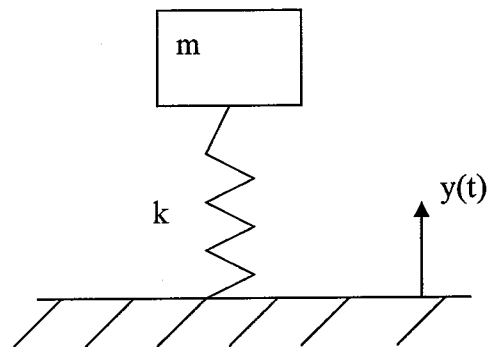


結構動力學試題(close book)

1. 請解釋下列名詞之意義(25%)
 - (a) Viscous Damping
 - (b) Critical Damping
 - (c) Square Root Sum of Squares (SRSS)
 - (d) Response Spectrum
2. 請問如何評估一煙囪建物之自然頻率(25%)
(煙囪形狀大小請自訂)
3. 試以曾文水庫為例，說明結構體動力反應分析之具體做法(25%)
4. 如圖所示之系統在 $t = 0$ 時為靜止狀態，當 $t > 0$ 時地表以 $y(t) = \sin t$ 之形式上下振動，試求質點 m 之反應(25%)



(1) Please explain how to write computer software to perform a finite element analysis. What is the most difficult procedure for your opinion. (50/3)

(2) Please explain the advantages and disadvantages of the isoparametric element (50/3)

3. Evaluate [J] (Jacobian matrix) and $\det[J]$ (determinant value) for each of the three elements shown in Fig.3. Also computer the ratio of element area to the area of a square two units on a side (Area=4). How is this ratio related to $\det[J]$, and why?

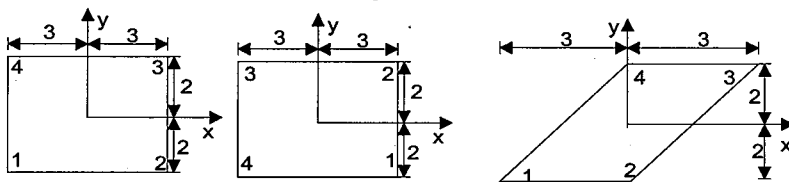


Fig.1

4. Use the 1 by 1 and 2 by 2 Gauss rule to approximate I over the rectangular region shown in Fig.2. $I = \iint \frac{x+y}{y} dx dy$

Order n	Sampling point	Weight factor
1	0	2
2	$\pm 1/\sqrt{3}$	1

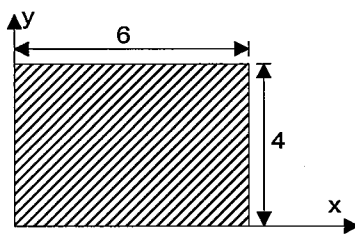


Fig.2

Engineering Mathematics

QUALIFYING EXAM

Spring 2005

1. (15%) The temperature any any point in space is given by

$$T = xy + yz + zx,$$

Find the derivative of T in the direction of $3\mathbf{i} - 4\mathbf{k}$ at the point $(1, 1, 1)$.

2. (15%) Derive the Cauchy-Riemann equations in polar coordinates.

Note that the C-R equations in rectangular coordinates for an analytic function $f(z) = u(x, y) + iv(x, y)$ are

$$\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}, \quad \frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}.$$

3. (20%) Derive the general expressions for the Laplace's equations in the circular region

$$\frac{\partial^2 T}{\partial r^2} + \frac{1}{r} \frac{\partial T}{\partial r} + \frac{1}{r^2} \frac{\partial^2 T}{\partial \theta^2} = 0, \quad a \leq r \leq b.$$

4. (20%) Explain (i) D'Alembert's solution, (ii) orthogonal matrix, (iii) elliptical type of PDE, (iv) divergence theorem.

5. (20%) Solve the system of equation $\mathbf{Ax} = \mathbf{b}$, in which the augmented matrix $[\mathbf{A}|\mathbf{b}]$ is given as

$$\begin{pmatrix} 0 & a & 1 & b \\ a & 0 & 1 & b \\ a & a & 2 & 2 \end{pmatrix}.$$

Determine for what fixed values of a and b the system possesses the following

- (a) A unique solution.
- (b) A one-parameter solution.
- (c) No solution.

6. (10%) Solve

$$\frac{d^2 y}{dx^2} + y = \sin x.$$

九十三年年度第二學期博士資格考試彈性力學試題

1. Determine the relations among the constants $a_1, a_2, b_1, b_2, c_1, c_2, c_3$ so that the following is a possible system of strains:

$$\varepsilon_x = a_1 + a_2(x^2 + y^2) + (x^4 + y^4)$$

$$\varepsilon_y = b_1 + b_2(x^2 + y^2) + (x^4 + y^4)$$

$$\gamma_{xy} = c_1 + c_2xy + c_3xy(x^2 + y^2)$$

$$\varepsilon_z = \gamma_{yz} = \gamma_{zx} = 0$$

and determine the displacements $u(x, y), v(x, y)$. (assumed 2D deformation.)

2. (a) Verify that each term of the series

$$u_x = \sum_{m=1}^{\infty} \frac{A_m}{\alpha_m} \sin \alpha_m x \sinh \alpha_m y$$

$$u_y = \sum_{m=1}^{\infty} \frac{-A_m}{\alpha_m} \cos \alpha_m x \cosh \alpha_m y$$

is a solution of the plane stress Navier equation for equilibrium with no body forces.

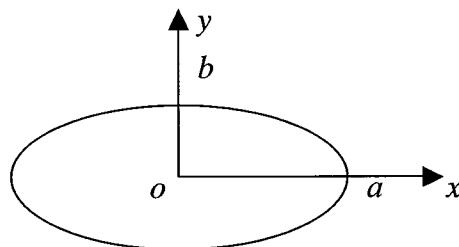
- (b) Show that the parameters α_m can be selected so that both u_x and τ_{xy} vanish on the side

$x=0$ and $x=L$ of a square. With this choice of α_1 consider only the first term for $m=1$ and sketch the traction distributions on the four sides $x=0, x=L, y=0,$ and $y=L$ of the square, and verify that the tractions provided by the first term satisfy the requirement that the total force in the x -direction and the total force in the y -direction each vanish.

3. The infinite plate with an elliptic hole (as shown in Fig.1) has, at infinity, uniform stress

$$\sigma_x = S_1 \quad \sigma_y = S_2 \quad \tau_{xy} = 0$$

- (a) Find an expression for the stress at the hole.
 (b) Show that if $S_1/S_2 = b/a$, the stress at the hole is the same all around the hole.
 (c) Show that when the stress at infinity is a pure shear at 45° to the axes of the ellipse, the greatest stress on the hole occurs at the ends of the major axis, and corresponds to a stress-concentration factor $2[1 + (a/b)]$.



九十三年度第二學期博士候選人資格考土壤力學試題

一·翻譯及解釋下列名詞:(25%)

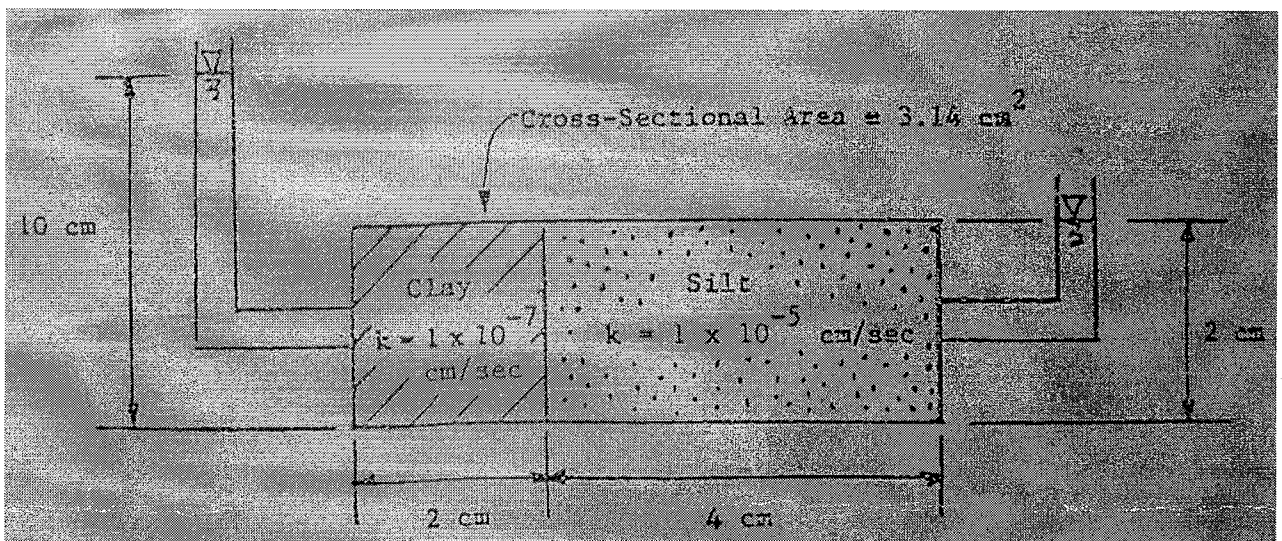
- (1) phreatic surface (2) quick clay (3) quick sand
(4) diffuse double layer (5) constrained modulus

二·(1) 說明如何求得土壤之顆粒粒徑分佈曲線?(8%)

(2) 在土壤顆粒粒徑分佈曲線上,定義那些主要之粒徑及係數,其在工程上有何具體之用途或意義?試說明之。(10%)

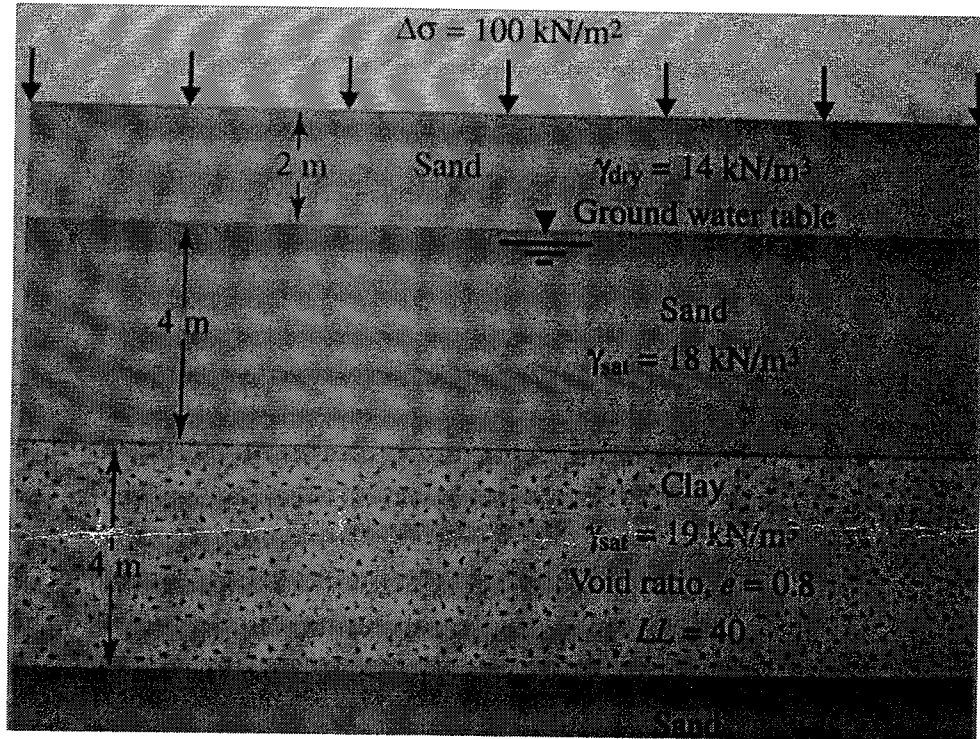
(3) 美國統一土壤分類法(USCS)與 AASHTO 土壤分類法,在界定不同土壤上有何異同?試說明之。(7%)

三·(1) Plot the total head and pore water pressure head as a function of position along the path of flow, (2) calculate the rate of flow, discharge velocity, and (3) draw the flow net in the soil for the following cases:
(Note: use the bottom of the sample as the datum.) (24%)



四·某一正常壓密黏土試樣,進行壓密不排水試驗,試驗後得到下列結果: $\sigma_3 = 80$ kPa, 軸差應力 $(\Delta\sigma_d)_f = 60$ kPa, 孔隙水壓力 $(\Delta u_d)_f = 44$ kPa。試計算此試樣之壓密不排水試驗之(a)總應力之摩擦角為若干?(b)有效應力之摩擦角為若干?(12%)

五·有一土層如圖所示,假設此土層為正常壓密黏土,試求黏土層在均佈載重 $\Delta\sigma$ 作用下之主壓密沉陷量(mm)? (14%)



土木系博士資格考試 岩石力學試題(2005.3)

(1. Open Book 2. 請將試題與試卷一起交回)

1. Derive a formula expressing the conductivity k (cm/s) of a rock mass with orthogonal fractures characterized by identical spacing S and aperture e if the fractures are filled with soil having permeability k_f (cm/s). (10%)
2. 在一具有節理的岩盤中開挖隧道，此岩盤有如下特性：①岩石材料單軸壓縮強度 75MPa，②岩心 RQD=70%，③節理間距=40cm，④節理面狀況：節理開口少於 1mm，節理面稍微粗糙、堅硬，⑤節理中地下水狀況：潮濕，又節理面的傾角為 50° ，節理面的走向平行於隧道軸向。請用 Bieniawski 的 Geomechanics Classification System 給此岩盤評分(Rock Mass Rating)。 (15%)
3. 求取岩石材料的張力強度有幾種方法？各有何種利弊？(20%)
4. 何謂 Hydrostatic Compression 及 Deviatoric Compression？給岩石材料分別施加 Hydrostatic Compression 及 Deviatoric Compression 將會產生何種反應？(20%)
5. 請問何謂正斷層(normal fault)、逆斷層(reverse fault)、平移斷層(strike slip fault)？各種斷層是在何種大地應力狀態下形成？(15%)
6. 使用水力破裂法(Hydraulic Fracturing)如何求得岩盤中之大地應力？此法必須在地表下多深方能使用？(20%)

國立成功大學土木工程學系博士班資格考試工程地質試題

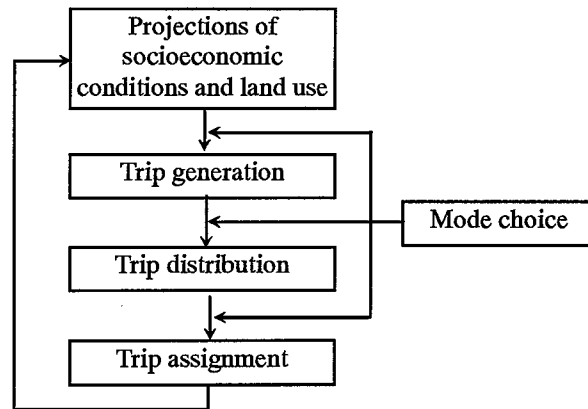
March 25, 2005

Note: 1 至 4 題每題各為 10 分，其餘每題各為 15 分

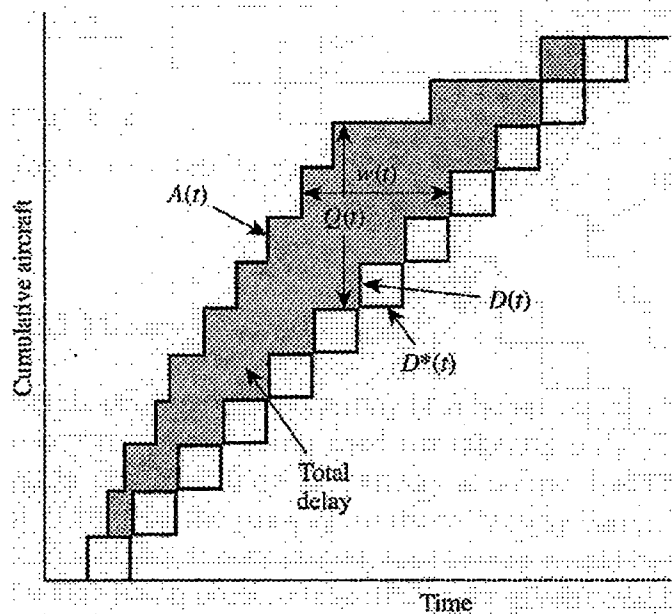
1. 一般而言，台灣可分成那三個地質分區，試以繪圖說明並指出其相對產生年代之早晚。
2. 至少指出台灣三個地層，說明其概略分佈之地理位置並分別說明各地層之主要工程特性。
3. 依據美國原子能委員會(U.S. Atomic Energy Commission)所訂之標準，定義「活動斷層」。依據此標準，台灣之活動斷層可分成幾類。指出至少三條台灣之活動斷層。
4. 在地質圖判別地層與地形之關係時，有所謂「V字法則」可依循，是指何物，試說明之。
5. 大地主應力方向不同將造成不同之斷層類別，說明二者之關係。
6. 台北盆地與高雄都會區之環境地質歷史有明顯不同，試說明其最主要差異。大地工程在此二地區進行時，必須注意那些事項，試分別說明之。
7. 近年來，台灣大部分水庫淤積嚴重，試分別就自然因素與人為因素，說明其造成之主要原因。
8. 一般公路工程之地質調查應包含那些事項。

成功大學土木工程系九十三學年博士班資格考試
交通工程試題

- 一、請解釋「macroscopic traffic flow model」與「microscopic traffic flow model」(10%)。並說明這兩者間的關係(10%)
- 二、請解釋下圖之涵義(20%)



- 三、請說明 Transportation planning 的目的與概要內容。(20%)
- 四、請說明下圖各參數之意義。(20%)



五、請詳細而且有條理說明下段文字之含意。(20%)

Different transportation systems vary a great deal with respect to the uniformity of speed distributions and the degree of maneuverability. At one extreme, rail rapid transit systems ideally operate at uniform speeds with no maneuverability; at the other, air traffic (except on runway approaches) exhibits a wide range of speeds and almost complete maneuverability in three dimensions. Highway traffic falls somewhere in between. In the case of highway traffic, moreover, there is a definite relationship between maneuverability and uniformity of the speed distribution: as traffic volumes increase, maneuverability decreases and speed distribution become more uniform. Nevertheless, considerable maneuverability still exists up to the point of flow breakpoint at capacity.

In situations in which maneuverability is restricted and nonuniform speed distribution are present, factors other than the minimum time headway determine capacity. This is the case, for instance, in mixed rail operations, in which the frequency and length of sidings (or the frequency of crossovers for double tracked lines) largely determine the capacity of the line, and on runway approach paths, where there is essentially no maneuverability and capacity is generally dependent on the speed distribution.

National Cheng Kung University
Department of Civil Engineering
Highway Engineering
Qualification Exam for Ph.D. Students
Open Books and Notes (100 minutes)
Spring 2005

1.

Explain the following terms:

(a) AASHTO, (b) superelevation, (c) ITS, (d) PMA, (e) design speed, (f) level of service, (g) 30HV, (h) RAP (25%)

2.

- (a) What are two major concepts upon which the highways are functionally classified? Please explain these two concepts. (10%)
- (b) Following question (a), what are the classes of highways? Please illustrate your answer by drawing a figure. (15%)

3.

An asphalt mixture was placed and compacted using normal rolling procedures. Two cores were taken from the compacted mixture. Core 1 had a bulk specific gravity of 2.404 and an air void content of 6.5 %. Core 2 had a bulk specific gravity of 2.420. What was the air void content of core 2? (25%)

4.

- (a) What is the difference between the "f" term in the stopping sight distance equation and the "f" term in the equation for the radius of a horizontal curve? You need to explain these two terms. (10%)
- (b) What are the factors affecting these two different coefficients? (10%)
- (c) Which value is larger? Why? (5 points)

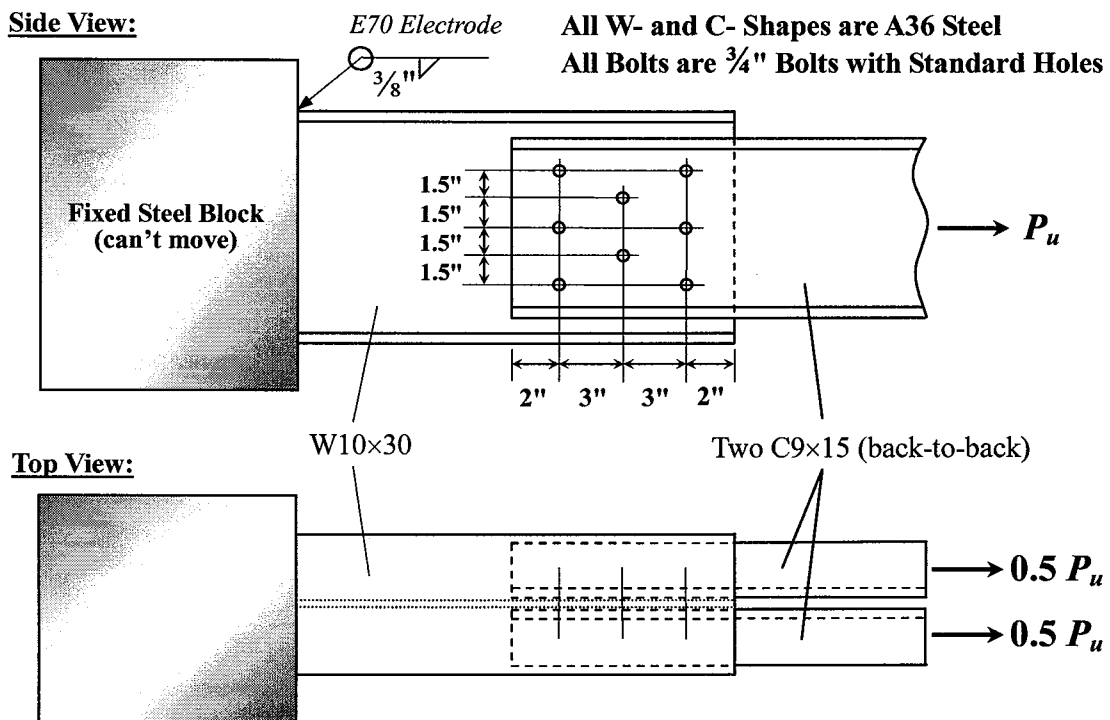
STEEL MATERIAL & STRUCTURES

(PhD Qualifying Exam)

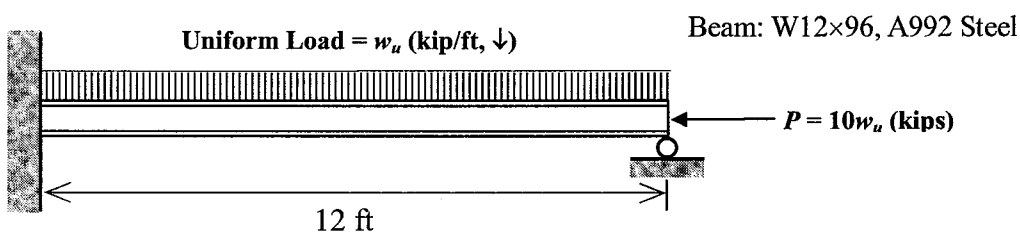
Note: Please solve the following problems in US units (i.e. inch ("), foot ('), kip, lb, ksi, psi)

1. Please give explanations for the following questions:
 - a.) Please show the principal process steps involved in converting iron-ore into steel product forms.
 - b.) What is "prying action" in bolted tension connections? How can we reduce this effect?
 - c.) What does "matching weld metal" mean in welding? How does it affect the local shear fracture of base metal?

2. Please estimate the maximum factored load P_u of the following tension member by the AISC-LRFD method. (You have to check all of the limit states for all the components in this tension member)



3. Please determine the maximum factored w_u (kip/ft) that the steel beam (see the figure below) can safely support by the AISC-LRFD beam design method. (Neglect beam self-weight)



本題組之主題為旅行推銷員問題(Traveling Salesman Problem, 簡稱 TSP)。有一類的 TSP 稱為 small TSP [Gabovich, 1970]。以下題目與 small TSP 有關。

令 n 為 TSP 之節點數量。令 $n \times n$ 方陣 C 為 TSP 之距離矩陣。令 a 與 b 為兩個具有 n 個維度的向量 (n -dimensional vectors), 亦即 $a = \{a_1, a_2, \dots, a_n\}$, $b = \{b_1, b_2, \dots, b_n\}$ 。令 C 之元素 $c_{ij} = \min\{a_i, b_j\}$ (c_{ij} 為 a_i 與 b_j 中之較小者)。則定義於 C 之 TSP 稱為 small TSP。

在此及以下所有小題假設所有的 a_i 與 b_j 均各不相同。令 $D = \{d_1, d_2, \dots, d_n\}$ 為 $\{a_1, a_2, \dots, a_n, b_1, b_2, \dots, b_n\}$ 中最小的 n 個元素, 且 $d = \sum_{i=1}^n d_i$ 。

以下(a)至(c)小題每小題 10 分, 其餘每小題 14 分。

(a) 試任意設計數值, 依上面的描述寫出一個 $n=5$ 的 small TSP 例子。

寫出 $a = \{a_1, a_2, \dots, a_n\}$ 、 $b = \{b_1, b_2, \dots, b_n\}$ 、及方陣 C 。

(b) 假設 $D = \{a_1, a_2, \dots, a_n\}$ 。試證明其 TSP 的路徑長度為 d 。

(c) 假設 $D = \{b_1, b_2, \dots, b_n\}$ 。試證明其 TSP 的路徑長度為 d 。

(d) (本小題與前面的(b)及(c)小題無關) 考慮一個 small TSP。其中的節點可以分割成 4 個集合： $D_0 = \{i | a_i \notin D, b_i \notin D\}$ 、 $D_a = \{i | a_i \in D, b_i \notin D\}$ 、 $D_b = \{i | a_i \notin D, b_i \in D\}$ 、 $D_2 = \{i | a_i \in D, b_i \in D\}$ 。定義符號 $|S|$ 為集合 S 之元素個數。試證明 $|D_0| = |D_2|$ 。

(e) 續上題之定義, 假設 D_2 不是空集合, 並以下列步驟建立一個 TSP 解：(1)由 D_2 中的任一個節點開始。(2)連接到 D_a 中的任一個節點。(3)以任意順序連接 D_a 中的其他所有節點。(4)連接到 D_0 中的任一個節點。(5)連接到 D_b 中的任一個節點。(6)以任意順序連接 D_b 中的其他所有節點。(7)以 D_2 、 D_0 、 D_2 、 D_0 的方式交錯連接 D_0 與 D_2

中所有未連接的節點直到完成。試證明這樣建立的路徑，其長度為 d 。

(f) 證明(e)小題所得的路徑為最佳解。

(g) 在(e)小題中所使用的方法是否為指數複雜度(exponential complexity)？

(h) 前面(b)、(c)、(e)小題中各有一個假設。試證明一個 small TSP 如果這三項假設均不成立，則其最佳解路徑長度 $> d$ 。

**Financial & Cost Concepts for Engineering and Construction
Qualification 2005**

1. Explain the following items (20%)
 - 1.1. Liquidity Ratio
 - 1.2. Depreciation
 - 1.3. Substantial Completion
 - 1.4. Work in Progress
 - 1.5. Accrual Basis

2. What is ABC(Activity-Based Costing)? Is ABC suitable for construction projects, why? (20%) You must clearly state your thoughts in details.

3. 請用三輪解釋如何建立一利潤計劃(20%)

4. The balance sheet of XYZ construction for July, 1998 and the transactions during 1 Aug. 1999 to 31 Aug. 1999 are shown in Table 1 and Table 2, respectively. Please complete the followings: (40%)
 - 4.1. Journalize all of the above transactions.
 - 4.2. Post journal entries to appropriate accounts.
 - 4.3. Develop income statement for period 1 Jan. 1999 to 31 Dec. 1999
 - 4.4. Develop the balance sheet for XYZ Construction as of 31 Dec. 1999.

Table 1

Assets		Liabilities	
Cash	\$39,000	Accounts Payable	\$78,000
Account Rec.	\$75,000	Notes Payable	\$20,000
Securities-T-Bills	\$35,000	Taxes payable	\$25,000
Inventory	<u>\$120,000</u>	Current Liabilities	<u>\$123,000</u>
Current Assets	\$269,000	Term Liabilities	
Fixed Assets		Mortgage On Bldg.	<u>\$340,000</u>
Equipment	\$45,000	Total Term Liabilities	\$340,000
Building	<u>\$670,000</u>	Total Liabilities	\$463,000
Total Fixed Assets	\$715,000	Owners Equity	
		Common Stock 1,000 shares	\$5,000
		Retained earnings	\$516,000
Total Assets	\$984,000	Total Liabilities and O. E.	\$984,000

Table 2

- a. Sold on credit, \$35,000 in material to South Building. (Note: This is the selling price for the material. The value of the inventory is unknown at this time. At the end of the month, a physical count of the inventory will be made and the CGS entry can be made then).
- b. Pay \$15,000 on account payable.
- c. Advertising in trade journal, paid \$3,000.
- d. Wages paid, \$2,500.
- e. Received \$22,000 from customer for account receivable
- f. Received bill from supplier for repair of equipment, \$1,000.
- g. Paid sales commission of \$1,500.
- h. Sold \$28,000 of material for each to customer.
- i. Billed Simpson Co. \$8,000 for installation services.
- j. Paid Mortgage Co. \$17,000 of which \$15,000 was toward principal and \$2,000 was interest.
- k. Paid part of tax owed, \$2,000.
- l. Declared and paid dividends of \$1,000
- m. Depreciation of equipment is \$1,000 and the building is \$2,000.
- n. Physical count of inventory at the end of the month is \$80,000. (Beginning inventory - removal during month = ending inventory).

12
6/19

工程時程控制 博士資格考 94 年 3 月

- 一、請說明已獲價值法(earned value method)的重點。(30 分)
- 二、某工作有下列作業、工期與關係，工期中 a 為最樂觀，m 最可能，b 為最悲觀時間。請畫出網圖，請說明 50 天以內完工機率的算法，及計算 95%機率的完工天數。單尾常態分配表中，機率 95% 之 $Z = 1.645$ 。(30 分)

作業	工期			前置作業
	a	m	b	
A	8	10	16	
B	11	12	14	A
C	7	12	19	B
D	6	6	6	B
E	10	14	20	B
F	6	10	10	C, D
G	5	10	17	D
H	4	8	11	E, G

- 三、某工作之作業、關係、正常及壓縮的工期、成本如下表所示，請計算最多可壓縮多少週，圖示以成本最小考量的壓縮過程，及各階段會增加的成本。(40 分)

Activity	Successors	Required weeks		Cost, \$	
		Normal	Crash	Normal	Crash
A	B, C	4	2	10,000	14,000
B	D, E	6	5	30,000	42,500
C	E	2	1	8,000	9,500
D	F	2	1	12,000	18,000
E	F	7	5	40,000	52,000
F	-	6	3	20,000	29,000