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**Multiple Choice (1% each, 20% in total)**

1. The market structure of an industry where firms have to invest a fixed cost before producing goods cannot be perfect competitive because
  - (a) the average cost decreases as production level decreases.
  - (b) the average cost is almost always higher than the marginal cost.
  - (c) the goods each firm produced are not perfectly substitute.
  - (d) firms always earn positive profit.
  
2. Suppose in a country, there is one firm in an industry. Suppose also there is infinite number of firms producing the same good in the rest of world. What is the possible impact on welfare when the country opening up to trade
  - (a) There will be no deadweight loss in the country.
  - (b) The deadweight loss still exists but smaller under trade.
  - (c) The deadweight loss is larger under trade.
  - (d) The producer surplus is larger under trade.
  
3. Suppose there are two countries. In the same industry, each country has only one producer. Producers produce the same good. Two producers have the same cost function and face the same demand function. Suppose there is international trade between two countries and producers choose output to maximize profit. There is also no collusion between firms.
  - (a) Compared with the scenario when there is no trade, the price charged by a firm is lower.
  - (b) Compared with the scenario when there is no trade, the production level of each firm is larger.
  - (c) Compared with the scenario when there is no trade, the deadweight loss is larger.
  - (d) Compared with the scenario when there is no trade, the profit of each firm increases.
  
4. In the industry with monopolistic competition,
  - (a) the price charged by a firm is larger than the average cost.
  - (b) the price charged by a firm is lower than the average cost.
  - (c) the number of producers increases as the aggregate demand increases.
  - (d) the number of producers decreases as the aggregate demand increases.
  
5. In the oligopoly economy with two identical producers producing the same product, when two producers collaborate to maximize aggregate profit
  - (a) The aggregate production level is higher than that when there is only one producer.

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- (b) The aggregate production level is lower than that when there is only one producer.  
 (c) The aggregate production level is the same as that when there is only one producer.  
 (d) The price is lower than that when there is only one producer.
6. Ryan has an income of \$3,000. When the price of good A is \$50 and the price of good B is \$30, he consumes 30 units of good A and 50 units of good B. After the price of good B decreases to \$15, he consumes 30 units of good A and 100 units of good B. We can use the information provided to conclude that
- (a) good A is a normal good.  
 (b) good A is a normal good, and good B is an inferior good.  
 (c) good A is an inferior good, and good B is a normal good.  
 (d) both goods A and B are normal goods.
7. Two drivers -Tom and Jerry- each drive up to a gas station. Before looking at the price, each places an order. Tom says, "I'd like 10 gallons of gas." Jerry says, "I'd like \$10 worth of gas." What is each driver's price elasticity of demand?
- (a) 0, 1.  
 (b) 1, 0  
 (c) 0, infinity.  
 (d) 1, infinity.
8. Suppose buyers of computers and printers regard those two goods as complements. Then an increase in the price of computers will cause
- (a) a decrease in the supply of printers and a decrease in the quantity demanded of printers.  
 (b) a decrease in the demand for printers and a decrease in the quantity supplied of printers.  
 (c) a decrease in the equilibrium price of printers and an increase in the equilibrium quantity of printers.  
 (d) an increase in the equilibrium price of printers and a decrease in the equilibrium quantity of printers.
9. In the market for widgets, the supply curve is the typical upward-sloping straight line, and the demand curve is the typical downward-sloping straight line. The equilibrium quantity in the market for widgets is 200 per month when there is no tax. Then a tax of \$5 per widget is imposed. As a result, the government is able to raise \$750 per month in tax revenue. We can conclude that the equilibrium quantity of widgets has fallen by
- (a) 25 per month.  
 (b) 50 per month.  
 (c) 75 per month.  
 (d) 100 per month.

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10. The total cost to the firm of producing zero units of output is

- (a) zero in both the short run and the long run.
- (b) its fixed cost in both the short run and the long run.
- (c) its fixed cost in the short run and zero in the long run.
- (d) zero in the short run and its fixed cost in the long run.

11. As a result of an open market purchase, bank reserves

- (a) rise and interest rates fall.
- (b) and interest rates both fall.
- (c) and interest rates both rise.
- (d) fall and interest rates rise.

12. Theoretically, one can distinguish a demand-pull inflation from a cost-push inflation by comparing

- (a) how fast prices rise relative to wages.
- (b) when prices rise relative to wages.
- (c) the unemployment rate with its natural rate level.
- (d) government debt to real GDP.

13. If oil prices fall at the same time that the government increases its purchases, in the short run

- (a) aggregate output and the price level will both fall.
- (b) aggregate output will increase, but the price level may either increase or decrease.
- (c) aggregate output and the price level will both increase.
- (d) aggregate output will increase, but the price level will fall.

14. The less interest-sensitive is money demand, the \_\_\_\_\_.

- (a) flatter is the LM curve
- (b) more effective is monetary policy relative to fiscal policy
- (c) steeper is the IS curve
- (d) more effective is fiscal policy relative to monetary policy

15. If currency outstanding equals \$200 million, checkable deposits equal \$1 billion, reserves equal \$150 million, and the required reserve ratio is 0.10, the money multiplier equals

- (a) 3.14.
- (b) 3.43.
- (c) 0.86.

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- (d) 4.
16. The total sales of all firms in the economy for a year
- (a) equals GDP for the year.
  - (b) is larger than GDP for the year.
  - (c) is smaller than GDP for the year.
  - (d) Any of the above is possible.
17. The theory of purchasing-power parity implies that the demand curve for foreign-currency exchange is
- (a) downward sloping.
  - (b) upward sloping.
  - (c) horizontal.
  - (d) vertical.
18. When a country allows trade and becomes an exporter of a good, which of the following is not a consequence?
- (a) The price paid by domestic consumers of the good increases.
  - (b) The price received by domestic producers of the good increases.
  - (c) The losses of domestic consumers of the good exceed the gains of domestic producers of the good.
  - (d) The gains of domestic producers of the good exceed the losses of domestic consumers of the good.
19. Suppose that the adult population is 4 million, the number of unemployed is 0.25 million, and the labor-force participation rate is 75%. What is the unemployment rate?
- (a) 6.25%.
  - (b) 8.3%.
  - (c) 9.1%.
  - (d) 18.75%.
20. If a \$1,000 increase in income leads to a \$750 increase in consumption expenditures, then the marginal propensity to consume is
- (a) 0.75 and the multiplier is  $1 \frac{1}{3}$ .
  - (b) 0.75 and the multiplier is 4.
  - (c) 0.25 and the multiplier is  $1 \frac{1}{3}$ .
  - (d) 0.25 and the multiplier is 4.

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**Problem Solving (80%)**

1. In a monopolistic competitive economy, each producer faces the following demand function

$$Q = \frac{1}{n} - P,$$

where Q is the production level, n is the number of producer and P is the price charged by a firm. Suppose each producer has the following cost function

$$TC = 1 + Q,$$

where TC is the total cost. Solve the production level and price charged by a firm. Please also solve the number of producer at equilibrium (it need not to be an integer.) (20%)

2. There are four industrial firms in Happy Valley.

Firm	Initial Pollution Level	Cost of Reducing Pollution by 1 Unit
A	70 units	\$25
B	80 units	\$20
C	50 units	\$15
D	40 units	\$10

The government wants to reduce pollution to 160 units, so it gives each firm 40 tradable pollution permits.

- (a) Graph the demand and supply curves for tradable pollution permits. (4%)
- (b) Who sells permits and how many do they sell at market equilibrium? Who buys permits and how many do they buy? What is the total cost of pollution reduction in this situation? (11%)
- (c) How much higher would the costs of pollution reduction be if the permits could not be traded? (3%)
- (d) What size of a corrective tax would achieve the goal of reducing pollution to 160 units? (2%)

3. Economist Michael Woodford recently says: "If prices or wages are sticky, monetary policy affects real activity, and so the consequences of an increase in government purchases depend on the monetary policy response."

- (a) Please explain the first part of the above quote, why is that if prices or wages are sticky, monetary policy affects real activity? (10%)
- (b) Please explain the second part of the above quote, what does it mean by "the consequences of an increase in government purchase depend on the monetary policy response"? (10%)

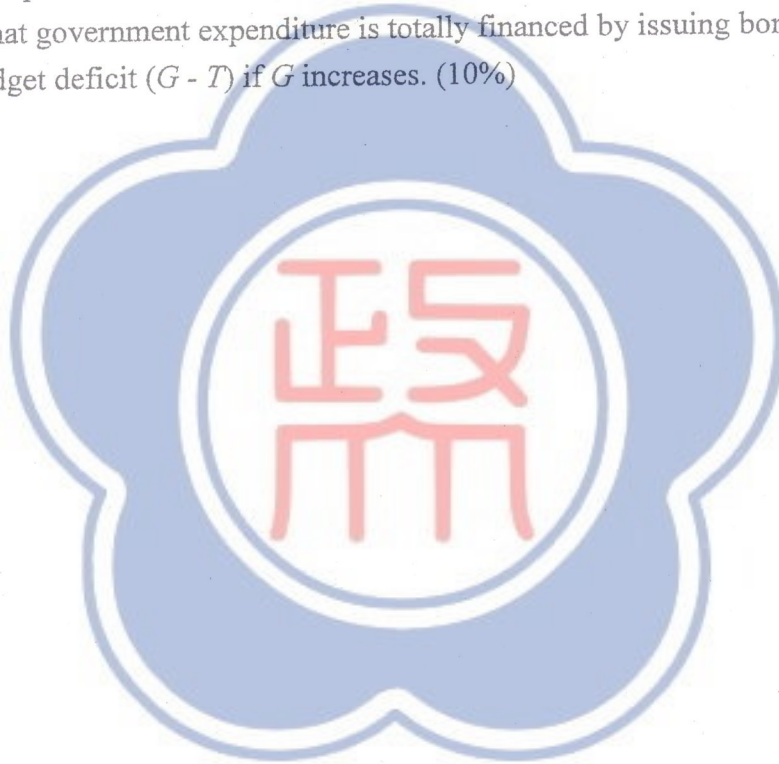
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4. Consider a close economy described by:

$$Y = C + I + G$$

$$C = a + b(Y - T), 0 < b < 1, I = \bar{I}$$

- (a) Compute the output multiplier with respect to government consumption ( $dY/dG$ ), under the assumption that  $G$  is totally financed by raising new lump-sum tax. (10%)
- (b) Now, assume a proportional taxation system, i.e.  $T = t \cdot Y$ , where  $t$  is the average income tax rate. Under the assumption that government expenditure is totally financed by issuing bonds, show what would happen to the budget deficit ( $G - T$ ) if  $G$  increases. (10%)



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1. (10%) You are running a maximum likelihood program to estimate a dynamic stochastic model. Let  $X$  denote the set of endogenous variables and  $\Theta$  be the set of parameters. However, the program always fails to give the solution. To find out the problem, you obtain the following summary of log-likelihood and of one of the parameters  $\psi$ ,  $\psi \in \Theta$ :

$\psi$	-2.55	-0.87	0.63	2.76	5.25
$\ln f(X; \Theta)$	-120.2525	-120.2528	-120.2521	-120.2522	-120.2526

Suppose that you can exclude any possibilities of technical (hardware, software and programming) issues. Explain why maximum likelihood fails in this case and propose a feasible solution to this problem.

2. You are estimating a linear stationary time-series model  $y_t = \beta_0 + \beta_1 x_t + u_t$ ,  $t = 1, 2, \dots, T$ . However, only  $x_t^*$  is observable and  $x_t^* = x_t + w_t$ . Thus the best you can do is to estimate  $y_t = \beta_0 + \beta_1 x_t^* + \epsilon_t$ . Assume that (1)  $u_t$  has mean zero, variance  $\sigma_u^2$  and is uncorrelated with  $x_t$  and  $w_t$ ; (2)  $w_t$  has mean zero, variance  $\sigma_w^2$  and is uncorrelated with  $x_t$ ; (3) each variable is correlated over time but not correlated with past values of other variables.

(a) (10%) Explain why the OLS estimator  $\hat{\beta}_{1,OLS}$  is inconsistent by checking  $Cov(x_t^*, \epsilon_t)$ .

(b) (10%) Consider another estimator  $\hat{\beta}_1$  where

$$\hat{\beta}_1 = \frac{\sum_{t=1}^T (y_t - \bar{y})(x_{t-1}^* - \bar{x}^*)}{\sum_{t=1}^T (x_t^* - \bar{x}^*)(x_{t-1}^* - \bar{x}^*)}$$

Show that  $\text{plim}_{n \rightarrow \infty} \hat{\beta}_1 = \beta_1$ .

3. A river flood warning system records the water mark everyday. Suppose that the low-water mark is set at 1 and the high-water mark  $Y$  has the following distribution function:

$$F(y) = 1 - \frac{1}{y^2}, 1 \leq y < \infty.$$

(a) (10%) Find the mean and standard deviation of the high-water mark.

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(b) (10%) Suppose that the low-water mark is reset at 0 and the unit of measurement is changed to half of the previous one. Let  $Z$  denote the new high-water mark. Find the pdf of  $Z$ , i.e.  $f(z)$ .

4. Let  $R_{t+1}$  be the gross return of holding a risky asset from period  $t$  to  $t + 1$  and  $R_{t+1}^f$  be the risk-free rate. The excess return is defined as  $RP_{t+1} = R_{t+1} - R_{t+1}^f$ . These assets can be priced as follows:

$$E_t(M_{t+1}R_{t+1}) = 1 = E_t(M_{t+1}R_{t+1}^f),$$

where  $M_{t+1}$  is the stochastic discount factor (SDF) and  $E_t$  denotes the expectation operator conditional on time  $t$  information.

(a) (10%) Show that the Sharpe ratio can be expressed as

$$\frac{E_t(RP_{t+1})}{\sigma_t(RP_{t+1})} = -\rho_t(M_{t+1}, R_{t+1}) \frac{\sigma_t(M_{t+1})}{E_t(M_{t+1})},$$

where  $\sigma_t$  denotes the conditional standard deviation operator and  $\rho_t$  is the conditional correlation operator.

(b) (10%) Let  $M_{t+1} = \beta(C_{t+1}/C_t)^{-\gamma}$  where  $C_t$  denotes the aggregate consumption,  $\beta$  and  $\gamma$  are constants. Define  $\Delta c_{t+1} = c_{t+1} - c_t = \ln(C_{t+1}/C_t)$ ,  $m_{t+1} = \ln M_{t+1}$  and  $r_{t+1}^f = \ln R_{t+1}^f$ . The logarithm of consumption growth follows a random-walk process, i.e.  $\Delta c_{t+1} = \mu + \epsilon_{t+1}$ , where  $\epsilon_{t+1} \sim N(0, \sigma^2)$ . Derive the Sharpe ratio when  $\rho_t(M_{t+1}, R_{t+1}) = -1$ .

(c) (10%) Use the asset pricing equation and the settings in (b) to solve for  $r_{t+1}^f$ .

5. Let  $X_1, X_2, \dots, X_n$  be i.i.d. draws from a Poisson distribution with parameter  $\lambda$  and let  $\lambda$  have a Gamma prior with parameters  $\alpha$  and  $\beta$ , i.e.

$$f(x|\lambda) = \frac{\lambda^x e^{-\lambda}}{x!}; \pi(\lambda) = \frac{1}{\Gamma(\alpha)\beta^\alpha} \lambda^{\alpha-1} e^{-\lambda/\beta}.$$

(a) (10%) Let  $Y = \sum_{i=1}^n X_i$ . Derive the posterior distribution of  $\lambda$ , i.e.  $\pi(\lambda|y)$ .

(b) (10%) Show that the posterior mean  $E(\lambda|y)$  converges to the maximum likelihood estimator  $\hat{\lambda}_{MLE}$  as  $n \rightarrow \infty$ .

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I. Explain the following terms briefly (24 %, each 4 %)

- (1) Dividend smoothing.
- (2) MM's Proposition II.
- (3) The pecking order theory.
- (4) Callable bonds.
- (5) WACC.
- (6) SML.

II. Computational Questions (36 %, each 6 %)

1. A firm with 2,000 outstanding shares selling for \$10 each does not have the cash to pay its dividend. In an ideal MM world, how many new shares must be sold and at what price to pay a \$2 dividend per share to old shareholders?
2. What is the expected return on equity for a firm with a 14% expected return on assets that pays 9% on its debt, which totals 70% of assets?
3. What was the market price of a share of stock before a rights issue if one share of new stock could be purchased at \$100 for every four shares that were previously owned? The stock price after the successful rights issue was \$200.
4. A firm with an asset beta of 1.0 has a debt beta of zero when 20% of the capital structure is debt, and is estimated to have a debt beta of 0.15 if debt went as high as 50% of the capital structure. What is the range for the equity beta under these circumstances?
5. A portfolio of three stocks with total market value of \$1,000,000 currently has a beta of 1.4. In light of an expected market downturn, you wish to reduce the portfolio beta to no more than 1.0. Two stocks are likely candidates for sale, one with a beta of 1.8 and a market value of \$200,000 and the other with a beta of 1.5 and a market value of \$250,000. Assuming that you could find one appropriate stock to replace these two, what should be its beta?
6. Calculate the nominal return, real return, and risk premium for the following common stock investment:  
(Both treasury bill yield and inflation rate are annual rates)

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Purchase price	\$60.00 per share
Dividend	\$3.50 per year
Sales price	\$73.00 per share
Treasury bill yield	8.5%
Inflation rate	7.5%

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

1. If interest tax shields are valuable, why don't all tax-paying firms borrow as much as possible?
2. The stock of Newmont Mining, the world's largest gold producer. Do you think the company will have high or low volatility? High or low beta? Explain your answer.

IV. Questions (28 %)

1. From late 2009, fears of a sovereign debt crisis developed among investors concerning rising government debt levels across the globe together with a wave of downgrading of government debt of certain European states.
  - a. Briefly describe the cause of the European sovereign debt crisis. (4%)
  - b. What happened of the Euro/Dollar exchange rate under the European sovereign debt crisis? Explain your answer. (4%)
  - c. If you are working for a multinational firm with Euro income, how do you hedge exchange risk caused by the European sovereign debt crisis? (4%)
2. Suppose that instead of plowing money back into lucrative ventures, Blue Skies' management is investing at an expected return on equity of 10%, which is below the return of 12% that investors could expect to get from comparable securities.
  - a. Find the sustainable growth rate of dividends and earnings in these circumstances. Assume a 60% payout ratio. (4%)
  - b. Find the new value of its investment opportunities. Explain why this value is negative despite the positive growth rate of earnings and dividends. (6%)
  - c. If you were a corporate raider, would Blue Skies be a good candidate for an attempted takeover? (6%)

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I. Explain the following terms briefly (24 %, each 4 %)

- (1) Perpetuity.
- (2) The term structure of interest rates.
- (3) TIPs.
- (4) Market efficiency.
- (5) Sunk costs.
- (6) Sharpe ratio.

II. Computational Questions (30 %, each 6 %)

1. A bond with a face value of \$1,000 has coupon rate of 7% (paid annually), yield to maturity of 10%, and five years to maturity. Calculate the bond's Macaulay duration.
2. The Wall Street Journal quotation for a company has the following values: Div: \$1.12, PE: 18.3, Close: \$37.22. Calculate the dividend payout ratio for the company (Approximately).
3. R&D Technology Corporation has just paid a dividend of \$0.50 per share. The dividends are expected to grow at 24% per year for the next two years and at 8% per year thereafter. If the required rate of return in the stock is 16% (APR), calculate the current value of the stock.
4. Dry-Sand Company is considering investing in a new project. The project will need an initial investment of \$1,200,000 and will generate \$600,000 (after-tax) cash flows for three years. Calculate the MIRR (modified internal rate of return) for the project if the cost of capital is 15%.
5. You are considering the purchase of one of two machines required in your production process. Machine A has a life of two years. Machine A costs \$50 initially and then \$70 per year in maintenance. Machine B has an initial cost of \$90. It requires \$40 in maintenance for each year of its 3 year life. Either machine must be replaced at the end of its life. Which is the better machine for the firm? The discount rate is 15% and the tax rate is zero.

III. Short Answer Questions (18 %, each 6 %)

1. Geothermal Corp. just announced good news: its earnings have increased by 20 percent. Most investors had anticipated an increase of 25 percent. Will Geothermal's stock price increase or decrease when the announcement is made? Explain your answer.
2. How does the information content of a repurchase program differ from that of dividend increase? Which signal has lasting result?

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3. Project A has an IRR of 20% while Project B has an IRR of 30%. These two project NPV profiles cross at an interest rate of 15%. Under what situations might you be inclined to select Project A, assuming the projects to be mutually exclusive projects?

IV. Questions (28 %)

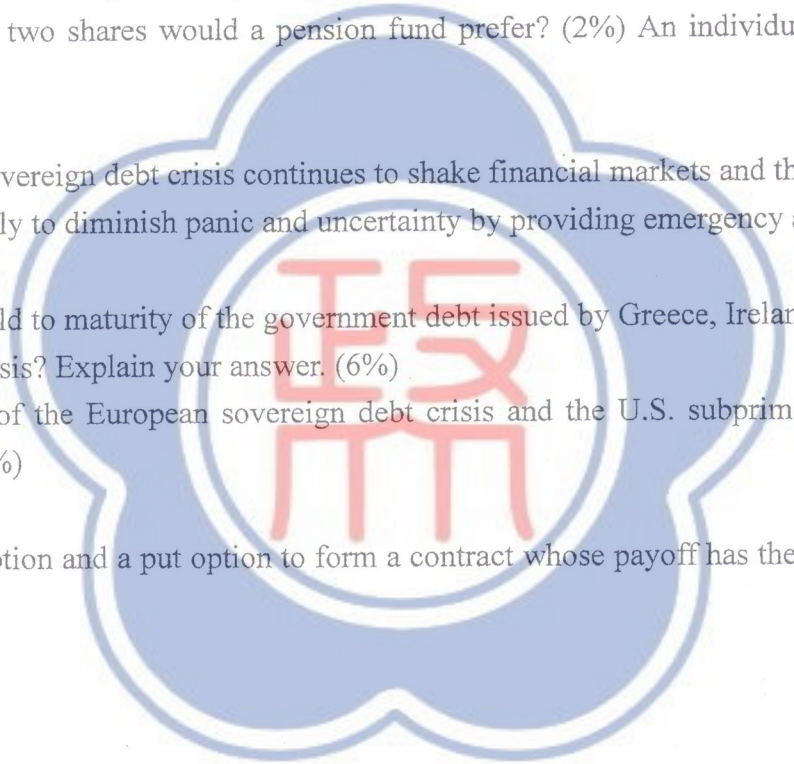
1. Suppose two equally risky shares, Div and Cap, offer the same expected return before tax. Div shares pay a generous dividend but offer low expected capital gains. Cap shares pay low dividends but offer high expected capital gains. Which of the two shares would a pension fund prefer? (2%) An individual? (2%) A corporation? (2%) Explain your answers.

2. The ongoing European sovereign debt crisis continues to shake financial markets and the Eurozone. The IMF and the EU have acted swiftly to diminish panic and uncertainty by providing emergency assistance to Greece, Ireland and Portugal.

a. What happened of the yield to maturity of the government debt issued by Greece, Ireland and Portugal under the European sovereign debt crisis? Explain your answer. (6%)

b. Comparing the impacts of the European sovereign debt crisis and the U.S. subprime mortgage crisis on the world financial markets. (8%)

3. How do you use a call option and a put option to form a contract whose payoff has the same form as shorting a forward contract? (8%)



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1. Choose at random a point from the interval  $(0,1)$  and let the random variable  $X_1$  be equal to the number which corresponds to that point. Then choose a point at random from the interval  $(0, x_1)$ , where  $x_1$  is the experimental value of  $X_1$ , and let the random variable  $X_2$  be equal to the number which corresponds to this point. (20%)

(a) What are the joint probability density function (p.d.f.)  $f(x_1, x_2)$ , the marginal p.d.f.  $f_1(x_1)$ , and the conditional p.d.f.  $f_2(x_2 | x_1)$ ? (10%)

(b) Compute  $\Pr(X_1 + X_2 \geq 1)$ . (5%)

(c) Find the conditional mean  $E(X_2 | x_1)$ . (5%)

2. Please answer the following questions. (20%)

(a) Let  $Y_1$  denote the first order statistic of a random sample of size  $n$  from a distribution that has the p.d.f.  $f(x) = e^{-(x-\theta)}$ ,  $\theta < x < \infty$ , zero elsewhere. Let  $Z = n(Y_1 - \theta)$ . Investigate the limiting distribution of  $Z$ . (10%)

(b) Let  $Y_n$  have a distribution that is Binomial distribution  $B(n, p)$ , and suppose that the mean  $\lambda = np$  is the same for every  $n$ ; that is  $p = \frac{\lambda}{n}$ , where  $\lambda$  is a constant. Please show that the limiting distribution of the binomial distribution is a Poisson distribution. (10%)

3. Please answer the following questions. (25%)

(a) Please describe and prove the Chebyshev inequality. (10%)

(b) Suppose that it is known that the stock return of the company during a year is a random variable with mean 0.1 and standard deviation 0.1, then what can be said about the probability that the year's return of the stock will be between -0.1 and 0.3? (5%)

(c) Please describe and prove the weak law of large numbers. (10%)

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4. Please answer the following questions. (10%)

(a) Please describe the Central Limit Theorem. (5%)

(b) Let  $\bar{X}$  denote the mean of a random sample of size 100 from a distribution that is  $\chi^2(50)$ . Compute an approximated value of  $\Pr(49 < \bar{X} < 51)$  by the Central Limit Theorem. The answer can be expressed in terms of cumulative normal distribution  $\Phi(\cdot)$ . (5%)

5. Let  $(X_i, Y_i)'$ ,  $i=1, 2, \dots, n$  be independent random vectors having the bivariate normal distribution with parameter  $\theta = (\mu_x, \mu_y, \sigma_x, \sigma_y, \rho)'$ . (25%)

(a) Please calculate the probability of  $P(aX_1 + bY_1 > c)$  in terms of the cumulative normal distribution  $\Phi(\cdot)$ . (5%)

(b) Please determine the distribution of  $\bar{X} - \bar{Y}$ . (5%)

(c) Please find the uniformly minimum variance unbiased estimators of the covariance,  $\sigma_{xy} = \rho\sigma_x\sigma_y$ . (15%)

