



本份試卷共 50 題單選題，每題 2 分

1. In response to news reports that taking aspirin daily can reduce an individual's risk of a heart attack, there will most likely be a(n)
 - A. increase in the supply of aspirins.
 - B. decrease in the supply of aspirins.
 - C. increase in the demand for aspirins.
 - D. increase in the quantity demanded of aspirins.

2. Consumer surplus will be zero at any quantity if
 - A. supply is perfectly elastic.
 - B. supply is perfectly inelastic.
 - C. demand is perfectly elastic.
 - D. demand is perfectly inelastic.

3. A firm is currently producing in the inelastic portion of its demand curve. What course of action should you recommend to this firm?
 - A. Continue producing at the current output level, because the firm will maximize its total revenue by producing in the inelastic portion of its demand curve.
 - B. Reduce price, because if demand is inelastic and price is reduced, total revenue will increase.
 - C. Increase price, because if demand is inelastic and price is increased, total revenue will increase.
 - D. Continue selling at the same price, but increase the number of units it produces.

4. The government is considering placing a tax on cigarettes to raise revenue to finance health care benefits. One of the arguments for this tax is that the demand for cigarettes is price inelastic. Which of the following statements is TRUE?
 - A. The tax on cigarettes may not raise as much revenue as anticipated in the years to come because the demand for cigarettes is likely to become more elastic over time.
 - B. This is a very good way to raise revenue both in the short term and in the long term because there are no substitutes for cigarettes.



- C. This tax will not raise much revenue either in the short term or the long term because demand is price inelastic.
- D. No tax revenue can be raised in this way because sellers of cigarettes will just lower their price by the amount of the tax and therefore the price of cigarettes to consumers will not change.
5. For Tom, the marginal utility of the first cup of coffee he drinks in the morning is worth \$2.00. The marginal utility of the 9th cup of coffee he drinks is positive and the marginal utility of the 10th cup of coffee he drinks in the morning is worth \$0. This implies that at a price of \$0, Tom
- A. would drink an infinite number of cups of coffee each morning.
- B. would drink at least 10 cups of coffee per morning.
- C. would drink more than 10 cups of coffee per morning, but the actual number is indeterminate from this information.
- D. would drink zero cups of coffee per morning.
6. Assuming that charitable giving is a normal good, the income effect of a decrease in personal tax rates should
- A. lead to less giving because giving to charity would become more expensive relative to other goods.
- B. lead to more giving because giving to charity would become less expensive relative to other goods.
- C. lead to more giving because households would have more disposable income.
- D. lead to less giving because households would spend that money on luxury goods.
7. If the substitution effect of a wage change outweighs the income effect of a wage change, the labor-supply curve is
- A. upward sloping.
- B. horizontal.
- C. vertical.
- D. backward bending.



8. Jerry sells cherry sno-cones along the boardwalk in New Jersey. During the summer this is a perfectly competitive business, and Jerry faces a perfectly elastic demand curve. If he wants to try to increase revenues he should
- A. raise the price of his sno-cones to make more per sale.
 - B. lower the price of his sno-cones to try to sell more.
 - C. keep the price the same but produce more to increase sales.
 - D. do nothing; there is nothing he can do to increase revenue.
9. If the marginal product of labor equals the average product of labor, then the
- A. average product is maximized.
 - B. marginal product is maximized.
 - C. marginal product is still increasing.
 - D. average product is still increasing.
10. You own a building that has four possible uses: a cafe, a craft store, a hardware store, and a bookstore. The value of the building in each use is \$2,000; \$3,000; \$4,000; and \$5,000, respectively. You decide to open a hardware store. The opportunity cost of using this building for a hardware store is
- A. \$2,000, the value if the building is used as a cafe.
 - B. \$3,000, the value if the building is used as a craft store.
 - C. \$10,000, the sum of the values if the building is used for a cafe, a craft store, or a bookstore.
 - D. \$5,000, the value if the building is used for a bookstore.
11. The total cost curve for a firm can be derived from isoquants and isocost lines by
- A. varying the prices of capital and labor and keeping total expenditure constant.
 - B. varying production technologies, but keeping input prices and expenditure levels constant.
 - C. varying total expenditures while keeping input prices and production technology constant.
 - D. varying the price of either capital or labor while keeping total expenditures and production technology constant.



12. If a firm's demand curve is perfectly elastic, then at the profit maximizing level of output
- A. $P = MR = MC$.
 - B. $P > MR > MC$.
 - C. $P < MR < MC$.
 - D. $P > 0$ and $MR = 0$.
13. A firm suffers operating losses if
- A. price exceeds average variable cost but is less than average total cost.
 - B. price exceeds marginal cost.
 - C. revenues are smaller than variable costs of production.
 - D. revenues are greater than variable costs of production but less than total costs.
14. If a firm is incurring an operating loss, in the short run the firm should _____ and in the long run the firm should _____.
- A. produce where $MC = MR$; exit the industry
 - B. shut down; exit the industry
 - C. produce where $MC = MR$; expand
 - D. shut down; expand
15. Engineers for The All-Terrain Bike Company have determined that a 15% increase in all inputs will cause a 15% increase in output. Assuming that input prices remain constant, you correctly deduce that such a change will cause _____ as output increases.
- A. average costs to increase
 - B. average costs to decrease
 - C. average costs to remain constant
 - D. marginal costs to increase
16. Assume the peanut industry, a perfectly competitive industry, is in long-run equilibrium with a market price of \$5. If demand for peanuts increases and this industry is a decreasing-cost industry, long-run equilibrium will be reestablished at a price
- A. greater than \$5.
 - B. less than \$5.



- C. equal to \$5.
- D. either greater than or less than \$5, depending on the number of firms that enter the industry.
17. Assuming labor is the only variable factor of production, production of a good will occur
- A. as long as the marginal revenue product of labor is positive.
 - B. if society values a good more than it costs firms to hire the workers to produce the good.
 - C. as long as the product's price is greater than the marginal revenue product of labor.
 - D. if the marginal cost of a unit of output equals the marginal revenue product of labor.
18. Because petroleum is fixed in supply, its price is
- A. demand determined.
 - B. supply determined.
 - C. inelastic.
 - D. independently determined.
19. The number of seats available in a stadium is fixed at 80,000. The equilibrium price for a ticket to a football game at the stadium is \$30. The equilibrium price for a ticket to a soccer match at the stadium is \$10. Which of the following is TRUE?
- A. Football games must be more expensive to produce than a soccer match.
 - B. The demand for each football game must be more than the demand for each soccer match.
 - C. The supply of soccer matches must be less elastic than the supply of football games.
 - D. The demand for each soccer game must be greater than the demand for each football game.
20. Joe and Carl are both reporters and they both have the same productivity. They each can write five articles a week. Joe writes articles about celebrities. Carl writes articles about economics. Joe earns twice as much as Carl. Which of the following could explain this?



- A. There are more reporters writing about celebrities than there are reporters writing about economics.
- B. The output effect is greater for celebrity writers than economics writers.
- C. There must be more substitutes available for economics writers than there are for celebrity writers.
- D. People are willing to pay more for stories about celebrities than for stories about economics.
21. When market interest rates _____, _____ investment projects are undertaken.
- A. decrease; more
- B. increase; more
- C. decrease; less
- D. increase; no
22. Monopolistic competition differs from perfect competition primarily because in
- A. monopolistic competition, firms can differentiate their products.
- B. perfect competition, firms can differentiate their products.
- C. monopolistic competition, entry into the industry is blocked.
- D. monopolistic competition, there are relatively few barriers to entry.
23. An oligopoly with a dominant price leader will produce an output level that is _____ than the output level that would prevail if the industry were a monopoly and sells it at a price that is _____ than the price that would prevail if the industry were a monopoly.
- A. higher; higher
- B. higher; lower
- C. lower; lower
- D. lower; higher
24. You want to purchase a new car. You have gone to 3 dealerships that sell the type of car you want. The price of the car is different at each of the dealerships. You have estimated that if you go to another dealership, the marginal amount you may save will be \$250, but the marginal cost of going to the dealership would be \$350. Which of the following statements is accurate?



- A. You should go to the next dealership, as you would be able to save an additional \$250.
- B. In order to determine whether or not you should go to the next dealership, you would need to know the total costs and total benefits of this action.
- C. You should not go to the next dealership because the marginal cost of this action exceeds the marginal benefit.
- D. You should continue going to dealerships as long as the marginal benefit of additional search is positive.
25. If the payroll tax for Social Security in the United States were levied on all wage and salary income instead of just the first \$87,000 of wage and salary income, the payroll tax would be
- A. regressive.
- B. progressive.
- C. proportional.
- D. an ability-to-pay tax.
26. Assume that apples cost \$0.50 in 2002 and \$1 in 2007, whereas oranges cost \$1 in 2002 and \$1.50 in 2007. If 4 apples were produced in 2002 and 5 in 2007, whereas 3 oranges were produced in 2002 and 5 in 2007, then the GDP deflator in 2007, using a base year of 2002, was approximately:
- A. 1.5
- B. 1.7
- C. 1.9
- D. 2.0
27. If there are 100 transactions in a year and the average value of each transaction is \$10, then if there is \$200 of money in the economy, transactions velocity is _____ times per year:
- A. 0.2
- B. 2
- C. 5
- D. 10



28. If income velocity is assumed to be constant, but no other assumptions are made, the level of ___ is determined by the quantity of money.
- prices
 - income
 - transactions
 - nominal GDP
29. The percentage change in the price level is approximately equal to the percentage change in:
- the quantity of money.
 - the quantity of money minus the percentage change in real output.
 - the quantity of money minus the percentage change in real output plus the percentage change in the transactions velocity of money.
 - the quantity of money minus the percentage change in real output minus the percentage change in the transactions velocity of money.
30. If the nominal exchange rate falls by 10 percent, the domestic price level rises by 4 percent, and the foreign price level rises by 6 percent, the real exchange rate will fall by:
- 0 percent
 - 8 percent
 - 10 percent
 - 12 percent
31. In a small open economy, if the introduction of automatic-teller machines reduces the demand for money, then net exports:
- fall and the real exchange rate falls.
 - fall but the real exchange rate remains unchanged.
 - remain unchanged but the real exchange rate falls.
 - and the real exchange rate remain unchanged.
32. Assume that some large foreign countries begin to subsidize investment by instituting an investment tax credit. Then, if world saving does not depend on the interest rate, world investment:
- will rise and home country investment will fall.
 - will rise and home country investment will remain unchanged.
 - will remain unchanged and home country investment will fall.
 - and home country investment will both remain unchanged.



33. Assume that a war breaks out abroad, and foreign investors choose to invest more in a large safe country, the United States. Then, the U.S. real interest rate:
- and net exports will both fall.
 - will fall and net exports will rise.
 - will rise and net exports will fall.
 - and net exports will both rise.
34. If the rate of separation is 0.02 and the rate of job finding is 0.08 but the current unemployment rate is 0.10, then the current unemployment rate is _____ the equilibrium rate, and in the next period it will move _____ the equilibrium rate.
- above; toward
 - above; away from
 - below; toward
 - below; away from
35. Assume that a country experience a reduction in productivity that shifts the labor demand curve downward and to the left. If the labor market were always in equilibrium, this would lead to:
- a lower real wage and a rise in unemployment.
 - a lower real wage and no change in unemployment.
 - a lower real wage and less unemployment.
 - no change in real wage or in unemployment.
36. If the per-worker production function is given by $y = k^{1/2}$, where y is output per worker, and k is capital per worker, the saving rate is 0.2, and the depreciation rate is 0.1, then the steady-state ratio of capital to labor is:
- 1
 - 4
 - 2
 - 9
37. Assume that a war reduces a country's labor force but does not directly affect its capital stock. If the economy was in a steady state before the war and the saving rate does not change after the war, then, over time, capital per worker will _____ and output per worker will grow _____ than it did before the war.



- A. decline; faster
B. decline; more slowly
C. increase; faster
D. increase; more slowly
38. If the U.S. production function is Cobb-Douglas with capital share 0.3, output growth is 3 percent per year, depreciation is 4 percent per year, and the Golden Rule steady-state capital-output ratio is 4.29, to reach the Golden Rule steady state, the saving rate must be:
A. 17.5 percent
B. 25 percent
C. 30 percent
D. 42.9 percent
39. If the marginal product of capital net of depreciation equals 8 percent, the rate of growth of population equals 2 percent, and the rate of labor-augmenting technical progress equals 2 percent, to reach the Golden Rule level of the capital stock the _____ rate in this economy must be _____:
A. saving; increased
B. population growth; decreased
C. depreciation; decreased
D. total output growth; decreased
40. If the production function is $Y = A \cdot K^{2/3} \cdot L^{1/3}$ in the land of Solovia, where A is a parameter measuring the productivity of technology, K denotes the amount of capital, and L denotes the amount of labor, and the labor force increases by 5 percent while capital is constant, labor productivity will:
A. increase by 3.33 percent.
B. increase by 1.67 percent.
C. decrease by 1.67 percent.
D. decrease by 3.33 percent.
41. The rate of growth of labor productivity (Y/L) may be expressed as the rate of growth of total factor productivity:
A. plus the capital share multiplied by the rate of growth of the capital-labor ratio.



- B. minus the capital share multiplied by the rate of growth of the capital-labor ratio.
- C. plus the rate of growth of capital productivity.
- D. minus the rate of growth of capital productivity.
42. If the demand for money increases, but the central bank keeps the money supply the same, then in the short run output will:
- A. fall and in the long run prices will remain unchanged.
- B. remain unchanged and in the long run prices will fall.
- C. remain unchanged and in the long run prices will remain unchanged.
- D. fall and in the long run prices will fall.
43. If the central bank reduces the money supply by 5 percent, then the real interest rate will:
- A. rise both in the short run and the long run.
- B. rise in the short run but return to its original equilibrium level in the long run.
- C. rise in the short run but will fall below its original equilibrium level in the long run.
- D. be unaffected both in the short run and the long run.
44. If central bank A cares only about keeping the price level stable and central bank B cares only about keeping output at its natural level, then in response to an exogenous increase in the price of oil:
- A. both central bank A and central bank B should increase the quantity of money.
- B. central bank A should increase the quantity of money whereas central bank B should keep it stable.
- C. central bank A should keep the quantity of money stable whereas central bank B should increase it.
- D. both central bank A and central bank B should keep the quantity of money stable.
45. Consider the impact of an increase in thriftiness in the Keynesian-cross analysis. Assume that the marginal propensity to consume is unchanged, but the intercept of the consumption function is made smaller so that at every income level saving is greater. This will:



- A. lower equilibrium income by the decrease in the intercept multiplied by the multiplier.
- B. lower equilibrium income by the decrease in the intercept.
- C. raise equilibrium income by the decrease in the intercept.
- D. rise equilibrium income by the decrease in the intercept multiplied by the multiplier.
46. The increase in income in response to a fiscal expansion in the IS-LM is:
- A. always less than in the Keynesian-cross model
- B. less than in the Keynesian-cross model unless the LM curve is vertical
- C. less than in the Keynesian-cross model unless the LM curve is horizontal
- D. less than in the Keynesian-cross model unless the IS curve is vertical
47. In a small, open economy with a floating exchange rate, the exchange rate will depreciate if
- A. taxes are decreased.
- B. import quotas are imposed.
- C. government spending is increased.
- D. the money supply is decreased.
48. If the demand function for money is $\frac{M}{P} = 0.5 \cdot Y - 100 \cdot r$, where M stands for the quantity of money, P stands for the price level, Y stands for income, and r stand for interest rate, then the slope of the LM curve is
- A. 0.001
- B. 0.005
- C. 0.01
- D. 0.05
49. If the demand function for money is $\frac{M}{P} = 0.5 \cdot Y - 100 \cdot r$ and if $\frac{M}{P}$ increases by 100, then the LM curve for any given interest rate shifts to the:
- A. left by 100.
- B. left by 200.
- C. right by 100.
- D. right by 200.



50. Other things equal, a given change in money supply has a larger effect on demand the:
- A. flatter the IS curve.
 - B. steeper the IS curve.
 - C. smaller the interest sensitivity of expenditure demand.
 - D. smaller the income sensitivity of expenditure demand.



1. 求 $\lim_{x \rightarrow 0} (5x + e^x)^{\frac{1}{x}}$ 之極限
2. 求 $\lim_{n \rightarrow \infty} \sum_{i=1}^n \frac{(n+i)^k}{n^{k+1}}$ 之極限
3. 求 $\int e^{2x} \sin 3x \, dx$ 之值
4. 求 $\int_0^1 \frac{xe^x}{(x+1)^2} dx$ 之積分
5. 求 $\int_0^\pi \frac{x \sin x}{a + b \cos^2 x} dx$ $a, b > 0$ 之積分
6. 設 $f(x) = x^2 - 2x - 3$, 求 $f(x)$ 在 $[-2, 4]$ 區間與 x 軸所圍成之面積
7. 設 $f(x) = e^x$, 求 $f(x)$ 對 $x = 0$ 及 $x = 3$ 之泰勒展開式
8. 設 $f(x) = \int_0^x e^{2t} \sin t \, dt$, 求 $f(x)$ 在 $0 \leq x \leq \pi$ 之極值
9. 求 $\sum_{n=1}^{\infty} \frac{n(x-1)^n}{2^n(3n-1)}$ 的收斂區間
10. 設 $x = \tan^2(y^2 + a)$, 求 $\frac{dy}{dx}$

(每題 10 分)


I. Multiple choice questions (75%)

In this test, there are 15 multiple choice questions with 5 points for each question. Please select the correct answer for each question.

1. A three-digit number can be formed from the digits 0, 1, 2, 3, 4, 5, 6, and each digit can be used only once. What is the probability on which this three-digit numbers are odd and greater than 330?

(A) $\frac{105}{180}$ (B) $\frac{75}{180}$ (C) $\frac{45}{180}$ (D) $\frac{25}{180}$

2. Let X and Y denote the lengths of life, in years, of two components in an electronic system. If the joint density function of these variables is given by

$$f(x, y) = \begin{cases} e^{-(x+y)} & x > 0, y > 0 \\ 0 & \text{elsewhere} \end{cases}$$

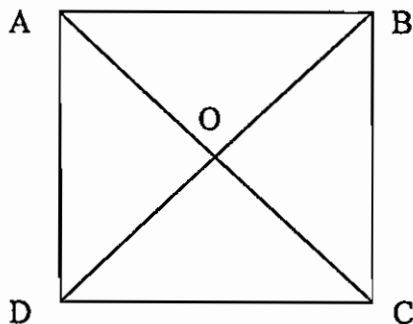
Find $P(0 < X < 1 \mid Y < 2)$

(A) 0.3679 (B) 0.4288 (C) 0.5712 (D) 0.6321

3. The empirical data on a certain test score is collected from 1200 students. The mean and variance of test score are 83 and 36, respectively. At least how many students receive test score between 71 and 95?

(A) 1050 (B) 900 (C) 480 (D) 300

4. David Douglas lives at O in the accompanying diagram and has four friends who live at A , B , C , and D . One day David Douglas decides to go visiting, so he tosses a fair coin twice to decide which of the four to visit. Once at a friend's house, he will either return home or proceed to one of the two adjacent houses (such as O , A , or C when at B), with each of the three possibilities having probability $1/3$. In this way David Douglas continues to visit friends until he returns home.





Let X be the number of times that David Douglas visits a friend, Y be the number of straight-line segments that David traverses (including those leading to and from O). Which one of the following statements is **true**?

(A) $f(x) = \left(\frac{2}{3}\right)^x * \left(\frac{1}{3}\right)^{x-1}$ for $x = 1, 2, 3$ (B) $f(y) = \left(\frac{3}{4}\right)^{y-1} * \left(\frac{1}{4}\right)$ for $y = 2, 3, 4, 5$

(C) $f(x) = \left(\frac{3}{4}\right)^{x-2} * \left(\frac{1}{4}\right)$ for $x = 1, 2, 3$ (D) $f(y) = \left(\frac{2}{3}\right)^{y-2} * \left(\frac{1}{3}\right)$ for $y = 2, 3, 4, 5$

5. A poker hand is defined as drawing five cards at random without replacement from a deck of 52 playing cards. Which one of the following statements is **false**?
- (A) The probability of four of a kind (four cards of equal face value) is 0.00024
 (B) The probability of full house (one pair and one triple of cards with equal face value) is 0.00144
 (C) The probability of two pairs (two pairs of equal face value plus one other card) is 0.004754
 (D) The probability of three of a kind (three equal face values plus two different cards) is 0.02113
6. A truth serum given to a suspect is known to be 90% reliable when the person is guilty and 99% reliable when the person is innocent. In other words, 10% of guilty are judged innocent by the serum and 1% of the innocent are judged guilty. If the suspect was selected from a group of suspects of which only 5% have ever committed a crime, and the serum indicates that he is guilty. What is the probability that he is innocent?
 (A) 0.174 (B) 0.8256 (C) 0.0092 (D) 0.165
7. The number of defects in printed circuit boards is hypothesized to follow a Poisson distribution. A random sample of $n = 60$ printed boards have been collected, and the number of defects observed as follows:
- | | | | | |
|----------------|----|----|---|---|
| No. of defects | 0 | 1 | 2 | 3 |
| Frequency | 32 | 15 | 9 | 4 |
- What is the Chi-Square goodness-of-fit test statistic?
 (A) 3.24 (B) 3.84 (C) 4.24 (D) 4.84



8. Let X and Y be random variables with joint density function

$$f(x, y) = \begin{cases} 4xy & 0 < x < 1, \quad 0 < y < 1 \\ = 0 & \text{elsewhere} \end{cases}$$

Find the expected value of $Z = \sqrt{X^2 + Y^2}$

- (A) 0.6812 (B) 0.7946 (C) 0.8358 (D) 0.9752

9. Infestation of crops by insects has long been of great concern to farmers and agricultural scientists. The paper "Cotton Square Damage by the Plant Bug, *Lygus hesperus*, and Abscission Rates" reports data on x =age of a cotton plant (days) and y =% damaged squares. The summary statistics are

$$\sum x_i = 246, \quad \sum x_i^2 = 5742, \quad \sum y_i = 572, \quad \sum y_i^2 = 35634, \quad \text{and} \quad \sum x_i y_i = 14022$$

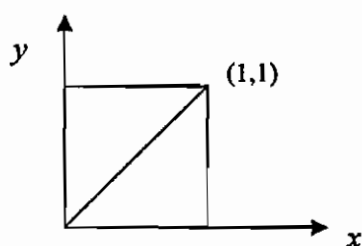
Predict the percentage of damaged squares when the age is 20 days.

- (A) 46.024 (B) 54.937 (C) 67.125 (D) 80.276

10. A random sample of 400 voters in a certain city are asked if they favor an additional 4% gasoline sales tax to provide badly needed revenues for street repairs. If more than 220 but fewer than 260 favor the sales tax, we shall conclude that 60% of the voters are for it. (1) If 60% of the voters favor the increased tax, what is the type I error? (2) If actually only 48% of the voters are in favor of the additional gasoline tax, what is the type II error? Which one of the following statements is **true**?
- (A) Type I error is 0.0094 and Type II error is 0.0061.
 (B) Type I error is 0.0046 and Type II error is 0.0122.
 (C) Type I error is 0.0046 and Type II error is 0.0061.
 (D) Type I error is 0.0094 and Type II error is 0.0122.

11. Suppose that the two-dimensional random variable (X, Y) is uniformly distributed over the triangular region $R = \{(x, y) \mid 0 < x < y < 1\}$

$$f(x, y) = \begin{cases} 2 & (x, y) \in R \\ = 0 & \text{elsewhere} \end{cases}$$



Which one of the following statements is **false**?

- (A) $E(X)=1/3$
 (B) $E(Y)=2/3$
 (C) $V(X)=2/18$
 (D) the correlation coefficient $\rho=1/2$

12. Let X be the damage incurred (in \$) in a certain type of accident during a given year. Possible X values are 0, 1000, 5000, and 10000, with probabilities 0.8, 0.2, 0.08, and 0.02, respectively. A particular company offers a \$500 deductible policy. If the company wishes its expected profit to be \$100, what premium amount should it charge?

- (A) 700 (B) 800 (C) 1200 (D) 1300

13. Two machines are used to fill plastic bottles with dishwashing detergent. The standard deviations of fill volume are known to be $\sigma_1 = 0.15$ fluid ounces and $\sigma_2 = 0.18$ fluid ounces for the two machines, respectively. Two random samples of $n_1 = 12$ bottles from machine 1 and $n_2 = 10$ bottles from machine 2 are selected, and the sample mean fill volumes are $\bar{x}_1 = 30.87$ fluid ounces and $\bar{x}_2 = 30.68$ fluid ounces. What is the correct answer for the 95% two-sided confidence interval on mean difference in fill volumes?

- (A) $0.0723 \leq \mu_1 - \mu_2 \leq 0.3076$ (B) $0.0826 \leq \mu_1 - \mu_2 \leq 0.4251$
 (C) $0.0568 \leq \mu_1 - \mu_2 \leq 0.5108$ (D) $0.0499 \leq \mu_1 - \mu_2 \leq 0.33$

14. Let X_1, X_2, \dots, X_n be a random sample of size n from $b(1, p)$. Thus $Y = \sum_{i=1}^n X_i$ is $b(n, p)$.

Which one of the following statements is **false**?

- (A) $\bar{X} = Y/n$ is an unbiased estimator of p . (B) $\text{Var}(Y) = np(1-p)$.
 (C) $E(\bar{X}(1-\bar{X})/n) = n(n-1)[p(1-p)/n]$. (D) $\text{Var}(\bar{X}) = p(1-p)/n$.



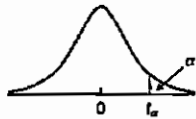
15. One-sixth of the male freshmen entering a large state school are out-of-state students. If the students are assigned at random to the dormitories, 180 to a building, what is the probability that in a given dormitory at least one-fifth of the students are from out of state?
 (A) 0.0968 (B) 0.1151 (C) 0.1357 (D) 0.1587

II. Problems (25%)

16. A random sample of n items is to be taken from a distribution with mean μ and standard deviation σ .
 (a) (5%) Use the Chebyshev inequality to determine the smallest number of items n that must be taken in order to satisfy the following relation:

$$P\left(|\bar{x}_n - \mu| \leq \frac{\sigma}{4}\right) \geq 0.99$$

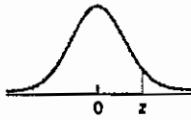
- (b) (10%) Use the central limit theorem to determine the smallest number of items n that must be taken in order to satisfy the relation in part (a) approximately.
17. (10%) Determine a value of c such that in a problem of simple linear regression, the statistic $c \sum_{i=1}^n (Y_i - \hat{\beta}_1 - \hat{\beta}_2 x_i)^2$ will be an unbiased estimator of σ^2 .


 TABLE IV
 Values of t_{α}


df	$t_{0.10}$	$t_{0.05}$	$t_{0.025}$	$t_{0.01}$	$t_{0.005}$	df
1	3.078	6.314	12.706	31.821	63.657	1
2	1.886	2.920	4.303	6.965	9.925	2
3	1.638	2.353	3.182	4.541	5.841	3
4	1.533	2.132	2.776	3.747	4.604	4
5	1.476	2.015	2.571	3.365	4.032	5
6	1.440	1.943	2.447	3.143	3.707	6
7	1.415	1.895	2.365	2.998	3.499	7
8	1.397	1.860	2.306	2.896	3.355	8
9	1.383	1.833	2.262	2.821	3.250	9
10	1.372	1.812	2.228	2.764	3.169	10
11	1.363	1.796	2.201	2.718	3.106	11
12	1.356	1.782	2.179	2.681	3.055	12
13	1.350	1.771	2.160	2.650	3.012	13
14	1.345	1.761	2.145	2.624	2.977	14
15	1.341	1.753	2.131	2.602	2.947	15
16	1.337	1.746	2.120	2.583	2.921	16
17	1.333	1.740	2.110	2.567	2.898	17
18	1.330	1.734	2.101	2.552	2.878	18
19	1.328	1.729	2.093	2.539	2.861	19
20	1.325	1.725	2.086	2.528	2.845	20
21	1.323	1.721	2.080	2.518	2.831	21
22	1.321	1.717	2.074	2.508	2.819	22
23	1.319	1.714	2.069	2.500	2.807	23
24	1.318	1.711	2.064	2.492	2.797	24
25	1.316	1.708	2.060	2.485	2.787	25
26	1.315	1.706	2.056	2.479	2.779	26
27	1.314	1.703	2.052	2.473	2.771	27
28	1.313	1.701	2.048	2.467	2.763	28
29	1.311	1.699	2.045	2.462	2.756	29
30	1.310	1.697	2.042	2.457	2.750	30
31	1.309	1.696	2.040	2.453	2.744	31
32	1.309	1.694	2.037	2.449	2.738	32
33	1.308	1.692	2.035	2.445	2.733	33
34	1.307	1.691	2.032	2.441	2.728	34
35	1.306	1.690	2.030	2.438	2.724	35
36	1.306	1.688	2.028	2.434	2.719	36
37	1.305	1.687	2.026	2.431	2.715	37
38	1.304	1.686	2.024	2.429	2.712	38
39	1.304	1.685	2.023	2.426	2.708	39
40	1.303	1.684	2.021	2.423	2.704	40
41	1.303	1.683	2.020	2.421	2.701	41
42	1.302	1.682	2.018	2.418	2.698	42
43	1.302	1.681	2.017	2.416	2.695	43
44	1.301	1.680	2.015	2.414	2.692	44
45	1.301	1.679	2.014	2.412	2.690	45
46	1.300	1.679	2.013	2.410	2.687	46
47	1.300	1.678	2.012	2.408	2.685	47
48	1.299	1.677	2.011	2.407	2.682	48
49	1.299	1.677	2.010	2.405	2.680	49



TABLE II (cont.)
Areas under the
standard normal curve



z	Second decimal place in z									
	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.7	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.8	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.9	1.0000 [†]									

[†] For $z \geq 3.90$, the areas are 1.0000 to four decimal places.