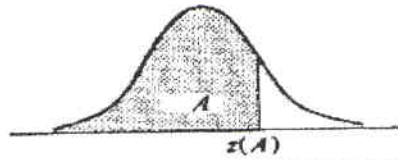
(a) (5%) Write down this objective function  $Q_n(\boldsymbol{\beta})$ .

(b) (10%) It can be shown that  $\sqrt{n}(\hat{\boldsymbol{\beta}}_{MLE} - \boldsymbol{\beta}) \xrightarrow{d} N(0, \boldsymbol{\Omega})$ , where  $\hat{\boldsymbol{\beta}}_{MLE}$  denotes the MLE for  $\boldsymbol{\beta}$ . Derive your answer of  $\boldsymbol{\Omega}$  and propose an estimator  $\hat{\boldsymbol{\Omega}}$  for  $\boldsymbol{\Omega}$ .



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Entry is area A under the standard normal curve from  $-\infty$  to  $z(A)$



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

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**Multiple Choice (1.7 points each)** 選擇題請在答案卡上作答，否則不予計分。  
**Identify the letter of the choice that best completes the statement or answers the question.**  
**Mark each answer clearly with a No. 2 pencil on the Scantron form.**

1. When a firm is operating at efficient scale, average total cost will
  - (a) fall as output is increased.
  - (b) fall as output is decreased.
  - (c) be at its maximum.
  - (d) none of the above.
  
2. If marginal cost exceeds marginal revenue, then
  - (a) the firm must be experiencing losses.
  - (b) the firm may still be earning a profit.
  - (c) the firm is most likely to be at a profit maximizing level of output.
  - (d) a profit maximizing firm should increase the level of production.
  
3. When a competitive market that is comprised of firms that have identical cost structures experiences a sudden yet persistent increase in demand, which of the following are most likely to happen?
  - (i) New firms will enter the market.
  - (ii) In the long-run all firms will be producing at their efficient scale.
  - (iii) The price will return to the level before the changes in demand in the long-run.
  - (a) (i) and (ii) only
  - (b) (i) and (iii) only
  - (c) (ii) and (iii) only
  - (d) (i), (ii) and (iii)
  
4. Excessive monopoly profits themselves represent
  - (a) a deadweight loss.
  - (b) a shrinkage in total surplus.
  - (c) a shrinkage in consumer surplus.
  - (d) all of the above.
  
5. Since natural monopolies have a declining average cost curve, regulating a natural monopoly by setting price equal to marginal cost would

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- (a) cause the monopolist to operate at a loss.  
 (b) maximize producer surplus.  
 (c) result in a less than optimal total surplus.  
 (d) achieve the optimal output level as in the competitive market in the long-run.
6. Consider the Chamberlin's monopolistic competition model. In the short-run equilibrium, the price of a firm must  
 (a) equal to the marginal cost  
 (b) equal to the marginal cost times the markup and be smaller than the average cost.  
 (c) equal to the marginal cost times the markup and be greater or equal to the average cost.  
 (d) be smaller than the marginal cost.
7. Suppose there are only two firms supplying in the market and they produce a homogeneous good. Two firms produce the good with the same constant marginal cost. There is no other cost of production. Firms compete by setting price simultaneously. Consumers maximize their utilities. The equilibrium price of both firms must  
 (a) equal to the marginal cost times the markup.  
 (b) equal to the marginal cost  
 (c) be greater than the marginal cost but smaller than the marginal cost times the markup.  
 (d) equal to the average cost.
8. Everything is the same as previous question, but one firm (firm A) has higher marginal cost than the other (firm B.) The equilibrium price must  
 (a) equal to the marginal cost of firm A  
 (b) equal to the marginal cost of firm B  
 (c) be slightly below the marginal cost of firm A or equal to the optimal price of firm B as it has the monopoly power.  
 (d) equal to the average cost of firm A.
9. Suppose in a country, there is a sector where producers produce a homogeneous good with an increasing constant marginal cost. There is a negative externality when producing the good. Suppose the country is a small open economy, which means it can import the good with a constant price. Suppose also that it does not have comparative advantage in producing the good and there is no complete specialization under free trade. In the following choices, what is the best policy to resolve the problem of externality?  
 (a) Using an import subsidy.  
 (b) Using a production subsidy.  
 (c) Using a tariff.  
 (d) Using a production tax.

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10. In a Ricardian trade model with two countries and two goods, suppose one country has absolute advantage in producing both goods. Goods are traded freely. The country with lower productivity must produce at least one good because
- (a) both countries enjoy gains from trade.
  - (b) otherwise, the factor market cannot be clear.
  - (c) two countries complete specialize in a sector at equilibrium.
  - (d) both goods are demanded.
11. A simple linear demand function may be stated as  $Q = a - bP + cI$  where  $Q$  is quantity demanded,  $P$  is the product price, and  $I$  is consumer income. To compute an appropriate value for  $c$ , we can use observed values for  $Q$  and  $I$  and then set the estimated income elasticity of demand equal to:
- (a)  $c(I/Q)$
  - (b)  $c(Q/I)$
  - (c)  $-b(I/Q)$
  - (d)  $Q/(cI)$
12. Use the following two statements to answer this question:
- I. If utility is ordinal, a market basket that provides 30 utils provides twice the satisfaction of a market basket that provides 15 utils.
  - II. When economists first studied utility it was believed that utility was cardinal, but it was later discovered that ordinal preferences are sufficient to explain how most individual decisions are made.
- (a) Both I and II are true.
  - (b) I is true, and II is false.
  - (c) I is false, and II is true.
  - (d) Both I and II are false.
13. Which of the following demand functions represents a price elasticity of demand equal to -0.33 and an income elasticity of demand equal to 0.8 at all points along the curve?
- (a)  $Q = 3 - 0.33P + 0.8I$
  - (b)  $Q = 4.5 - 0.33\log(P) + 0.8I$
  - (c)  $\log(Q) = 1.34 - 0.33\log(P) + 0.8I$
  - (d)  $\log(Q) = 2.34 - 0.33 \log(P) + 0.8 \log(I)$
14. Bob views apples and oranges as perfect substitutes in his consumption, and  $MRS = 1$  for all combinations of the two goods in his indifference map. Suppose the price of apples is \$2 per pound, the price of oranges is \$3 per pound, and Bob's budget is \$30 per week. What is Bob's utility maximizing choice between these two

請注意：背面還有試題。

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goods?

- (a) 4 pounds of apples and 6 pounds of oranges
- (b) 5 pounds of apples and 5 pounds of oranges
- (c) 10 pounds of oranges and no apples
- (d) 15 pounds of apples and no oranges

15. Assume that we have a demand curve of the form:

$$\log(Q) = a - b \log(P) + c \log(I),$$

where  $Q$  = quantity,  $P$  = price,  $I$  = income, and  $a$ ,  $b$ , and  $c$  are positive constants. The income and price elasticities for the demand curve represented above are always

- (a) equal to one.
- (b) equal to zero.
- (c) equal (i.e., income elasticity always equals price elasticity).
- (d) constant but not necessarily equal to one **another**.

16. Let  $P$  denote the price of goods in the Taiwan,  $P^W$  denote the price of goods in the foreign country, and  $E$  the exchange rate, measured as the number of units of foreign currency that can be purchased with one NTD.

According to the law of one price,

- (a)  $P = EP^W$ .
- (b)  $P^W = EP$ .
- (c)  $E = P/P^W$ .
- (d)  $P^W = E + P$ .

17. Purchasing-power parity describes the forces that determine

- (a) prices in the short run.
- (b) prices in the long run.
- (c) exchange rates in the short run.
- (d) exchange rates in the long run.

18. If a McDonald's Big Mac cost \$3.06 in the United States and 3.21 euros in the Euro area, then purchasing-power parity implies the nominal exchange rate is how many euros per dollar (approximately)?

- (a) 1.05. If the value is less than this, it costs more dollars to buy a Big Mac in the U.S. than in the Euro area.
- (b) 1.05. If the value is less than this, it costs fewer dollars to buy a Big Mac in the U.S. than in the Euro area.
- (c) .95. If the value is less than this, it costs more dollars to buy a Big Mac in the U.S. than in the Euro area.
- (d) .95. If the value is less than this, it costs fewer dollars to buy a Big Mac in the U.S. than in the Euro area.



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19. Which of the following does the level of real GDP measure?
- (a) total real income
  - (b) productivity
  - (c) the standard of living
  - (d) All of the above are correct.
20. "When workers have a relatively small quantity of capital to use in producing goods and services, giving them an additional unit of capital increases their productivity by a relatively large amount." This statement
- (a) is an assertion that production functions have the property of constant returns to scale.
  - (b) is consistent with the view that capital is subject to diminishing returns.
  - (c) is inconsistent with the view that it is easier for a country to grow fast if it starts out relatively poor.
  - (d) All of the above are correct.
21. If an unemployed person quits looking for work, then, other things the same, the unemployment rate
- (a) decreases and the labor-force participation rate is unaffected.
  - (b) and the labor-force participation rate both decrease.
  - (c) is unaffected and the labor-force participation rate decreases.
  - (d) and the labor-force participation rate are both unaffected.
22. Suppose that efficiency wages become more common in the economy. Economists would predict that this would
- (a) increase the quantity demanded and decrease the quantity supplied of labor, thereby decreasing the natural rate of unemployment.
  - (b) decrease the quantity demanded and increase the quantity supplied of labor, thereby increasing the natural rate of unemployment.
  - (c) increase the quantity demanded and decrease the quantity supplied of labor, thereby increasing the natural rate of unemployment.
  - (d) decrease the quantity demanded and increase the quantity supplied of labor, thereby decreasing the natural rate of unemployment.
23. An increase in the money supply
- (a) and an investment tax credit both cause aggregate demand to shift right.
  - (b) and an investment tax credit both cause aggregate demand to shift left.
  - (c) causes aggregate demand to shift right, while an investment tax credit causes aggregate demand to shift left.

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- (d) causes aggregate demand to shift left, while an investment tax credit causes aggregate demand to shift right.
24. Sticky nominal wages can result in
- (a) lower profits for firms when the price level is lower than expected.
  - (b) a decrease in real wages when the price level is lower than expected.
  - (c) a short-run aggregate-supply curve that is vertical.
  - (d) a long-run aggregate-supply curve that is upward-sloping.
25. Which of the following would cause prices and real GDP to rise in the short run?
- (a) an increase in the expected price level
  - (b) an increase in the money supply
  - (c) a decrease in the capital stock
  - (d) None of the above is correct.
26. Which of the following monetary policy violates Taylor principle?
- (a) The central bank raises the federal funds rate from 1% to 2% when inflation goes from 2% to 2.5%.
  - (b) The central bank raises the federal funds rate from 1% to 2% when output gap goes from 2% to 3%.
  - (c) The central bank raises the federal funds rate from 1% to 2% when inflation goes from 2% to 3%.
  - (d) The central bank raises the federal funds rate from 1% to 2% when output gap goes from 2% to 2.5%.
27. The M1 money multiplier will shrink due to
- (a) smaller excess reserves ratio.
  - (b) smaller currency ratio.
  - (c) greater time deposits ratio.
  - (d) greater required reserves ratio.
28. A higher growth rate of money supply causes
- (a) lower interest rates if liquidity effect is larger than income and expected inflation effects.
  - (b) higher interest rates if liquidity effect is larger than income and expected inflation effects.
  - (c) lower interest rates if liquidity effect is smaller than income and expected inflation effects and the adjustment of expected inflation is slow.
  - (d) lower interest rates if liquidity effect is smaller than income and expected inflation effects and the adjustment of expected inflation is fast.
29. Nowadays, most countries do not adopt monetary targeting since
- (a) the public do not understand how monetary targeting works.
  - (b) the velocity of money is unstable and quite volatile.

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- (c) the relationship of output and money aggregates is weak.  
 (d) inflation and money aggregates have inverse relationship.

30. Which of the following statements is true?

- (a) The conventional Phillips curve has microeconomic foundation.  
 (b) The New Keynesian Phillips curve is merely a statistical relation.  
 (c) The New Keynesian Phillips curve describes how current inflation depends on future expected inflation and unemployment.  
 (d) The New Keynesian Phillips curve describes how current inflation depends on future expected inflation and real marginal cost.

#### Numerical/algebraic problems and short-essay questions

Please answer the following questions IN SEQUENCE. All questions may be answered in EITHER Chinese OR English.

1. A video game producer has costs of \$25,000 per month that are fixed with regard to output. The firm has a flat marginal cost at \$5 per unit of output for output between 1 and 16,000 units. The firm **cannot** produce more than 16,000 units. Information from the market research group indicates that the demand for the video game can be represented by the following  $P = 9.8 - 0.0002Q$ .

- (a) (3 points) What price should be set to maximize profit? How many units of the game are sold? What are the profits of the firm?

The firm has the opportunity to sell in a second market that is separated from the first. For the second market the market research group has estimated the demand relationship to be  $P_2 = 7 - 0.0001Q_2$ .

- (b) (5 points) The firm believes that this second market offers an opportunity for additional profit. Should it sell only units that would not be absorbed in the primary market at the profit-maximizing price or should it divert some units from the primary to the secondary market? What price would you set in each market? What is the profit of the firm?

2. Suppose there is a country producing two goods with the following technology

$$Q_x = L_x$$

$$Q_y = K_y$$

Suppose that the labor supply is fixed at 50 units and the capital supply is fixed at 100 units. Consumers spend

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half of their income on good X and the rest of income on good Y. All markets are perfectly competitive. Let good Y be the numeraire. Answer the following questions

- (a) (3 points) Derive the equilibrium price of X relative to Y.
- (b) (3 points) Suppose there is another country producing two goods with the same technology and consumers in that country also evenly spend their income on both goods. In this country, the supply of labor is fixed at 100 units and the supply of capital is fixed at 50 units. Derive the equilibrium price of X relative to Y if two countries trade freely.
- (c) (3 points) What is the good the capital abundant country exports? How many quantities of that good does it export?
3. Chester lives in a dormitory that offers soft drinks and chips for sale in vending machines. His utility function is  $U = 3SC$  (where S is the number of soft drinks per week and C the number of bags of chips per week), so his marginal utility of S is  $3C$  and his marginal utility of C is  $3S$ . Soft drinks are priced at \$0.50 each, chips \$0.25 per bag.
- (a) (3 points) Write an expression for Chester's marginal rate of substitution between soft drinks and chips.
- (b) (3 points) Use the expression generated in part (a) to determine Chester's optimal mix of soft drinks and chips.
- (c) (2 points) If Chester has \$5.00 per week to spend on chips and soft drinks, how many of each should he purchase per week?
4. To catch up with the living standard of the US,
- (a) (4 points) Can a sufficiently poorer country achieve this goal by simply receiving more capital donated by the United Nation on a per-capita basis? Why or why not?
- (b) (4 points) Can a sufficiently poorer country achieve this goal by simply increase her saving rate? Why or why not?
5. Use the model of aggregate demand and aggregate supply to illustrate each of the following event's short-run and long-run impacts on the aggregate price level and aggregate output.
- (a) (4 points) There is an increase in households' wealth due a stock market boom.
- (b) (4 points) The government lowers taxes, leaving households with more disposable income, with no corresponding reduction in government spending.
6. Consider a model that the central bank may have incentives to deviate from a monetary policy rule. The central bank's objective is to maximize the expected value of

$$U = \lambda(y - y_n) - \frac{1}{2}\pi^2,$$

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where  $y$  is output,  $y_n$  is the economy's natural rate of output,  $\pi$  is inflation rate, and  $\lambda > 0$ . The aggregate output is given by a Lucas-type supply function:

$$y = y_n + a(\pi - \pi^e) + e,$$

where  $\pi^e$  is expected inflation,  $e$  is a supply shock ( $e \sim N(0, \sigma_e^2)$ ), and  $a > 0$ . The link between inflation and the monetary policy instrument is given by

$$\pi = \Delta m + v,$$

where  $\Delta m$  is the growth rate of money and  $v$  is a velocity disturbance ( $v \sim N(0, \sigma_v^2)$ ). We assume that the central bank can observe  $\pi^e$  and the realization of  $e$  but not the realization of  $v$  before its choice of  $\Delta m$ . We also assume that two disturbances  $e$  and  $v$  are uncorrelated.

- (a) (4 points) What is the central bank's optimal choice of  $\Delta m$ ?
- (b) (4 points) Compared to the case that the central bank commits to a rule  $\Delta m = 0$ , which policy makes the society better off (i.e. higher expected utility)? Show all your work.

考試科目	財務管理	所別	金融學系 會計學系	考試時間	2月27日(日)第3節
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I. Explain the following terms briefly (24 points, each 4 points)

- (1) Golden parachute
- (2) Leveraged buyout
- (3) Private placement
- (4) Imputation tax system
- (5) The law of conservation of value
- (6) The leftists' point of view on dividends and taxes

II. Computational problems (36 points, each 6 points)

1. The Granite Paving Co. wishes to have debt-to-equity ratio of 1.5. 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? Assume a tax rate of 30%.

2. Companies A and B are valued as follows:

	A	B
# of shares	2000	1000
Earnings per share	\$10	\$10
Share price	\$100	\$50

Company A now acquires B by offering one (new) share of A for every two shares of B (that is, after the merger, there are 2500 shares of A outstanding). If investors are aware that there are no economic gains from the merger, what is the price-earnings ratio of A's stock after the merger?

3. Bombay Company's balance sheet is as follows:

(NWC = net working capital; LTA = long term assets; D = debt; E = equity; V = firm value):

Book Values				Market Values			
NWC	200	500	D	NWC	200	500	D
LTA	2300	2000	E	LTA	2800	2500	E
	2500	2500	V		3000	3000	V

According to MM's Proposition I corrected for taxes, what will be the change in company value if Bombay issues \$200 of equity and uses it to make a permanent reduction in the company's debt? Assume a 35% tax rate.

4. Learn and Earn Company is financed entirely by common stock that is priced to offer a 20% expected rate of return. The stock price is \$60 and the earnings per share are \$12. If the company repurchases 50% of the stock and substitutes an equal value of debt yielding 8%, what is the expected earnings per share value after refinancing?

5. Given the following information, leverage will add how much value to the unlevered firm per dollar of debt? (Approximately)

Corporate tax rate: 34%

備註 試題隨卷繳交

考試科目	財務管理	所別	金融學 會計學 財務管理	考試時間	2月27日(日)第3節
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Personal tax rate on income from bonds: 30%

Personal tax rate on income from stocks: 20%

6. The DOC Corporation with a book value of \$20 million and a market value of \$30 million has merged with the CIC Corporation with a book value of \$6 million and a market value of \$8 million at a price of \$9 million. If the transaction is a purchase will there be any goodwill; and if so, what is the amount of goodwill?

III. Short answer questions (12 points, each 6 points)

1. Why do firms rely heavily on internal funds?
2. Briefly explain the difference between a spin-off and a carve-out.

IV. Questions (28 points)

1. The following table shows estimates of the risk of two well-known British stocks:

	Standard Deviation %	$R^2$	Beta	Standard Error of Beta
British Petroleum (BP)	.25	.27	.81	.17
British Airways	.57	.37	2.12	.37

- a. What proportion of each stock's risk was market risk and what proportion was unique risk? (4 points)
  - b. What is the variance of BP? What is its unique variance? (4 points)
  - c. What is the confidence level on British Airways beta? (4 points)
  - d. If the CAPM is correct, what is the expected return on British Airways? Assume a risk-free interest rate of 5 percent and an expected market return of 12 percent. (2 points)
  - e. Suppose that next year the market provides a zero return. What return would you expect from British Airways? (2 points)
2. Percival Hygiene has \$10 million invested in long-term corporate bonds. This bond portfolio's expected annual rate of return is 9 percent, and the annual standard deviation is 10 percent.

Amanda Reckonwith, Percival's financial adviser, recommends that Percival consider investing in an index fund which closely tracks the Standard and Poor's 500 index. The index has an expected return of 14 percent, and its standard deviation is 16 percent. (12 points, each 6 points)

- a. Suppose Percival puts all his money in a combination of the index fund and Treasury bills. Can he thereby improve his expected rate of return without changing the risk of his portfolio? The Treasury bill yield is 6 percent.
- b. Could Percival do even better by investing equal amounts in the corporate bond portfolio and the index fund? The correlation between the bond portfolio and the index fund is +.1.

考 試 科 目	統計學 B	所 別	金融學系	考 試 時 間	2 月 27 日 ( 日 ) 第二節
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1. Let  $f(x_1 | x_2) = c_1 x_1 / x_2^2$ ,  $0 < x_1 < x_2$ ,  $0 < x_2 < 1$ , zero, elsewhere, and  $f_2(x_2) = c_2 x_2^4$ ,  $0 < x_2 < 1$ , zero, elsewhere, denote, respectively, the conditional p.d.f. of  $X_1$ , given  $X_2 = x_2$ , and marginal p.d.f. of  $X_2$ . Determine:
- (a). the constants  $c_1$  and  $c_2$ ; (5%)
  - (b). the joint p.d.f. of  $X_1$  and  $X_2$ ; (5%)
  - (c).  $\Pr(\frac{1}{4} < X_1 < \frac{1}{2} | X_2 = \frac{5}{8})$ ; (5%) and
  - (d).  $\Pr(\frac{1}{4} < X_1 < \frac{1}{2})$ . (5%)

2. Let the stochastic process  $X(t)$  be normal with mean 0 and variance  $t$ , where its density function is given by
- $$f_t(x) = \frac{1}{\sqrt{2\pi t}} e^{-x^2/2t},$$

and the stochastic process  $X(t)$  has stationary and independent increments, where  $X(t_1)$ ,  $X(t_2) - X(t_1), \dots, X(t_n) - X(t_{n-1})$  for  $t_1 < \dots < t_n$  are independent and  $X(t_k) - X(t_{k-1})$  is normal with mean 0 and variance  $t_k - t_{k-1}$ . Assume  $X(t_1) = x_1, X(t_2) = x_2, \dots, X(t_n) = x_n$ ,

- (a). Please give the joint density of  $X(t_1), X(t_2), \dots, X(t_n)$ . (5%)
  - (b). Please find the conditional distribution of  $X(s)$  given  $X(t) = B$  where  $s < t$ . (10%)
3. Let  $X$  be a normal distribution with mean  $\mu$  and  $\sigma^2$ , and consider the transformation  $X = \ln Y$  or, equivalently,  $Y = e^X$ .
- (a). Find the mean and the variance of  $Y$ . (5%)
  - (b). Find the p.d.f. of  $Y$ . This is called the lognormal distribution. (5%)

4. Let  $X_1, X_2, \dots, X_n$  be a random sample of known size  $n$  from a gamma distribution with parameter  $\alpha = 1$ , and unknown  $\beta > 0$ . Then

- (a). Please derive the distribution of  $\frac{2 \sum_{i=1}^n X_i}{\beta}$ . (5%)
- (b). Please construct a 95% confidence interval for  $\beta$  by  $\Pr(x_{0.025}(2n) < \chi^2(2n) < x_{0.975}(2n)) = 95\%$ , where  $\chi^2(2n)$  is a Chi-square distribution with  $2n$  degrees of freedom. (5%)

備 註	試 題 隨 卷 繳 交
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請注意：背面還有試題。



考 試 科 目	統計學 B	所 別	金融學系	考 試 時 間	2 月 27 日 ( 日 ) 第二節
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5. In order to test the assumption of a Poisson distribution for the number of arrivals during weekday morning hours, a store employee randomly selects a sample of 100 5-minute intervals during weekday mornings over a 3-week period. For each 5-minute intervals in the sample, the store employee records the number of customer arrivals.
- (a). Suppose the sample is  $x_1, x_2, \dots, x_n$ . Under the assumption of a Poisson distribution for the number of arrivals, please find the estimation for the mean of arrival rate  $\lambda$  by the maximum likelihood estimate method (MLE). (5%)
- (b). Is the estimation of the mean in the arrival rate for MLE unbiased? Please prove it. (5%)
- (c). Is the estimation of the mean in the arrival rate for MLE consistent? Please prove it. (5%)
- (d). In summarizing the data, the employee determines the number of 5-minute interval having no arrivals, the number of 5-minute intervals having two arrivals, and so on. These data are summarized in the table 5. Use  $\alpha$ -level=0.05, and test whether the number of customer arrivals follows a Poisson distribution, where  $\chi^2_{0.05}(4) = 9.49$ ,  $\chi^2_{0.05}(5) = 11.07$ ,  $\chi^2_{0.05}(6) = 12.59$ ,  $\chi^2_{0.05}(7) = 14.06$ . (10%)

Table 5 Data in the number of arrivals

Number of Customers Arriving	Observed Frequency
0	5
1	15
2	21
3	25
4	18
5	10
6	6

6. Suppose you've specified the regression model as  $Y_i = \beta X_i + \varepsilon_i$ , where  $\varepsilon_i, i = 1, \dots, n$ , are independent and  $E(\varepsilon_i) = 0$  for all  $i$ . Please answer the problem as follows,
- (a). If the true model is  $Y_i = \beta X_i + \varepsilon_i$ , please find the estimator  $\hat{\beta}$  of  $\beta$  using OLS estimate (5%), and prove  $\hat{\beta}$  is unbiased. (5%)
- (b). If the true model has a constant term so that  $Y_i = \alpha + \beta X_i + u_i$ , where  $u_i, i = 1, \dots, n$ , are independent and  $E(u_i) = 0$  for all  $i$ , show that  $\hat{\beta}$ , which you use wrong model (the regression model of no constant term) to estimate, is biased (5%). Please give the condition under which  $\hat{\beta}$  will be unbiased even though the wrong model was used. (5%)