



注意：請按照題號及子題號順序作答；不按題號順序作答不以計分。

1. Consider the following integer programming problem:

$$(\text{IP}) \begin{cases} \max & 8x_1 + 5x_2 \\ \text{s.t} & 24x_1 + 15x_2 \leq 156 \\ & 4x_1 + 16x_2 \leq 26 \\ & x_1, x_2 \geq 0, x_1, x_2 \text{ integer} \end{cases}$$

Let's denote (LPR) as the LP relaxation of (IP) and you are asked to use Branch-and-Bound to solve (IP).

- (a) Use Simplex (**tableau**) Method (denoting the slack/excess variables as  $x_3, x_4, x_5, \dots$ ) to solve (LPR) by setting the origin as the initial solution. If there is tie in the entering or leaving variable, please select the **smallest** index one. (10%)
- (b) What kind of properties can you say about the optimal solution in (a)? (5%)
- (c) What is the **dual** problem of (LPR)? Use the primal optimal solution of (LPR) in (a) and the **Theorem of Complementary Slackness** to find a dual optimal solution of (LPR). (10%)
- (d) Use the dual optimal solution in (c) to find (please calculate it **step by step**) the optimal tableau of the dual of (LPR). (10%)
- (e) According to the solution in (a), what is the **current bound** of (IP)? What is the **branching variable**? By branching this variable, what are the two constraints you have to add into (LPR) to create two subproblems (LPR<sub>1</sub>) and (LPR<sub>2</sub>)? (5%)
- (f) Convert (LPR<sub>1</sub>) and (LPR<sub>2</sub>) to their dual problems and use the (dual (LPR)) optimal tableau in (d) by conducting **sensitivity analysis** to solve the dual problems of (LPR<sub>1</sub>) and (LPR<sub>2</sub>), respectively. (10%)
- (g) According to the (dual) solutions in (f), what can you say about the primal optimal solutions of (LPR<sub>1</sub>) and (LPR<sub>2</sub>), and please state your reasons. (5%)
- (h) Give the **solution tree** after the first iteration of Branch-and-Bound for (IP) by using the solution in (a) and (g), please state your reasons for each subproblem. (5%)



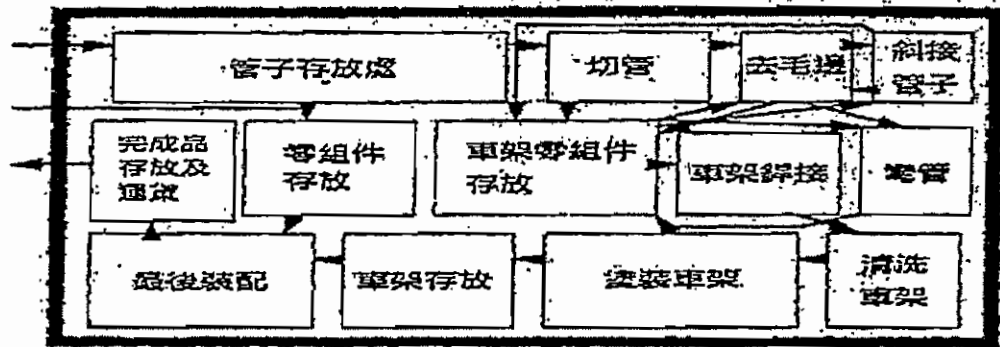
2. An  $(s, S)$  inventory control system is to place an order when the inventory level of the system drops below  $s$  (less than  $s$ ) and the order size is such that when the replenishment arrives, it will bring the inventory level up to level  $S$ . Let  $D$  be the demand size for the items in each day where  $P(D = 0) = 0.3, P(D = 1) = 0.3, P(D = 2) = 0.4$ . The inventory status is checked at the end of each day and the replenishment of the inventory is placed immediately if needed. The set up cost for each replenishment is \$5. Assume that lead time for each replenishment is 1 days. Thus if an order is placed at the end of day 1, replenishment of the order will arrive at the end of day 2 before the inventory status is updated. When the demand cannot be met from the shelf, the demand is lost. Assume that each item costs \$10 the holding cost rate per item per day is \$1 and there is a penalty cost of \$4 per item for each lost demand. (20%)
- Define the state of the system, draw the transition probability diagram and write down the set of balance equations (Do not solve this set of equations).
  - Define your own notations for the limiting distribution and give the expression of the average cost per day in terms of limiting distribution.  $(s, S) = (1, 3)$
3. One bakery store has a policy of selling only cakes of at most two days old. Thus, any cake that can not be sold within two days after it coming out of the oven is discarded. The demand,  $X_i$  for the cakes in day  $i$  before Mother's day ( $i = 2, 1, 0$ ) has probability distribution :  $P(X_2 = 1) = 0.3, P(X_2 = 2) = 0.4, P(X_2 = 3) = 0.2, P(X_2 = 4) = 0.1,$   
 $P(X_1 = 1) = 0.2, P(X_1 = 2) = 0.3, P(X_1 = 3) = 0.3, P(X_1 = 4) = 0.2,$  ,  $P(X_0 = 3) = 0.2, P(X_0 = 4) = 0.3, P(X_0 = 5) = 0.3, P(X_0 = 6) = 0.2$ . Assume that the demand for cakes on the day after the Mother's day is zero and number of cakes on hand at the end of day 3 before Mother's day is 0. The cost of each discarded cake is \$150 and the penalty cost of each unsatisfied demand is  $P_i$  on day  $i$  where  $P_2 = 30, P_1 = 50, P_0 = 100$ . Cakes are made at the end of the day and the bakery store needs to determine the number of cakes to make at the end of each day,. Formulate and solve this problem as a dynamic programming to minimize the total cost. (20%)



1. 某公司某產品過去十二期之銷售量如下表所示，請問您將使用何方法來預測未來三期（13-15 期）之銷售量（您不必算出預測值但請說明您之理由）？您將如何來驗證此方法之正確性？（10%）

期數	1	2	3	4	5	6	7	8	9	10	11	12
銷售量	16	20	22	13	15	19	21	14	17	22	24	15

2. 某工廠生產自行車之佈置圖如下所示，請問此佈置屬於何種類型之佈置？此佈置之缺點為何？試提出您之改善方案與改善做法。（15%）



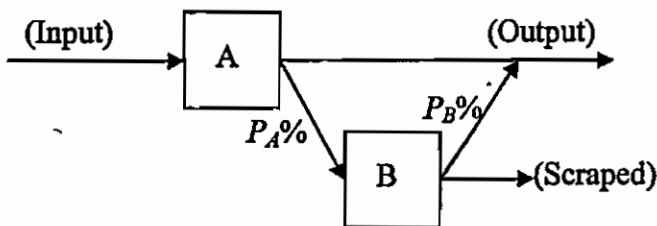
3. 某工廠某期間共收到五張訂單，每一訂單均經兩工作站加工，且加工程序均須先經第一工作站加工。五張訂單在各工作站之加工時間（單位：小時）如下表所示：

訂單	A	B	C	D	E
工作站一	10	4	6	4	2
工作站二	5	6	6	3	4

- (a) 依 FCFS 順序(A-B-C-D-E)生產之總完工時間為何？工作站二之閒置時間為何？(5%)
- (b) 依 Johnson 法則安排生產則生產之順序為何？總完工時間為何？工作站二之閒置時間為何？(10%)
- (c) 若依 Johnson 法則安排生產且每一訂單均可分兩小批生產與搬運，則那些訂單之分批搬運對總完工時間有幫助？總完工時間為何？工作站二之閒置時間為何？(10%)



4. A manufacturing process is described in the following Figure. Machine A is the normal production process with a scrap rate  $P_A\%$ . Machine B is a special rework process for the products rejected from machine A. If the product can be fixed by machine B, it will go to the output area for next process. However, only  $P_B\%$  of the products can be successfully fixed by machine B. The detailed manufacturing data is collected and summarized in the following Table.



Process ID	Scrap Rate (%)	Standard Operating Time (hours per product)	Machine Working Hours per Year
Machine A	$P_A\%$	$T_A$	$H_A$
Machine B	$1 - P_B\%$	$T_B$	$H_B$

- (a) If the yearly input quantity is  $Q$ , derive number of machine required for machine A and machine B, respectively. (5%)
- (b) If the yearly output quantity is  $K$ , derive number of machine required for machine A and machine B, respectively. (10%)
- (c) If allowance percentage ( $W\%$ ) and efficiency percentage ( $E\%$ ) are considered, modify the answers derived in question (a). (5%)
5. A store manager is searching for a low cost inventory system for a specific on sale merchandise. Sales records and purchasing information have been collected as follows: Daily demand is firm on 30 and cost of processing one purchase order is \$1500. Lead time for processing a purchase order needs 10 days and holding one unit for a year costs \$10. Assume 5 working days per week and 50 weeks per year.
- (a) If a fixed-order-quantity (economic order quantity) inventory system is considered, find the order quantity which will balance the annual ordering cost and the annual holding cost. What is the safety stock in this situation? (10%)
- (b) Consider a specific fixed-order-interval inventory system which has 40-day period for a replenishment cycle. The amount to order is determined by the following equation:
- $$\text{Order Quantity} = (\text{Demand during Order Interval and Lead Time}) + (\text{Safety Stock}) - (\text{Amount On Hand at Reorder Time})$$
- Evaluate this inventory system from cost view point. Compare this inventory system with the fixed-order-quantity system. What is your recommendation? (10%)
- (c) If a two-bin inventory system is considered, find the minimal bin size and calculate the total annual cost in this situation using the data collected for this merchandise. (10%)



## 一、(24%) 請說明以下名詞或概念

- (1) Class and Object
- (2) Inheritance
- (3) Collaboration diagram and Sequence diagram
- (4) Queue
- (5) Relational database
- (6) ASP or JSP (擇一說明)
- (7) 3-Tier architecture
- (8) Multiprogramming and multitasking

## 二、有一學生課程的評分系統，目的為建立成績冊並完成學生成績登錄及評分的工作。系統的評分作業處理主要分成四部份，依作業流程順序分別為：1. 建立成績冊 2. 評定學生的作業成績 3. 評定最後成績 4. 產生成績報告。各項作業處理說明如下：

- 1) 由學生紀錄系統讀取修課班級學生名單，並由老師輸入評分參數，以建立成績冊。
- 2) 由學生的繳交的作業，評定學生的作業成績，將作業的評分成績交給學生，並登錄成績於成績冊內。
- 3) 依據學生的成績冊內作業成績及評分參數，評定最後成績，並將結果記錄於成績冊內及傳回給學生紀錄系統。
- 4) 最後依據學生的成績冊內的成績紀錄，產生成績報告給老師。

請回答下列問題：

1. (4%) 依評分系統的作業描述，請找出系統的外部實體及資料儲存。
2. (18%) 依作業流程的順序，繪製評分系統的資料流程圖(DFD, data flow diagram)。
3. (8%) 請解說資料流程圖的分層技術及何謂平衡的資料流程圖。



三、 承上題，由成績的評分系統，可以延伸建立學生「成績查詢模組」，其查詢的報表如下圖所示。請回答下列問題：

1. (4%) 請定義以下術語：主鍵、備選鍵、次級鍵及外來鍵。
2. (16%) 請由成績查詢報表歸納出相關實體及屬性，並繪出實體關係圖及產生正規化後之關聯表。

成績查詢結果					
學期：		學生姓名：		學號：	
課號	課程名稱	選必修	學分數	授課老師	成績
總修課學分：		實得學分：		學期平均成績：	

四、 (26%) 類別設計

「有理數」為任意可以用  $\frac{q}{p}$  表示之數值，此處  $p$  與  $q$  為整數( $p \neq 0$ )。請以任何程式語言設計有理數類別(Rational)，包括其「屬性」(attribute)及以下之「成員函數」/方法(Method):

- (1) void reduce(): 將有理數  $\frac{q}{p}$  化簡為最簡分數，例如  $\frac{6}{9}$  應化簡為  $\frac{2}{3}$ 。
- (2) Rational add(Rational r): 加上有理數物件 r，並將最簡結果傳回。
- (3) Rational subtract(Rational r): 減去有理數物件 r，並將最簡結果傳回。
- (4) Rational multiply(Rational r): 乘上有理數物件 r，並將最簡結果傳回。
- (5) Rational divide(Rational r): 除以有理數物件 r，並將最簡結果傳回。
- (6) void print(): 以  $q/p$  格式印出。



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I 複選題 (每一題要少有一個選項是正確的) (20%)

1)  $A, B: n \times n$  matrix

(a)  $(A+B)(A-B) = A^2 - B^2$ .

(b)  $AB=I$  implies that  $A$  and  $B$  are invertible ( $I$  denotes the identity matrix).

(c)  $A^2 = 0$  implies that  $A = 0$ , where  $0$  denotes the zero matrix.

(d)  $\text{tr}(AB) = \text{tr}(BA)$ , where  $\text{tr}(A)$  means the trace of  $A$ .

(e)  $\text{rank}(A) = 0$  if and only if  $A$  is the zero matrix.

2) Which of the following are elementary matrices

(a)  $\begin{bmatrix} 0 & 0 & -1 \\ 0 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$  (b)  $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}$  (c)  $\begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & -1 \\ 0 & 0 & 1 \end{bmatrix}$  (d)  $\begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$  (e)  $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & \pi \end{bmatrix}$

3)

(a) Every vector space contains a zero vector.

(b) A vector space cannot have more than one basis.

(c) Any set contains zero vector is linearly dependent.

(d) The intersection of any two subsets of a vector space is vector space.

(e) Subsets of linearly independent sets are linear independent.

4)

(a) The rank of a matrix is equal to the number of its nonzero columns.

(b) Any homogeneous system of linear equations has at least one solution.

(c) A linear system of 5 equations and 10 variables must be consistent.

(d) The reduced row-echelon form of a given matrix is unique.

(e) Given  $Ax = b$ , if  $(A|b)$  is in reduced row-echelon form then  $Ax = b$  must have a solution.

5)

(a) If  $P(\lambda)$  is the characteristic polynomial of matrix  $A$ , then  $P(A) = 0$  (zero matrix).

(b) Any  $n \times n$  matrix hat has fewer than  $n$  distinct eigenvalues is not diagonalizable.

(c) Any  $n \times n$  symmetric matrix is orthogonally diagonalizable.

(d) Eigenvalues must be nonzero scalars.

(e) Similar matrices always have the same eigenvectors.



## II 問答題 (計算過程不要附上) (10%)

 1) For any given real numbers  $a$  and  $b$ , please compute

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ b & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & -a \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & a \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ -b & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}. \quad (5\%)$$

 2) Consider the following matrix with symbolic real parameters  $\alpha$ ,  $\beta$ , and  $\gamma$ .

$$\begin{bmatrix} 1 & -1 & 0 & 0 & 1 \\ 0 & 0 & \alpha & \beta & 0 \\ 0 & 0 & 0 & \gamma & 1 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Under which conditions for  $\alpha$ ,  $\beta$ , and  $\gamma$  is the matrix in row echelon form? Note that there may be several such conditions so please find all of them. (5%)

## III 計算證明題 (需詳列計算或證明過程) (70%)

 1) Consider the vector subspace  $W$  of  $R^3$  with basis  $\left\{ \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 2 \\ 1 \\ 4 \end{bmatrix} \right\}$ .

 (a) Use the Gram-Schmidt process to find an orthonormal basis for  $W$ . (5%)

 (b) Find the  $QR$ -decomposition of  $\begin{bmatrix} 1 & 2 \\ 0 & 1 \\ 1 & 4 \end{bmatrix}$ . (5%)

 2) Let  $A = \begin{bmatrix} 1 & -2 & 2 \\ -2 & -2 & 4 \\ 2 & 4 & -2 \end{bmatrix}$ . Find a matrix  $P$  that orthogonally diagonalizes  $A$ , and determine  $P^{-1}AP$ . (10%)

 3) Compute  $\lim_{n \rightarrow \infty} \frac{1}{n} \left\{ \cos \frac{\pi}{n} + \cos \frac{2\pi}{n} + \cdots + \cos \frac{n-1}{n} \pi \right\}$ . (10%)

 4) Let  $f(x) = \frac{2x+1}{x^2-2x-3}$ , what is  $f^{(n)}(x) = ?$  (10%)

 5) Let  $x = r \cos \theta$ ,  $y = r \sin \theta$ , prove that  $\left(\frac{\partial f}{\partial x}\right)^2 + \left(\frac{\partial f}{\partial y}\right)^2 = \left(\frac{\partial f}{\partial r}\right)^2 + \frac{1}{r^2} \left(\frac{\partial f}{\partial \theta}\right)^2$ . (10%)

 6) Find this integral  $\int \frac{x \cos^{-1} x}{\sqrt{1-x^2}} dx$ . (10%)

 7) Evaluate  $\int_0^1 \frac{x^a - x^b}{\ln x} dx$ . (10%)





本次試題共三題，總分 100 分，請盡可能在思緒連貫、條理分明原則下，精簡陳述。

問題一 (50%)

Most services provided in banks and post offices have being changed from having customers choose the service counter they prefer to wait for service to asking customers pick up a number upon arrival and wait for their turn for service when the number they picked is called. Thus, in the past, there is a queue in front of each service counter, and the system has multiple queues in it. Nowadays, there is only one queue, in which customers are ordered in terms of the number they pick upon arrival, in the system. Such change of service pattern is an application of queueing theory which indicates that the average waiting time of customers in a system with multiple service counters and single queue is shorter than that of customers in a system with multiple service counters and multiple queues when customers in such system are not allowed to switch queue once he enters one. In fact, even without knowing anything about queueing theory, by intuitive induction it can be verified that the average waiting time of customers in a system with multiple service windows and single queue is shorter than that of customers in a system with multiple service counters and multiple queues.

(A) Give an intuitive induction on this. -- 25%

However, after the change in the service pattern, most customers complaining that they experienced longer wait in queue in the new system.

(B) What are the possible reasons for such inconsistent result between theory and real world applications? - 25%

**問題二 (20%)**

目視管理或稱為走動式管理在發覺工作環境內部的缺點是一個有效的方法，原因在於與其他方法相比，花費時間與成本較少即可獲得相關績效評量資訊。某大賣場的倉儲部門希望你提出相關規劃作為其進行目視管理的依據，請以流程圖方式將你的執行構想陳列出來。

**問題三 (30%)**

針對相關研發產品進行合適的試驗評估，探究其是否能達成預期功效具有提供科學客觀證據的正面意義。某行為顧問公司希望評估開車時接聽免持聽筒的新型無線手機是否對行車安全造成影響（現行法規禁止行車時接聽手持式手機），請你提出一個合理的實驗設計計畫書，可提供該顧問公司實際依照你的設計進行安全性評估實驗。



In this test, there are 25 multiple choice questions with 4 points for each question. Please select the correct answer for each question.

1. Two balls are drawn from an urn containing 5 balls numbered from 1 to 5. The first ball is kept if it is numbered 1, and returned to the urn otherwise. What is the probability that the second ball drawn is number 2?

(A) 0.18      (B) 0.21      (C) 0.24      (D) 0.27      (E) 0.30

2. At a certain college, 20 percent of the men and 1 percent of the women are over six feet tall. Furthermore, 40 percent of the students are women. If a student is randomly picked and is observed to be over 6 feet tall, what is the probability that the student is a woman?

(A) 0.012      (B) 0.017      (C) 0.022      (D) 0.027      (E) 0.032

3. Consider the following probability density function:

$$\begin{aligned} f(x) &= kx; & 0 \leq x < 2, \\ &= k(4-x), & 2 \leq x \leq 4, \\ &= 0, & \text{otherwise.} \end{aligned}$$

What is the variance of  $X$ ?

(A) 1/3      (B) 2/3      (C) 1.0      (D) 4/3      (E) 5/3

4. A continuous random variable  $X$  has the probability density function

$$f(x) = \frac{2x}{9}, \quad 0 < x < 3.$$

What is the value of  $m$  such that  $P(X \geq m) = P(X \leq m)$ ?

(A) 1.8383      (B) 2.0      (C) 2.1213      (D) 2.3333      (E) 2.6667

5. The repair time  $X$  (in hours) for a certain electronically controlled milling machine follows the density function:

$$f(x) = 4xe^{-2x}, \quad x > 0.$$

What is the moment-generating function of  $X$ ?

(A)  $(1-t/2)^{-2}$       (B)  $(1-t/2)^{-1}$       (C)  $(1-t/3)^{-2}$   
 (D)  $(1-t/3)^{-1}$       (E)  $(1-2t)^{-1}$



6. Let  $X_1$  and  $X_2$  be distributed according to

$$f(x_1, x_2) = 2, \quad 0 \leq x_1 \leq x_2 \leq 1.$$

What is the correlation coefficient between  $X_1$  and  $X_2$ ?

- (A) 0.35      (B) 0.4      (C) 0.45      (D) 0.5      (E) 0.55

7. For the multivariate distribution

$$f(x, y) = \frac{k}{(1+x+y)^5}, \quad x \geq 0, y \geq 0.$$

What is the value of  $k$ ?

- (A) 12      (B) 14      (C) 16      (D) 18      (E) 20

8. A lot of 25 color television tubes is subjected to an acceptance testing procedure.

The procedure consists of drawing five tubes at random, without replacement, and testing them. If two or fewer tubes fail, the remaining ones are accepted. Otherwise the lot is rejected. Assume the lot contains four defective tubes. What is the probability of lot acceptance?

- (A) 0.82      (B) 0.86      (C) 0.90      (D) 0.94      (E) 0.98

9. Let  $X$  be uniformly distributed between  $a$  and  $b$  and symmetric about zero with variance 1.

What is the value of  $a^2 + b^2$ ?

- (A) 2      (B) 4      (C) 6      (D) 8      (E) 10

10. A certain type of light bulb has an output known to be normally distributed with mean 2500 end footcandles and standard deviation 75 end footcandles. What is the lower specification limit such that only five percent of the manufactured bulbs will be defective?

- (A) 2369.45 fc      (B) 2376.63 fc      (C) 2383.33 fc  
(D) 2389.78 fc      (E) 2396.66 fc

11. The Rockwell hardness of a particular alloy is normally distributed with mean 70 and standard deviation 4. Suppose a specimen is acceptable only if its hardness is between 62 and 72. What is the expected number of acceptable specimens among the nine randomly selected specimens?

- (A) 5.099      (B) 5.333      (C) 5.667      (D) 6.018      (E) 6.333



12. An assembly consists of three components placed side by side. The length of each component is normally distributed with mean 2 inches and standard deviation 0.2 inches. Specifications require that all assemblies are between 5.7 and 6.3 inches long. On the average, how many assemblies will pass these requirements?  
 (A) 0.416 (B) 0.456 (C) 0.516 (D) 0.556 (E) 0.616
13. Round-off error has a uniform distribution on  $[-0.5, +0.5]$  and round-off errors are independent. A sum of 50 numbers is calculated where each is of the form  $XXX.D$ , rounded to  $XXX$  before adding. What is the probability that the total round-off error exceeds five?  
 (A) 0.0071 (B) 0.0081 (C) 0.0091 (D) 0.0101 (E) 0.0111
14. A college statistics professor has office hours from 9:00 am to 10:30 am daily. A sample of waiting times to see the professor (in minutes) is 10,12,20,15,17,10,30,28,35,28,19,27,25,22,33,37,14,21,20,23. Assuming  $\sigma = 7.84$ , find the 95% confidence interval for the population mean.  
 (A) 18.8 to 25.8 (B) 19.5 to 35.1 (C) -3.5 to 3.5  
 (D) -7.7 to 7.8 (E) 14.46 to 30.14
15. In which of the following situations is it reasonable to use the z-interval procedure to obtain a confidence interval for the population mean? Assume that the population standard deviation is known.  
 A.  $n=10$ , the data contain no outliers; the variable under consideration is not normally distributed.  
 B.  $n=10$ , the variable under consideration is normally distributed.  
 C.  $n=38$ , the data contain no outliers; the variable under consideration is far from normally distributed.  
 D.  $n=18$ , the data contain outliers; the variable under consideration is normally distributed.  
 (A) B (B) C (C) B,C (D) A,B,C (E) A,D
16. The weekly earnings of students in one age group are normally distributed with a standard deviation of 36 dollars. A researcher wishes to estimate the mean weekly earnings of students in the age group. Find the sample size needed to assure with 98% confidence that the sample mean will not differ from the population mean by more than 3 dollars.  
 (A) 22 (B) 66 (C) 77 (D) 782 (E) 11



17. Which of the following statements regarding t-curves is/are true?
- The total area under a t-curve with 10 degrees of freedom is greater than the area under the standard normal curve.
  - The t-curve with 10 degrees of freedom is flatter and wider than the standard normal curve.
  - The t-curve with 10 degrees of freedom more closely resembles the standard normal curve than the t-curve with 20 degrees of freedom.
  - As the degrees of freedom increases, the t-curve is more close to the standard normal curve.
- (A) B,C      (B) B      (C) A,B      (D) A,B,C      (E) B,D
18. At one school, the average amount of time that students spend watching television each week is 21.6 hours. The principal introduces a campaign to encourage the students to watch less television. One year later, the principal wants to perform a hypothesis test to determine whether the average amount of time spent watching television per week decreased. Assume that  $\sigma = 7.5$  hours,  $n = 49$  and the significance level is .05. Find the probability of type II error of the test if in fact  $\mu = 20$  hours.
- (A) 0.95      (B) 0.1808      (C) 0.0808      (D) 0.2802      (E) 0.3192
19. The amounts (in ounces) of juice in eight randomly selected juice bottles are:  
15.7, 15.3, 15.6, 15.3, 15.4, 15.0, 15.6, 15.4  
Find a 95% confidence interval for the standard deviation,  $\sigma$ , of the amounts of juice in all such bottles.
- (A) 0.13 to 0.46      (B) 0.22 to 0.46      (C) 0.15 to 0.45  
(D) 0.18 to 0.69      (E) 0.02 to 0.21
20. Find the p-value for a test of the claim that more than 50% of the people following a particular diet will experience increased energy. Of 100 randomly selected subjects who followed the diet, 47 noticed an increase in their energy level.
- (A) 0.0239      (B) 0.4761      (C) 0.2743      (D) 0.4514      (E) 0.5239
21. The equation of regression line for the paired data below is  $\hat{y} = 3x$ . Find SSE.
- |   |   |    |    |    |
|---|---|----|----|----|
| x | 2 | 4  | 5  | 6  |
| y | 7 | 11 | 13 | 20 |
- (A) 14.25      (B) 10.00      (C) 88.75      (D) 78.75      (E) 16.78



22. Which of the following statement concerning the linear correlation coefficient is/are correct?

- A. If the linear correlation coefficient for two variables is zero, then there is no relationship between the variables.
  - B. If the slope of the regression equation is negative, then the linear correlation coefficient is negative.
  - C. The value of the linear correlation coefficient always lies between -1 and 1 inclusive.
  - D. A correlation coefficient of 0.62 suggests a stronger linear relationship than a correlation coefficient of -0.82.
- (A) B,C      (B) C,D      (C) A,B      (D) A,D      (E) A,C

23. A grass seed company conducts a study to determine the relationship between density of seeds planted (in pounds per 500 square feet) and the quality of the resulting lawn. Eight similar plots of land are selected and each is planted with a particular density of seed. One month later the quality of each lawn is rated on a scale of 0 to 100. The sample data are given below.

Seeds Density, $x$	1	1	2	3	3	3	4	5
Lawn Quality, $y$	30	40	40	40	50	65	50	50

The equation of regression line is  $\hat{y} = 33.14 + 4.54x$ . Find the residual for  $x=3$ .

- (A) -6.76, 3.24, 18.24      (B) 14.72      (C) 4.91  
 (D) 6.76; 3.24, 18.24      (E) 46.76, 46.76, 46.76

24. Again use the problem in above question, the equation of regression line is  $\hat{y} = 33.14 + 4.54x$ . A 95% confidence interval for the slope of the population regression line that relates lawn quality to seed density is -1.50 to 10.58. Which of the following is/are a correct interpretation of this confidence interval?

- A. We can be 95% confident that the slope,  $\beta_1$ , of the population regression line is between -1.50 and 10.58.
- B. We can be 95% confident that with each unit increase in seed density, the increase in lawn quality is somewhere between -1.50 and 10.58.
- C. We can be 95% confident that with each unit increase in seed density, the increase in mean lawn quality is somewhere between -1.50 and 10.58.
- D. If seed density increase by one unit, there is a 95% chance that the increase in lawn quality lies between -1.50 and 10.58.

- (A) B,C      (B) C,D      (C) A,B      (D) A,D      (E) A,C



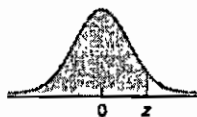
25. Three different brands of tires were compared for wear characteristics. From each brand of tire, ten tires were randomly selected and subjected to standard wear-testing procedures. The average mileage obtained for each brand of tire and sample variances (both in 1,000 miles) are shown below.

	Brand A	Brand B	Brand C
Average Mileage	37	38	33
Sample Variance	3	4	2

Which of the following statement concerning the ANOVA table is/are correct?

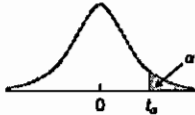
- (A)  $SSTR = 108$       (B)  $SSE = 9$       (C)  $MSE = 3$   
 (D)  $MSTR = 140$       (E)  $F = 28.3$




 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 <sup>†</sup>									

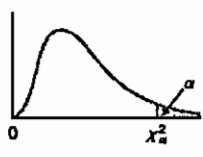
<sup>†</sup> For  $z \geq 3.90$ , the areas are 1.0000 to four decimal places.


 TABLE IV  
 Values of  $t_\alpha$ 


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 VII  
Values of  $\chi^2_\alpha$



df	$\chi^2_{0.995}$	$\chi^2_{0.99}$	$\chi^2_{0.975}$	$\chi^2_{0.95}$	$\chi^2_{0.90}$
1	0.000	0.000	0.001	0.004	0.016
2	0.010	0.020	0.051	0.103	0.211
3	0.072	0.115	0.216	0.352	0.584
4	0.207	0.297	0.484	0.711	1.064
5	0.412	0.554	0.831	1.145	1.610
6	0.676	0.872	1.237	1.635	2.204
7	0.989	1.239	1.690	2.167	2.833
8	1.344	1.646	2.180	2.733	3.490
9	1.735	2.088	2.700	3.325	4.168
10	2.156	2.558	3.247	3.940	4.865
11	2.603	3.053	3.816	4.575	5.578
12	3.074	3.571	4.404	5.226	6.304
13	3.565	4.107	5.009	5.892	7.042
14	4.075	4.660	5.629	6.571	7.790
15	4.601	5.229	6.262	7.261	8.547
16	5.142	5.812	6.908	7.962	9.312
17	5.697	6.408	7.564	8.672	10.085
18	6.265	7.015	8.231	9.390	10.865
19	6.844	7.633	8.907	10.117	11.651
20	7.434	8.260	9.591	10.851	12.443
21	8.034	8.897	10.283	11.591	13.240
22	8.643	9.542	10.982	12.338	14.041
23	9.260	10.196	11.689	13.091	14.848
24	9.886	10.856	12.401	13.848	15.659
25	10.520	11.524	13.120	14.611	16.473
26	11.160	12.198	13.844	15.379	17.292
27	11.808	12.879	14.573	16.151	18.114
28	12.461	13.565	15.308	16.928	18.939
29	13.121	14.256	16.047	17.708	19.768
30	13.787	14.953	16.791	18.493	20.599
40	20.707	22.164	24.433	26.509	29.051
50	27.991	29.707	32.357	34.764	37.689
60	35.534	37.485	40.482	43.188	46.459
70	43.275	45.442	48.758	51.739	55.329
80	51.172	53.540	57.153	60.391	64.278
90	59.196	61.754	65.647	69.126	73.291
100	67.328	70.065	74.222	77.930	82.358


 TABLE VII (cont.)  
 Values of  $\chi^2_{\alpha}$ 

$\chi^2_{0.10}$	$\chi^2_{0.05}$	$\chi^2_{0.025}$	$\chi^2_{0.01}$	$\chi^2_{0.005}$	df
2.706	3.841	5.024	6.635	7.879	1
4.605	5.991	7.378	9.210	10.597	2
6.251	7.815	9.348	11.345	12.838	3
7.779	9.488	11.143	13.277	14.860	4
9.236	11.070	12.833	15.086	16.750	5
10.645	12.592	14.449	16.812	18.548	6
12.017	14.067	16.013	18.475	20.278	7
13.362	15.507	17.535	20.090	21.955	8
14.684	16.919	19.023	21.666	23.589	9
15.987	18.307	20.483	23.209	25.188	10
17.275	19.675	21.920	24.725	26.757	11
18.549	21.026	23.337	26.217	28.300	12
19.812	22.362	24.736	27.688	29.819	13
21.064	23.685	26.119	29.141	31.319	14
22.307	24.996	27.488	30.578	32.801	15
23.542	26.296	28.845	32.000	34.267	16
24.769	27.587	30.191	33.409	35.718	17
25.989	28.869	31.526	34.805	37.156	18
27.204	30.143	32.852	36.191	38.582	19
28.412	31.410	34.170	37.566	39.997	20
29.615	32.671	35.479	38.932	41.401	21
30.813	33.924	36.781	40.290	42.796	22
32.007	35.172	38.076	41.638	44.181	23
33.196	36.415	39.364	42.980	45.559	24
34.382	37.653	40.647	44.314	46.928	25
35.563	38.885	41.923	45.642	48.290	26
36.741	40.113	43.195	46.963	49.645	27
37.916	41.337	44.461	48.278	50.994	28
39.087	42.557	45.722	49.588	52.336	29
40.256	43.773	46.979	50.892	53.672	30
51.805	55.759	59.342	63.691	66.767	40
63.167	67.505	71.420	76.154	79.490	50
74.397	79.082	83.298	88.381	91.955	60
85.527	90.531	95.023	100.424	104.213	70
96.578	101.879	106.628	112.328	116.320	80
107.565	113.145	118.135	124.115	128.296	90
118.499	124.343	129.563	135.811	140.177	100



1. (20%) 隨著網路與資訊軟硬體技術的快速發展，電子化(e 化)已成為無論「製造業」或「服務業」能否具有競爭力或是能否永續經營的關鍵之一，請說明你所服務單位「目前使用」或「預計導入」資訊系統的狀況、成功的應用與發生的困難及原因。

「管理」可視為規劃、執行、分析、與回饋改善的循環，請回答以下問題：

2. (20%) 請說明你所服務的單位如何進行管理之「規劃面」，資訊系統如何能協助你。
3. (20%) 請說明你所服務的單位如何進行管理之「執行面」，資訊系統如何能協助你。
4. (20%) 請說明你所服務的單位如何進行管理之「分析面」，資訊系統如何能協助你。
5. (20%) 請說明雲林科技大學「工業工程與管理研究所」如何能提供你在專業管理能力之提升。



1. (25%) 經濟日報採訪台大醫院許世明副院長有關健康產業發展的報導指出：「所謂「健康產業」的狹義定義，是指從預防、營養食品、到健康維護與提升、早期診斷、疾病治療、復健、到居家護理和老年安養等的垂直整合與規畫。但「健康產業」的正確或廣義的定義應含生物與醫學〔生醫〕科技產業、醫療產業與其它相關知識經濟型產業。有別於其他產業，「健康產業」的顧客大多數是醫師或醫院，或來自於醫師的推薦。所有「健康產業」的發展，首要是必須了解顧客的需求與實用性。健康產業畢竟有關人體健康，我們必須再三強調，產品開發一定要經過嚴謹的醫學臨床驗證，或產品的可靠性必須經過醫學中心確認無誤，否則危害健康。醫療健康產業肯定是高附加價值產業，必須在關鍵領域或尖端科技有領導地位，以品質優勢和因應快速變化的能力，及建立自有品牌，在亞洲展現領導地位。」根據上述觀點，請闡述健康產業管理必須面對的課題，並從工業工程與管理的角度提出相關之因應對策。
2. (25%) 日前邱小妹妹事件暴露了白色巨塔的許多問題，其中急診人力不足，也成為醫界重大問題之一；有鑒於此，現今出現了急診人力派遣公司。對於派遣醫師方面的醫療責任歸屬，如果只是醫師個人負責，恐怕會引發爭議，衛生署醫事處處長薛瑞元就表示，衛生署不准醫院和醫師責任脫鉤，就算急診外包，醫院還是要有醫療管理責任。(1) 如果你是中小型醫院的經營者，你會如何評估是否應採行急診外包的經營模式？(2) 從全面品質管理的觀點來看，在急診外包的經營模式下，醫院如何擔負醫療管理責任以確保應有的醫療品質水準與病患滿意？



3. (25%) 隨著台灣經濟的快速發展、社會人口結構的改變等因素的影響下，使得一般民眾對醫療服務品質的要求日益增加。在就醫過程中，病患期望與實際所接受的服務有落差時則會產生抱怨，若無法獲得適當且滿意的回應時，則會進一步演變為醫療糾紛。而醫療的特徵是極端變化、複雜性、不確定性、不可預測性、多種醫療科目合作與時間壓力，使得醫院具有高風險之特性，經常遠比其他產業還要高。

根據行政院衛生署的資料顯示整理如圖 1 所示，現今醫療糾紛事件有逐年增加的趨勢，且在近幾年來醫療糾紛更加層出不窮，已由單純的衝突轉變成威脅恐嚇、抬棺抗議...等訴諸暴力的惡性行爲，使得醫護人員在提供服務時，往往諸多顧忌，不無戒心。進而導至醫療糾紛在現今醫界上已演變為一可怕的名詞，長久以往，勢必成為醫院管理上的嚴重問題。故預防醫療糾紛的發生已經成為醫院危機管理的重點之一。請根據您的經驗與想法，為醫院建構一套預防醫療糾紛的系統或是流程。請適度說明這一套系統或流程。

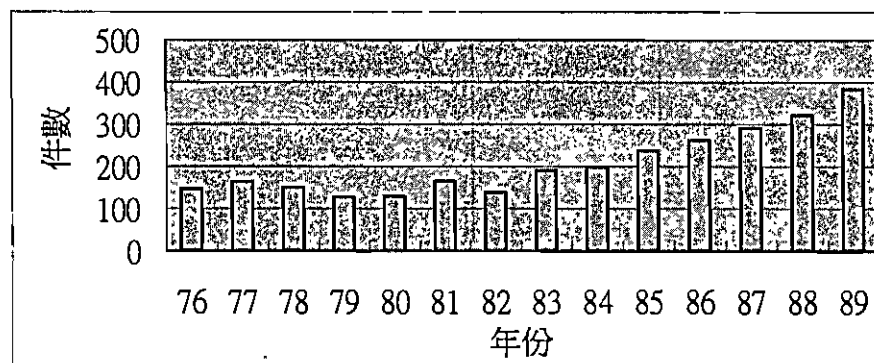


圖 1 醫療糾紛申報件數

【資料來源：行政院衛生署公佈之數據】



4. (25%) 台大公共衛生學院院長王榮德在其一篇文章“後 SARS 時代健康產業經營的再思”中曾有以下的論述：

「醫療產業原為良心產業，要從事這方面服務或投資經營此業者，必須以服務人民的健康為優先考量，換言之，重視人民健康權的公平正義勝於效率（績效或利潤），重視實質勝於表象。到目前為止，西方的醫療產業仍然主張以成本/效性（cost/effectiveness）來談論決策，而不敢貿然以成本/效益（cost/benefit）來作經營的基本理念，就是這個緣故。管理大師彼得杜拉克也主張，醫療產業的首要目標在於改變生命而非營利。台灣自 1995 年實施健保制度以來，逐步使全體國人 97% 有醫療保險，就醫不擔心付不起醫藥費用，使得人民的健康權逐漸獲得保障，這是台灣在國際上除了經濟發展之外了不起的成就之一。

但自 20 世紀末葉以來，台灣醫療產業受到其他一般製造業經營理念之影響，開始強調績效與利潤。由於資源有限，如此強調雖然原意可能是良好的，但是經營者過份重視績效，加上健保論量計酬之給付制度，使得醫師之薪資結構逐漸改變，底薪減少，而以看病人數來決定績效好壞，績效好薪水就增加。當醫療團隊的領導者醫師及醫院經營者一味的追求績效與利潤，如同一般產業之業務員，只求量多就好，其他要花成本但卻看不見收入的工作，例如院內感染控制、員工安全衛生... 等等，就漸漸變成只作表面而無法深入踏實。」

如此反省下，您認為台灣的醫院與其他的健康產業應如何合作經營，方能造成政府、業者與民眾三贏的局面？請具體列舉出合作的健康產業及合作之模式。





Part I. Microeconomics (each question 5 point); answer the following questions pointedly.

1. A New York City cab driver appears to be making positive profits in the long run after carefully accounting for the operating and labor costs. Does this violate the competitive model? Why or why not?
2. True or false? The only reasonable long-run level profits for a competitive firm that has constant returns to scale at all levels of output is a zero level of profits.
3. The technical rate of substitution between factors  $x_2$  and  $x_1$  is -4. If you desire to produce the same amount of output but cut your use of  $x_1$  by 3 units, how many more units of  $x_2$  will you need?
4. Given the Paasche quantity index is less than 1. What can you conclude about how well-off the consumer is at time  $t$  compared to his situation at base time  $b$ ?
5. Given the consumption data,

Observation	$P_1$	$P_2$	$X_1$	$X_2$
1	1	2	1	2
2	2	1	2	1
3	1	1	2	2

How can you say about the consumer's preference?

6. Show mathematically that a monopolist always sets its price above marginal cost.
7. State the First Theorem of Welfare Economics and its implications for the competitive markets.
8. Suppose that one individual's demand curve is  $D_1(p)=20-p$  and another individual's is  $D_2(p)=10-2p$ . What is the market demand function?
9. If a consumer has a utility function  $u(x_1, x_2)=x_1x_2^4$ , what fraction of her income will she spend on good 2?
10. Draw the indifference curves for the utility function  $u(x_1, x_2)=\ln x_1+x_2$ .



Part II. Macroeconomics: answer the following questions pointedly

True or false? Explain your answer.

1. If both government spending and taxes increase by the same amount, the IS curve does not shift. (8 points)
2. Budget deficits cause trade deficits..(9 points)
3. In the absence of changes in fiscal and/or monetary policy, the economy will always remain at the natural level of output.(8 points)
4. According to the Phillips curve relation, the sacrifice ratio is independent of the speed of disinflation.(8 points)
5. Capital accumulation does not affect the level of output in the long run. Only technological progress does.(8 points)
6. The higher the saving rate, the higher consumption in steady state.(9 points)