

科目：統計學

系組：統計資訊學系

年級：二

1. 請寫下(算術)平均數的定義,用途,及缺點。(10%)
2. 請寫下中位數的定義,用途,及優點。(10%)
3. 請寫下標準差的定義及用途。(10%)
4. 以下有關事件 A_1, A_2 之機率的敘述何者有誤? (10%)
 - a. $P(A_1)+P(A_2)$ 必為正值
 - b. $P(A_1 \cup A_2) \leq P(A_1)+P(A_2)$
 - c. $P(A_1)-P(A_2)$ 必為正值
 - d. $P(A_1)-P(A_2) \leq 1$
5. 某學校學生吸毒問題嚴重有 10%的學生為毒品吸食者。校方正評估是否引進一個測毒儀器；根據實驗數據，該測毒儀器對真實吸毒者有 90%的判斷正確率，對未吸毒者則有 80%的判斷正確率。今在學校隨機抽取了一位學生，經儀器檢測為吸毒者，請問此生真的有吸毒的機率為何? (20%)
6. 小明常在某一傳統市場蛋商處購買雞蛋，據經驗，該蛋商所售之每一顆雞蛋為劣質品的機率為 20%。若 X 表小明每次買 5 顆雞蛋中劣質品的個數，請問：
 - a. 平均每買 5 顆蛋會有幾顆劣質品? (10%)
 - b. X 服從何種機率分配? (10%)
 - c. $X=1$ 的機率(10%)
 - d. $X \geq 4$ 的機率(10%)

※ 注意：1. 考生須在「彌封答案卷」上作答。

2. 本試題紙空白部份可當稿紙使用，試題須隨答案卷繳回。

3. 考生於作答時可否使用計算機、法典、字典或其他資料或工具，以簡章之規定為準。

科目：微積分

系組：統計資訊學系

年級：二

1. (40 %) Find each integral

(a) $\int \frac{e^x + e^{-x}}{e^x - e^{-x}} dx$

(b) $\int x \cos x dx$

(c) $\int x^2 e^{-2x} dx$

(d) $\int \frac{\ln x}{x} dx$

(e) $\int_0^1 \int_{2x}^2 e^{y^2} dy dx$

2. (10 %) Find $(1 - \frac{2^2}{2!} + \frac{2^4}{4!} - \frac{2^6}{6!} + \dots)^2 + (2 - \frac{2^3}{3!} + \frac{2^5}{5!} - \frac{2^7}{7!} + \dots)^2$ 3. (10 %) Use Newton's method to approximate the root of $x^3 + x - 4 = 0$, beginning with the given $x_0 = 1$ to find the two approximations x_1 and x_2 .4. (10 %) Find all relative extreme points and saddle points of $f(x, y) = x^2 + y^3 - 6x - 12y$.5. (10 %) Use differentials to approximate $\sqrt[3]{63}$ using the fact that $\sqrt[3]{64} = 4$.6. (10 %) Find the Taylor series at $x = 0$ for $\frac{e^x - 1}{x}$.7. (10 %) For the demand function $D(p) = \frac{300}{p}$, find the elasticity of demand. Determine whether the demand is elastic, inelastic, or unit-elastic at the given price $p = 4$.

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科目：經濟學

系組：統計資訊學系

年級：二

一、Multiple Choice (40%) (每題2分)

Assume that England and Holland can switch between producing milk and oats at a constant rate.

Table 1

	Number of Units Produced in an Hour	
	Milk	Oats
England	10	4
Holland	8	6

- Refer to Table 1. The opportunity cost of 1 Milk for England is
 - 2.5 Oats.
 - 0.1 hours of labor.
 - 0.4 Oats.
 - 0.25 hours of labor.
- Refer to Table 1. The opportunity cost of 1 Oats for Holland is
 - 0.75 Milk.
 - 0.125 hours of labor.
 - 1.33 Milk.
 - 0.167 hours of labor.
- Refer to Table 1. Given this, we know that
 - England has a absolute advantage in Milk and Oats.
 - Holland has a comparative advantage in Milk.
 - Holland has an absolute advantage in in Milk and Oats.
 - England has a comparative advantage in Milk.
- In a market economy,
 - supply determines demand and demand, in turn, determines prices.
 - demand determines supply and supply, in turn, determines prices.
 - supply and demand determine prices and prices, in turn, allocate the economy's scarce resources.
 - the allocation of scarce resources determines prices and prices, in turn, determine supply and demand.
- Which of the following would cause price to increase?
 - an increase in supply.
 - a decrease in demand.
 - surplus of the good.
 - shortage of the good.
- A decrease in the price of a good would
 - increase the supply of the good.
 - increase the quantity demanded of the good.
 - give producers an incentive to produce more to keep profits from falling.
 - shift the supply curve for the good to the left.

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科目：經濟學

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年級：二

7. Demand is said to have unit elasticity if the price elasticity of demand is
 - a. equal to 1.
 - b. greater than 1.
 - c. less than 1.
 - d. equal to 0.
8. Because the demand for wheat tends to be inelastic, the development of a new, more productive hybrid wheat would tend to
 - a. increase the total revenue of wheat farmers.
 - b. decrease the total revenue of wheat farmers.
 - c. decrease the demand for wheat.
 - d. decrease the supply of wheat.
9. In a labor market, a minimum wage is
 - a. a price ceiling and creates a labor shortage.
 - b. a price floors and creates unemployment.
 - c. nonbinding and creates a labor shortage.
 - d. nonbinding and creates neither a labor shortage nor unemployment.
10. A firm's opportunity costs of production are equal to its
 - a. explicit costs + implicit costs.
 - b. explicit costs only.
 - c. implicit costs only.
 - d. explicit costs + implicit costs + total revenue.
11. If a production function shows declining marginal product of an input as the quantity of the input increases, then the production function exhibits
 - a. diminishing profitability.
 - b. increasing returns to scale.
 - c. increasing marginal product.
 - d. diminishing marginal product.
12. Which of the following is a characteristic of a natural monopoly?
 - a. Fixed costs are typically a small portion of total costs.
 - b. Average total cost declines over large regions of output.
 - c. The product sold is a natural resource such as diamonds or water.
 - d. All of the above are correct.
13. Which of the following is not a characteristic of a public good?
 - a. Because it is a free good, there is no opportunity cost.
 - b. It is not excludable.
 - c. Its benefits cannot be withheld from anyone.
 - d. It is not diminished or depreciated as additional people consume the good.

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年級：二

14. When a U.S. citizen buys \$500 of Chinese-made parts for a motorcycle,
- U.S. consumption falls by \$500, U.S. net exports decline by \$500, and U.S. GDP declines by \$1000.
 - U.S. consumption increases by \$500, U.S. net exports remain the same, and U.S. GDP increases by \$500.
 - U.S. consumption does not change, U.S. net exports decline by \$500, and U.S. GDP declines by \$500.
 - U.S. consumption increases by \$500, U.S. net exports decline by \$500, and U.S. GDP remains the same.
15. Other things equal, relatively poor countries tend to grow
- slower than relatively rich countries; this is called the poverty trap.
 - slower than relatively rich countries; this is called the fall-behind effect.
 - faster than relatively rich countries; this is called the catch-up effect.
 - faster than relatively rich countries; this is called the constant-returns-to-scale effect.
16. Which list ranks assets from most to least liquid?
- currency, demand deposits, money market mutual funds.
 - currency, money market mutual funds, demand deposits.
 - money market mutual funds, demand deposits, currency.
 - demand deposits, money market mutual funds, currency.
17. If R represents the reserve ratio for all banks in the economy, then the money multiplier is
- $1/(1-R)$.
 - $1/R$.
 - $1/(1+R)$.
 - $(1+R)/R$.
18. The natural unemployment rate includes
- both frictional and structural unemployment.
 - neither frictional nor structural unemployment.
 - structural, but not frictional unemployment.
 - frictional, but not structural unemployment.
19. A basis for the slope of the short-run Phillips curve is that when unemployment is high there are
- downward pressures on prices and wages.
 - downward pressures on prices and upward pressures on wages.
 - upward pressures on prices and downward pressures on wages.
 - upward pressures on prices and wages.
20. The theory of liquidity preference is most helpful in understanding
- the wealth effect.
 - the exchange-rate effect.
 - the interest-rate effect.
 - misperceptions theory.

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年級：二

二、問答與計算(60%)

(須寫出推導或計算過程並說明理由，否則不予計分)

1. 假設蘋果市場之「需求與供給」函數分別為： $q=72-p$ 與 $q=-12+p$ 。
(p 、 q 分別為蘋果市場之價格與數量)。假設政府今對供給者每顆蘋果課徵 4 元的從量稅，則試問：
 - (1). 課稅前，蘋果市場的均衡價格與均衡數量為何？(6%)
 - (2). 在(1)的均衡結果下，消費者剩餘與生產者剩餘分別為多少？(6%)
 - (3). 課稅後，消費者每顆蘋果將多付多少錢？供給者每顆蘋果將少收多少錢？(6%)
 - (4). 政府之稅收收入為多少？(3%)
2. 小美平常很愛以炸雞和可樂當晚餐，並一定以 3 塊炸雞搭配 2 杯可樂的比例來消費，而超出比例之外多的炸雞或可樂並不會對小美帶來額外的滿足。假設炸雞每塊 15 元，而可樂每杯也 15 元，小美現在口袋有 150 元。試問：
 - (1). 利用一效用函數來刻劃小美對炸雞和可樂的消費偏好。(令 X =炸雞， Y =可樂) (9%)
 - (2). 請計算出小美最適的炸雞與可樂消費量。(6%)
3. 根據簡單凱因斯模型，假設消費函數為 $C=100+0.6(Y-T)$ ，計畫投資為 100，稅收為 100。試問：
 - (1). 當政府支出多少時，均衡所得為 2000。(6%)
 - (2). 此時政府支出乘數為多少？(6%)
4. 在凱因斯模型下，政府採行緊縮財政政策，將會造成均衡的利率、所得與物價分別產生何種變化？請利用 IS-LM 和 AD-AS 圖形繪圖說明。(12%)

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科目：統計學

系組：統計資訊學系

年級：三

1. 請寫下中位數的定義,用途,及優點。(10%)
2. 請寫下期望值的定義及用途。(10%)
3. 請寫下四分位距 (interquartile range, IQR) 的定義及用途。(10%)
4. 請問:
 - I. 在什麼情況下我們會稱兩個隨機變數不相關?(5%)
 - II. 在什麼情況下我們會稱兩個隨機變數獨立?(5%)
5. 根據某診所的經驗,來看診的病患為重症的比率為 10%,請問:
 - I. 連續兩個病患皆為重症的機率為何?(10%)
 - II. 診所每小時收 4 個病患,請問平均會有多少個重症患者?(10%)
 - III. 4 個病患中,完全沒有重症患者的機率?(10%)
 - IV. 4 個病患中,剛好有一半的重症患者的機率?(10%)
6. 在統計假設檢定中,何謂型一誤差?何謂型二誤差?(10%)
7. 某一車廠原廠大燈燈泡使用壽命為常態分配,標準差為 4 個月,一主管隨機抽取了公司內的 64 個大燈燈泡記錄,發現平均壽命為 30 個月,請問該燈泡平均壽命的 95%信賴區間為何($Z_{0.25}=-1.96$)?(10%)

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科目：微積分

系組：統計資訊學系

年級：三

1. (40 %) Find each integral

(a) $\int \frac{x^5}{x^6+1} dx$

(b) $\int_{-\infty}^{\infty} e^{-x^2/2} dx$

(c) $\int_0^{\infty} x^5 e^{-x/3} dx$

(d) $\int_0^1 x^4(1-x)^3 dx$

(e) $\int_{-1}^2 |2x-1| dx$

2. (20 %) Find the interval of convergence of each series

(a) $\sum_{n=0}^{\infty} \frac{(-1)^n x^n}{n!}$

(b) $1 + 2(x-3) + 3(x-3)^2 + 4(x-3)^3 + \dots$

3. (20 %)

(a) Approximate $e^{0.5}$ using the third Taylor polynomial for e^x , and estimate the error.(b) Find the Taylor series at $x=0$ for e^{-x^2} .4. (10 %) Minimize $f(x, y) = \ln(x^2 + y^2)$ subject to the constraint $2x + y = 25$.5. (10 %) Solve the differential equation and initial condition: $\frac{dy}{dx} = xy$
 $y(0) = 2$.

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