



本試題共有六大計算題，每題的配分如各題的開頭所顯示。

1. Suppose that a firm's production function is $Q=LK^2$. The per-unit prices of inputs L and K are \$60 and \$5, respectively.
 - a. (10 points) Determine the optimal combination of inputs and the minimum cost level if the firm wants to produce 3,888 units of output.
 - b. (10 points) The firm chooses the combination of (L, K) as $(12, 18)$ in order to produce 3,888 units of output. As a result, only 3,000 units of output are produced. Please evaluate the firm's allocative and technical efficiency, respectively.

2. The AA Company manufactures product X selling for \$2.98 each. Sales have averaged 10,000 units per month during the last year. Recently AA's closest competitor, BB Company, cut its prices on similar product from \$3.49 to \$2.59. AA noticed that its sales declined to 8,000 units per month after the price cut.
 - a. (5 points) What is the arc cross elasticity of demand between AA's and BB's products?
 - b. (10 points) If AA knows the arc price elasticity of demand for product X is -2.2 , what price would they have to charge in order to obtain the same level of sales as before BB's price cut?

3. (15 points) Two companies (A and B) are duopolists that produce identical products. Demand for the products is given by the following demand function:

$$P = 10,000 - Q_A - Q_B,$$
 where Q_A and Q_B are the quantities sold by the respective firms and P is the selling price. Total cost functions for the two companies are:

$$TC_A = 300,000 + 400Q_A + .5Q_A^2 \text{ and } TC_B = 100,000 + 200Q_B + Q_B^2$$
 Assume that the firms form a cartel to maximize total industry profits. Determine the optimum output and selling price for each firm.



4. Assume that an economy is characterized by the following equations:

$$C = 100 + \left(\frac{2}{3}\right) \cdot (Y - T)$$

$$T = 600$$

$$G = 500$$

$$I = 800 - \left(\frac{50}{3}\right) \cdot r$$

$$\left(\frac{M^s}{P}\right) = \left(\frac{M^d}{P}\right) = 0.5 \cdot Y - 50 \cdot r$$

Where C denotes consumption, Y denotes output, T denotes taxes, G denotes government spendings, I denotes investment, r denotes interest rate, M^s denotes money supply, M^d denotes money demand, and P denotes price.

- (4 points) Write the numerical IS curve for this economy, showing Y as a numerical function of r and other exogenous variables of this model.
 - (4 points) Write the numerical LM curve for this economy, showing r as a function of Y and other exogenous variables of this model.
 - (8 points) Solve for the equilibrium values of Y and r , and the corresponding consumption, and investment, assuming $P=1$ and $M=1200$. How do they change when $P=2$?
 - (4 points) Write the numerical aggregate demand curve for this economy, expressing Y as a function of P and other exogenous variables of this model.
5. Assume that in a small open economy with full employment, consumption depends only on disposable income. National saving is 300, investment is given by $I = 400 - 20 \cdot r$, where r is the real interest rate in percent, and the world interest rate is 10 percent.
- (4 points) If government spending rises by 100, does investment change? What is the level of investment after the change?
 - (4 points) Does the trade balance change if government spending rises by 100? If it changes, does it increase or decrease, and by how much?
 - (4 points) Does net capital outflow change if government spending rises by 100? If it changes, does it increase or decrease, and by how much?
 - (4 points) Will the real exchange rate rise, fall, or remain constant as a result of the change in government spending?



國立雲林科技大學 104 學年度
碩士班招生考試試題

系所：財金系、環安系、工管系
科目：經濟學

6. Consider an economy where savings follow the rule of thumb that they are a constant fraction s of income, i.e. $S_t = s \cdot Y_t$ with $s \in (0, 1)$. The production function is $Y_t = A_t \cdot L^{1/2}$, where Y denotes output, A denotes technology, L denotes labor, and the labor force is fixed at $L=1$. The growth rate of productivity is g , i.e. $A_{t+1} = (1+g) \cdot A_t$, with $A_0 = 1$. The government spends G_t each period and collects a lump-sum tax of T_t . The economy exists for three periods $t = 0, 1, 2$.
- (2 points) Find the path for private savings $S_t^{pr} = Y_t - T_t - C_t$ and public savings $S_t^{gov} = T_t - G_t$ if $G_t = T_t = 0$ for all t . (i.e. express private savings as a function of s and g .)
 - (2 points) Find the path for private savings if government spending is fixed at a fraction $p \in (0, 1)$ of GDP and the government is running a balanced budget every period. (i.e. express private savings as a function of s and g .)
 - (6 points) Now consider the case where the government spends $G_0 = p \cdot Y_0$ at period 0 and zero in all other periods, and collects taxes $T_2 = p \cdot Y_2$ in period 2 and zero in all other periods. Find private and public savings at each period. (i.e. express private and public savings at each period as a function of s , p and g .)
 - (2 points) Is there Ricardian equivalence in this economy?
 - (2 points) Now assume that aggregate savings S is allowed to depend on G (as well as Y as before.) Find a dependence that S must have on G , so that Ricardian equivalence holds in this economy.



國立雲林科技大學 104 學年度
碩士班招生考試試題

系所：工管系
科目：計算機概論(2)

1. (5%) 說明何謂 HTML 及其重要性？
2. (5%) 將十進位數字 427 轉換為二進位數字(需詳列處理過程)
3. (5%) 說明何謂 SaaS？請舉出五例。
4. (5%) 簡述何謂 Moore's Law (摩爾定律)
5. (5%) 說明何謂分時處理(Time sharing)？
6. (5%) 簡述電腦有哪些特性？
7. (5%) 說明作業系統的功能為何？
8. (5%) 主從架構中，說明何謂 n-tier 運算架構？
9. (5%) 物件導向程式設計中，何謂「同名異式」？
10. (5%) 說明何謂巨量資料(big data)，其擁有哪些特性，應用性為何？
11. (5%) 說明何謂結構化程式設計？
12. (5%) 以網路資訊倫理來說，請針對資訊隱私權、資訊正確性、智慧財產權等問題及如何防範進行說明？
13. (20%) 請用任何程式語言完成下列程式，作答時請先註明使用哪種程式語言的語法：
要求使用者輸入一整數 n，並計算 $1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \dots + \frac{1}{n!}$ ， $n! = 1 \times 2 \times 3 \times \dots \times n$ ，執行結果如下：

```
Please input a integer greater than 0:6
The resulte is 2.718056
```



14. 若要將以下資料分析整理為一訂單資料庫，請完成下述四個問題：

customerID	顧客 ID
itemID	品項 ID
orderID	訂單 ID
customerLastName	顧客姓
customerFirstName	顧客名
itemName	品項名稱
itemPrice	品項單價
orderSequel	訂單項次 (整數，一訂單可訂購多品項)
orderItemID	訂購項目
orderQuantity	訂購數量
orderDate	訂購日期
orderAddress	送貨地址

- (4%) 分析這些資料有哪些資料實體(Entity)?請為每一實體命名並列舉其資料項。
- (4%) 分析並繪出實體關聯圖。
- (6%) 建立資料庫正規化的資料表，請註明各資料表的主鍵為何?
- (6%) 如欲查詢客戶 ID 為 c201501 所有的訂單 ID 及其全部訂購品項 ID，如下表範例所示，應該用何 SQL 指令?

OrderID	OrderItemID
1	0131828274
1	0131525239
2	0132404168
3	0131525239
3	0131857576
3	0131828274

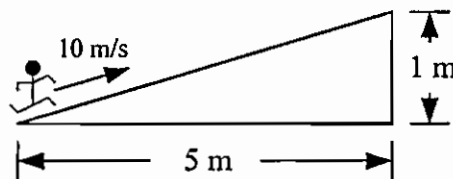


每題 6.25 分

1. The number N of locations of a popular coffeehouse chain is given in the table. Please estimate the instantaneous rate of growth in 2012.

Year	2010	2011	2012	2013	2014
N	8569	10241	12440	15011	16680

2. A man run over the ramp (as the figure) at a speed of 10 m/s. How fast is the man rising as he leaves the ramp?



3. For the limit $\lim_{x \rightarrow \infty} \frac{x+4}{x^2-2x+5} = 0$, please find the a number of x ($x > 0$) that correspond to the allowed error of the value of limit $\varepsilon = 0.1$.
4. A manufacturer has been selling 1000 flat-screen TVs a week at \$450 each. A market survey indicates that for each \$10 rebate offered to the buyer, the number of TVs sold will increase by 100 per week. If the weekly cost function is $C(x) = 68000 + 150x$, Please find the production level that will maximize profit.
5. For a right circular cylinder is inscribed in a sphere of radius r , please find the largest possible volume of such a cylinder.
6. If a function $f(x) = x^3 + 3\sin x + 2\cos x$. Please find the slope of the inverse function of $f(x)$ at $x = 2$.
7. Please express the exponential number e as a limit.
8. Find the horizontal asymptote of the function $f(x) = \left(\frac{2x-3}{2x+5}\right)^{2x+1}$



9. Evaluate $\lim_{h \rightarrow -4} \frac{\sqrt{h^2+9}-5}{h+4}$
10. Find $\iint_D xy d_A$, where D is the region enclosed by the line $y=x-1$ and parabola $y^2=2x+6$
11. Evaluate the integral $\int_0^1 \frac{x^3}{\sqrt{4+x^2}} dx$
12. Find the inverse $f^{-1}(x)$ of the function $f(x) = \sqrt{x^2 + 2x}$, $x > 0$
13. Evaluate $\int_{-\infty}^0 xe^x dx$
14. Evaluate the integral $\int \frac{x^2+2x-1}{x^2-x} dx$
15. $z = e^{x+2y}$, $x = s/t$ $y = t/s$, use the Chain Rule to find $\frac{\partial z}{\partial t}$
16. (證明題)–須列出證明過程 f is a differentiable function of x and y . Prove that the maximum value of the directional derivative $D_u f(x, y)$ occurs when the unit vector \mathbf{u} has the same direction as the gradient vector $\nabla f(x)$
 [提示: $\mathbf{u} \cdot \mathbf{v} = \|\mathbf{u}\| \|\mathbf{v}\| \cos \theta$, where θ is the angle between vector \mathbf{u} and vector \mathbf{v}]


Part A 試題說明：

1. Part A 試題共有 9 題選擇題，其中 4 題單選題(題號：A-1 至 A-4)，5 題複選題(題號：A-5 至 A-9)。
2. 單選題每題 5 分(共 20 分)，複選題每題 6 分(共 30 分)。Part B 試題合計 50 分。
3. 單選題請以最接近的答案選答，複選題須完全答對才計分。

A-1. (單選題) 某公司過去第一期至第四期的實際銷售量，依序分別為：40、50、35、40。則下列敘述何者正確？

- (A) 若採用指數平滑法預測，假設 $F_2=A_1$ 及 $\alpha=0.0$ 時，則第五期的預測值為 50
 (B) 若採用指數平滑法預測，假設 $F_2=A_1$ 及 $\alpha=0.5$ ，則 $MAD=0$
 (C) 若採用指數平滑法預測，假設 $F_2=A_1$ 及 $\alpha=1.0$ 時，則第五期的預測值為 35
 (D) 若採用指數平滑法預測，假設 $F_2=A_1$ 及 $\alpha=0.5$ ，則第五期預測值與第四期預測值相同
 (E) 若採用簡單移動平均法且假設 $n=3$ 時，則第五期的預測值為 38

A-2. (單選題) 能夠達成大量生產以增加生產效能，同時亦可兼顧客戶特殊規格需求，以達到客製化生產的目的。採用下述何種方法最為適合？

- (A) 可行性分析(Feasibility Analysis) (B) 逆向工程(Remove Engineering)
 (C) 強韌化設計(Robust Design) (D) 延遲差異化設計(Delayed Differentiation)
 (E) 損益平衡分析(Break-Even Analysis)

A-3. (單選題) 某產品之年需求量為 5000 件，該產品需使用機器 B 進行加工，其加工時間為每件 1.5 小時。機器 B 加工時所產生的不良品率為 20%，且不良品均報廢。機器 B 的設計產能(Design Capacity)為每年每台 2500 小時、機器 B 的有效產能(Effective Capacity)為每年每台 2200 小時、機器 B 去年的實際產出(Actual Output)為每年每台 2000 小時。依據前述資料，計算機器 B 需求台數？

- (A) 3 台 (B) 4 台 (C) 5 台 (D) 6 台 (E) 7 台

A-4. (單選題) 醫院中開刀房內的佈置理念與下述何種佈置的理念最為相似？

- (A) 汽車裝配線佈置 (B) U 型生產線佈置 (C) 彈性製造系統佈置 (D) 加護病房佈置
 (E) 群族式佈置

A-5. (複選題) 某公司一年四季的需求量呈現規則循環現象，且僅知第一季至第三季的季節指數，依序分別為：0.7、1.2、1.3。近幾年來，公司每年的年需求量均呈現直線的變化，去年整年的需求為 1800，今年整年的需求為 2100。以上述資料為預測基礎，則下列敘述何者正確？

- (A) 第四季的季节指數為 0.8 (B) 第四季的季节指數為 0.93
 (C) 明年第四季需求預測值為 420 (D) 明年第四季需求預測值為 480
 (E) 連續三年(去年、今年、及明年)的第四季需求呈現直線的增加

A-6. (複選題) 公司對於各類平價電腦產品，均採用相同的散熱電扇設計。此設計理念與下述哪兩種觀念最為接近？

- (A) Robust 設計 (B) Standardization 設計 (C) Interchangeable Parts 設計
 (D) Supply-Chain Based 設計 (E) Sustainability 設計



- A-7. (複選題) 某公司若自製 A 產品，則需固定成本 10,000 元、變動成本 20 元/件。以損益平衡分析(Break-Even Analysis, Cost-Volume Analysis)概念，選擇下列正確的敘述。
- (A)損益平衡分析假設固定成本、單位變動成本、及售價等三項都沒有數量折扣(指保持定值)
 (B)損益平衡分析的數量均不考量庫存量，即假設生產數量就等於銷售數量
 (C)若銷售量預計達到 1,000 且預計獲利大於 5,000 元，則售價應低於 35 元/件
 (D)若單價為 60 元/件且預計獲利 2000 元，則銷售量應為 300 件
 (E)若設定銷售 800 件就可達到損益平衡點，則售價應訂為 32.5 元/件
- A-8. (複選題) 假設生產線在原料充分供給下正常生產。有關生產線平衡的方法及生產線運作的現象，下列敘述何者正確?
- (A)指派作業單元(Task)時，必需確保該工作站的作業時間總和不可超出規劃週期時間(Target Cycle Time)
 (B)實際生產時，所謂生產線的瓶頸工作站，是指工作站作業時間最短的工作站
 (C)實際生產時，瓶頸工作站之後的工作站，可能有閒置時間
 (D)實際生產時，生產線中作業時間最長的工作站，其使用率可達 100%
 (E)實際生產時，生產線的實際週期時間(Actual Cycle Time)是指工時最長的工作站之作業時間
- A-9. (複選題) 有關選址決策及選址方法的敘述，下列敘述何者正確?
- (A)選址決策是屬於長期的決策
 (B)若比較製造業與服務業在選址時的考量因素：則製造業選址著重考慮與成本(Cost)相關的因子、服務業選址著重考慮與收益(Revenue)相關的因子
 (C)Center of Gravity Method 是以多重目標考量下，推算最佳的位址座標
 (D)Transportation Model 方法是採用單一的目標做為選址的依據
 (E)Factor Rating Method 可以綜合考慮量化及非量化等多種因子(例如：成本、氣候、環境、治安等)做為選址依據
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Part B 試題說明：

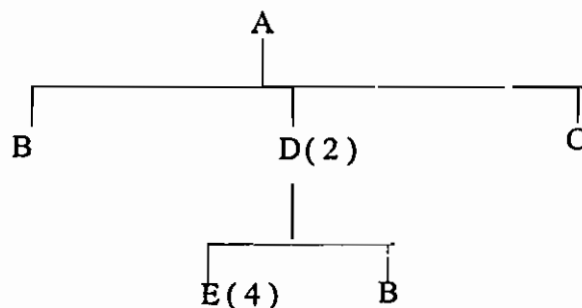
Part B 試題共有兩題計算題，每一題 25 分。

B-1. Demands of a cake shop during last 10 days are 30, 30, 20, 10, 40, 30, 40, 40, 10, 40. Assume it costs \$6 to prepare each cake. Fresh cake sell for \$10, and day-old cakes sell for \$2each.

- What is the optimal quantity that cake should be prepared in each day? (15%)
- What is the expected cost of preparing 20 cakes? (10%)

B-2. Assumed the computer of a company breakdown just after it generated the following information: Planned order release for item E = 800 units in week two. The company can reconstruct all the information they lost except the master schedule for end product A. The company is fortunate because item E is used only in A. Given the following product structure tree and associated inventory status record information, determine what master schedule entry for A was exploded into the material requirement plan that killed the computer. (25%)

Part #	On hand	Lot size	Lead time
Inventory			
A	10	Lot-for lot	1 week
B	40	Lot-for lot	2 week
C	80	Lot-for-lot	1 week
D	50	Lot-for-lot	2 week
E	40	Lot-for-lot	1 week





1. Consider a linear programming problem with three " \leq " constraints and two variables x_1 and x_2 . The right-hand sides are $b_1 = 11$, $b_2 = 14$, and $b_3 = 18$, respectively. Let s_i denote the slack variable of constraint i ($i = 1, 2, 3$). Regarding these slack variables, only s_3 is a basic variable that has a RHS of 10 in the optimal tableau. Please answer the following questions:
 - (a) Determine the range of values of b_3 for which the current basis remains optimal. (5%)
 - (b) Determine the shadow price associated with the third constraint with a brief explanation. (5%)
 - (c) Determine the reduced costs of x_1 and x_2 with a brief explanation. (6%)
 - (d) If this is a "maximization" problem with a unique solution, determine the conditions of the reduced costs of s_i ($i = 1, 2, 3$) in the optimal tableau. (9%)
2. The demands of YunTech company during the next four seasons are 50, 40, 60, and 70. In the beginning, YunTech company has 10 units on hand. Backlogging is not allowed. Production costs are \$5, \$3, \$6, \$4 during the next four seasons. The inventory cost from one season to the next is \$2 per unit. Each inventory worths a residual value \$3 at the end of the fourth season. Answer the following questions to minimize YunTech's costs (do not derive the optimal solutions of the problems).
 - (a) Formulate the YunTech's production problem as a linear programming problem. (10%)
 - (b) Suppose the a fixed cost \$150 is incurred during each season when production takes place. Revise the YunTech's production problem as a mixed integer programming problem. (8%)
 - (c) If the production in the second season exceeds 50 units, the production in the third season must also exceed 50 units. Revise the formulation of Part (b). (7%)



3. Consider a manufacturing stage consisting of one machine, named as primary machine. When the primary machine is operable (up), it produces 1000 units per day. If the primary machine is up at the start of a day, then it fails at the end of the day with probability 0.3. When primary machine fails, it is repaired immediately and the repair is completed at the end of the next day:
- Model the manufacturing stage as a Markov chain with suitable states. Find the expected number of units produced per day in the steady state. (%10)
 - If it takes two days to repair the primary machine, modeling the manufacturing stage as a Markov chain with suitable states, find the expected number of units produced per day in the steady state. (%15)
 - Assume that the system has two repairmen and the repair of a machine is conducted by one repairman. Now, it takes two days to repair the primary machine. Besides the primary machine, there is a standby machine which takes care the manufacturing responsibility only if the primary machine is inoperable (i.e., under repair). The daily output of the standby machine is 800 units. If the standby machine is up manufacturing at the start of a day, then it fails at the end of the day with probability 0.1. When standby machine fails, it is repaired immediately and the repair is completed at the end of the next day.
 - This system can be modeled as a Markov chain. Define the state of the Markov chain, the state space, and derive the transition probability matrix. (%15)
 - Assume you have found the steady state distribution of this Markov chain, give the expression of the expected number of units produced per day in steady state in terms of steady state distribution. (%10)



(一) 概念性選擇題：單選題，每題 2 分。

1. A 95% confidence interval for a population mean is determined to be 100 to 120. If the confidence coefficient is reduced to 0.90, the interval for μ
 - (A) becomes narrower
 - (B) becomes wider
 - (C) does not change
 - (D) becomes 0.1
2. After computing a confidence interval, the user believes the results are meaningless because the width of the interval is too large. Which one of the following is the best recommendation?
 - (A) Increase the level of confidence for the interval.
 - (B) Decrease the sample size.
 - (C) Increase the sample size.
 - (D) Reduce the population variance.
3. In determining the sample size necessary to estimate a population proportion, which of the following information is **not** needed?
 - (A) The maximum margin of error that can be tolerated.
 - (B) The confidence level required.
 - (C) A preliminary estimate of the true population proportion.
 - (D) The mean of the population.
4. When the level of confidence decreases, the margin of error
 - (A) stays the same.
 - (B) becomes smaller.
 - (C) becomes larger.
 - (D) becomes smaller or larger, depending on the sample size.
5. The power curve of a hypothesis test provides the probability of
 - (A) correctly accepting the null hypothesis.
 - (B) incorrectly accepting the null hypothesis.
 - (C) correctly rejecting the alternative hypothesis.
 - (D) correctly rejecting the null hypothesis.



6. Which of the following does **not** need to be known in order to compute the p -value?
- (A) Knowledge of whether the test is one-tailed or two-tailed.
 - (B) The value of the test statistic.
 - (C) The level of significance.
 - (D) None of these alternatives is correct.
7. The average life expectancy of tires produced by the Whitney Tire Company has been 40,000 miles. Management believes that due to a new production process, the life expectancy of their tires has increased. In order to test the validity of their belief, the correct set of hypotheses is
- (A) $H_0: \mu < 40,000$ $H_a: \mu \geq 40,000$
 - (B) $H_0: \mu \leq 40,000$ $H_a: \mu > 40,000$
 - (C) $H_0: \mu > 40,000$ $H_a: \mu \leq 40,000$
 - (D) $H_0: \mu \geq 40,000$ $H_a: \mu < 40,000$
8. An important application of the chi-square distribution is
- (A) making inferences about a single population variance.
 - (B) testing for goodness of fit.
 - (C) testing for the independence of two variables.
 - (D) All of these alternatives are correct.
9. In regression analysis, which of the following is **not** a required assumption about the error term ε ?
- (A) The expected value of the error term is one.
 - (B) The variance of the error term is the same for all values of X .
 - (C) The values of the error term are independent.
 - (D) The error term is normally distributed.
10. If the coefficient of determination is a positive value, then the regression equation
- (A) must have a positive slope.
 - (B) must have a negative slope.
 - (C) could have either a positive or a negative slope.
 - (D) must have a positive y intercept.



(二) 計算性選擇題：單選題，每題 5 分。

11. Consider a situation in which a used-car store contains five **Honda**, four **Mazda**, and five **Toyotas**. If five cars are selected at random to be placed on a special sale, what is the probability that three are **Honda** and two are **Mazda**?
- (A) 0.09 (B) 0.03 (C) 0.04 (D) 0.06
12. A new phone answering system installed by the Chunghwa Telecom Company is capable of handling five calls every 10 minutes. Prior to installing the new system, company analysts determined that the incoming calls to the system are Poisson distributed with a mean equal to two every 10 minutes. If this incoming call distribution is what the analysts think it is, what is the probability that in a 10-minute period more calls will arrive than the system can handle?
- (A) 0.0166 (B) 0.0812 (C) 0.174 (D) 0.0233
13. A police officer wants to estimate the true proportion of all drivers who exceed the speed limit on a certain stretch of road where accidents frequently happen. How large should the sample to be so that, with 95 percent confidence, the sample proportion will not differ from the true proportion by more than .027?
- (A) 673 (B) 36 (C) 1318 (D) 899
14. A discrete random variable X has the probability function
- $$p(x) = k(1/2)^x \quad x = 1, 2, 3$$
- What is the mean of X ?
- (A) $\frac{11}{32}$ (B) $\frac{21}{16}$ (C) $\frac{15}{12}$ (D) $\frac{11}{7}$

(三) 計算題，每題 10 分。

15. (10%) According to recent surveys, 60% of teenagers have mobile phones. If a random sample of 180 teenagers is selected, what is the probability that fewer than 100 have a mobile phone?



16. (10%) The manager of a Food company has found that a case of cans that have not been properly sealed. There are three lines that processed cans of this type, and the manager wants to know which line is most likely to be responsible for this mistake. Provide the manager this information.

Line	Contribution to total	Proportion defective
1	0.40	0.05
2	0.35	0.10
3	0.25	0.07

17. (10%) Two automatic dispensing machines are being considered for use in a fast-food chain. The first dispenses an amount of liquid that has a normal distribution with a mean of 11.9 ounces and a standard deviation of 0.07 ounces. The second dispenses an amount of liquid that has a normal distribution with a mean of 12.0 ounces and a standard deviation of 0.05 ounces. Acceptable amounts of dispensed liquid are between 11.9 and 12.0 ounces. Calculate the relevant probabilities and determine which machine should be selected.
18. (10%) Shown below is a portion of a computer output for regression analysis relating Y (dependent variable) and X (independent variable).

ANOVA		
	<i>df</i>	<i>SS</i>
Regression	1	110
Residual	8	74
Total	9	184

	<i>Coefficients</i>	<i>Standard Error</i>
Intercept	39.222	5.943
x	-0.5556	0.1611

- (a) What has been the sample size for the above?
- (b) Perform a t-test and determine whether or not X and Y are related. Let $\alpha = 0.05$.
- (c) Perform an F test and determine whether or not X and Y are related. Let $\alpha = 0.05$.
- (d) Compute the coefficient of determination and interpret its meaning.



19. (10%) Five drivers were selected to test drive two makes of automobiles. The following table shows the number of miles per gallon for each driver driving each car.

Automobile	Drivers				
	1	2	3	4	5
A	30	31	30	27	32
B	36	35	28	31	30

Consider the makes of automobiles as treatments and the drivers as blocks, test to see if there is any difference in the miles/gallon of the two makes of automobiles. Let $\alpha = .05$.

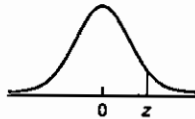
20. (10%) Suppose that two independent random samples of n_1 and n_2 observations are selected from normal populations. Assume that the populations possess a common variance σ^2 . Let

$$S_i^2 = \frac{\sum_{j=1}^{n_i} (Y_{ij} - \bar{Y}_i)^2}{n_i - 1} \quad i = 1, 2$$

- (a) Show that the pooled estimator of σ^2 , given below, is unbiased.

$$S^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}$$

- (b) Find $V(S^2)$.


 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.

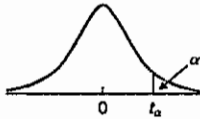


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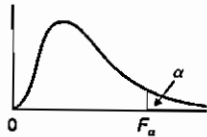
TABLE IV
Values of t_α



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 VIII
Values of F_α



dfd	α	dfn								
		1	2	3	4	5	6	7	8	9
1	0.10	39.86	49.50	53.59	55.83	57.24	58.20	58.91	59.44	59.86
	0.05	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54
	0.025	647.79	799.50	864.16	899.58	921.85	937.11	948.22	956.66	963.28
	0.01	4052.2	4999.5	5403.4	5624.6	5763.6	5859.0	5928.4	5981.1	6022.5
	0.005	16211	20000	21615	22500	23056	23437	23715	23925	24091
2	0.10	8.53	9.00	9.16	9.24	9.29	9.33	9.35	9.37	9.38
	0.05	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38
	0.025	38.51	39.00	39.17	39.25	39.30	39.33	39.36	39.37	39.39
	0.01	98.50	99.00	99.17	99.25	99.30	99.33	99.36	99.37	99.39
	0.005	198.50	199.00	199.17	199.25	199.30	199.33	199.36	199.37	199.39
3	0.10	5.54	5.46	5.39	5.34	5.31	5.28	5.27	5.25	5.24
	0.05	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81
	0.025	17.44	16.04	15.44	15.10	14.88	14.73	14.62	14.54	14.47
	0.01	34.12	30.82	29.46	28.71	28.24	27.91	27.67	27.49	27.35
	0.005	55.55	49.80	47.47	46.19	45.39	44.84	44.43	44.13	43.88
4	0.10	4.54	4.32	4.19	4.11	4.05	4.01	3.98	3.95	3.94
	0.05	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00
	0.025	12.22	10.65	9.98	9.60	9.36	9.20	9.07	8.98	8.90
	0.01	21.20	18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.66
	0.005	31.33	26.28	24.26	23.15	22.46	21.97	21.62	21.35	21.14
5	0.10	4.06	3.78	3.62	3.52	3.45	3.40	3.37	3.34	3.32
	0.05	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77
	0.025	10.01	8.43	7.76	7.39	7.15	6.98	6.85	6.76	6.68
	0.01	16.26	13.27	12.06	11.39	10.97	10.67	10.46	10.29	10.16
	0.005	22.78	18.31	16.53	15.56	14.94	14.51	14.20	13.96	13.77
6	0.10	3.78	3.46	3.29	3.18	3.11	3.05	3.01	2.98	2.96
	0.05	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10
	0.025	8.81	7.26	6.60	6.23	5.99	5.82	5.70	5.60	5.52
	0.01	13.75	10.92	9.78	9.15	8.75	8.47	8.26	8.10	7.98
	0.005	18.63	14.54	12.92	12.03	11.46	11.07	10.79	10.57	10.39
7	0.10	3.59	3.26	3.07	2.96	2.88	2.83	2.78	2.75	2.72
	0.05	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68
	0.025	8.07	6.54	5.89	5.52	5.29	5.12	4.99	4.90	4.82
	0.01	12.25	9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.72
	0.005	16.24	12.40	10.88	10.05	9.52	9.16	8.89	8.68	8.51
8	0.10	3.46	3.11	2.92	2.81	2.73	2.67	2.62	2.59	2.56
	0.05	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39
	0.025	7.57	6.06	5.42	5.05	4.82	4.65	4.53	4.43	4.36
	0.01	11.26	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91
	0.005	14.69	11.04	9.60	8.81	8.30	7.95	7.69	7.50	7.34