國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：工程數學

1. Find the general solution for each of the following differential equation.

(a) $y''+10y'+24y=1, \quad y(1)=10, \quad y'(1)=10$ (10%)

(b) $y'''-4y''+13y'+50y=-4\cos(2x)$ (10%)

2. Find the Laplace transformation of the following function.

$$f(t)=\begin{cases}0, & \text{if } 0\le t<4\\ e^{-3t}, & \text{if } 4\le t<6\\ 1+t, & \text{if } t\ge 6\end{cases}$$ (15%)

3. Find the inverse Laplace transformation of the following function.

$$F(s)=\frac{1}{(s^2+4)(s+12)}$$ (10%)

4. (a) Find the Fourier series for the periodic function $f(x+2\pi)=f(x)$

$$\&\quad f(x)=\begin{cases}0, & -\pi<x<0\\ x^2, & 0\le x\le\pi\end{cases}$$ (12%)

(b) From (a), Find the value of $\sum_{n=1}^{\infty}\frac{(-1)^{n-1}}{n^2}=?$ (8%)

5. Use the Fourier transform to solve $y''(t)+6y'(t)+5y(t)=\delta(t-3)$ (10%)

6. Determine the relationship of a, b, c and the solution(s) of (i) (ii) such that the following system of linear equations has

(i) exactly one solution, (6%)
(ii) an infinite number of solutions, (5%)
(iii) no solution. (4%)

$$\begin{aligned}x+5y+\ z&=0\\ x+6y-\ z&=0\\ 2x+ay+bz&=c\end{aligned}$$

7. Find all values of t for which the set S is linear independent.

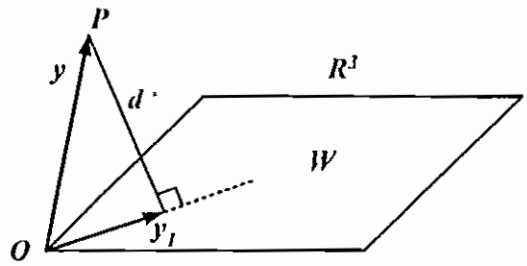
$$S=\left\{\begin{bmatrix}t\\t\\t\end{bmatrix}\ \begin{bmatrix}t\\1\\0\end{bmatrix}\ \begin{bmatrix}t\\0\\1\end{bmatrix}\right\}$$ (10%)

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：線性代數

請依題號作答並將答案寫在答案卷上，違者不予計分。

1. (20%) Let W be the plane spanned by the vectors (1,1,0) and (2,0,1) and let y=(1,2,-1).
(a) Find the orthogonal projection y_1 of the vector y on W.
(b) Find the distance d from the point P = (1, 2, -1) to the plane W (see Figure).



2. (20%) Determine whether or not the systems below are consistent.
(a) $2x + 3y + z = 4$
$x - y + z = 2$
$x + 4y = 2$

(b) $x - 3y + z + w = 4$
$x + y + z - w = 2$
$x + 5y + z - 3w = 1$

3. (10%) By means of the method of Gaussian elimination, find all solutions to the system of linear equations shown below:
$2x_1 - 3x_2 - x_3 + 2x_4 + 3x_5 = 4$
$4x_1 - 4x_2 - x_3 + 4x_4 + 11x_5 = 4$
$2x_1 - 5x_2 - 2x_3 + 2x_4 - x_5 = 9$
$2x_2 + x_3 + 4x_5 = -5.$

4. (25%) (a) Given $A=\begin{bmatrix} 1 & -2 \\ -1 & 0 \end{bmatrix}$, compute A^4.
(b) Given two matrices, Please simplify the following matrix expression
$A(A+2B) + 3B(2A-B) - A^2 + 7B^2 - 5AB$
(c) Prove that $(I-A)^{-1} = I+A+A^2+\ldots\ldots+A^m$. Assuming $A^{m+1} \approx \mathbf{0}$.

5. (25%) The following stochastic matrix gives occupational transition probabilities.

(initial generation)	White-collar	manual	
	0.9	0.2	white-collar
	0.1	0.8	manual (next generation)

(a) If the father is a manual worker, what is the probability that the son will be a white-collar.
(b) If there are 10,000 in the white-collar category and 20,000 in the manual category, what will the distribution be one generation later?

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：科技英文

選擇題 (每題 2 分，36 分)

1. According to the third law of thermodynamics, _____ possible is -273.16 degrees centigrade.
(A) that temperature is lowest
(B) the temperature is lowest
(C) lowest temperature
(D) the lowest temperature

2. Muskrats generally _____ close to the edge of a bog, where their favorite plant foods grow plentifully.
(A) staying
(B) stay
(C) they are staying
(D) to stay there

3. Oliver Ellsworth, _____ of the United States Supreme Court, was the author of the bill that established the federal court system.
(A) he was the third chief justice
(B) the third chief justice was
(C) who the third chief justice
(D) the third chief justice

4. _____ Colonial period the great majority of Connecticut's settlers came from England.
(A) Since
(B) The time
(C) During the
(D) It was

5. A politician can make a legislative proposal more _____ by giving specific examples of what its effect will be.
(A) to understanding
(B) understandably
(C) understandable
(D) when understood

6. Before every presidential election in the United States, the statisticians try to guess the proportion of the population that _____ for each candidate.
(A) are voted
(B) voting
(C) to be voted
(D) will vote

7. The air inside a house or office building often has higher concentrations of contaminants _____ heavily polluted outside air.
(A) than does
(B) more

(C) as some that are
(D) like of

8. The decimal numeral system is one of the _____ ways of expressing numbers.
(A) useful most world's
(B) world's most useful
(C) useful world's most
(D) most world's useful

9. The mountains surrounding Los Angeles effectively shield the city from the hot, dry winds the Mojave Desert, _____ the circulation of air.
(A) but they also prevent
(B) also prevented by them
(C) and also to prevent
(D) and also preventing

10. _____ the demands of aerospace, medicine, and agriculture, engineers are creating exotic new metallic substances.
(A) Meet
(B) Being met are
(C) To meet
(D) They are meeting

11. _____ no real boundary to the part of the ocean referred to as a "deep" because of changing water levels and movement in the sea floor.
(A) It is
(B) To be
(C) Being
(D) There is

12. A few animals sometimes fool their enemies _____ to be dead.
(A) appear
(B) to appear
(C) by appearing
(D) to be appearing

13. Abraham Lincoln insisted that _____ not just on mere opinion but on moral purpose.
(A) to base democracy
(B) whenever democracy is based
(C) democracy be based
(D) for democracy to be based

14. World trade patterns are indicative of the important economic issues _____ confront the world today.
(A) what
(B) that
(C) who
(D) they

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：科技英文

15. In the symphony orchestra, bass drums are not _____ kettle drums.
(A) as prevalent
(B) that prevalent
(C) so prevalent as
(D) prevalent than

16. Most natural ports are located where the shoreline is irregular and _____.
(A) the water is deep
(B) is the water deep
(C) deep water
(D) there is the deep water

17. _____ to the reproductive rates of other small mammals, that of the bat is very low indeed.
(A) Compared
(B) It is compared
(C) To be comparing
(D) Have compared

18. _____ native to Europe, the daisy has now spread throughout most of North America.
(A) That it is
(B) If it were
(C) In spite of
(D) Although

閱讀測驗 (每題 2 分，36 分)

The owner of a computer store is planning a window display of five products. Three are to be hardware items selected from K, L, M, N, and O, and two are to be software manuals selected from R, S, T, and U. The display items are to be selected according to the following conditions:

If K is displayed, U must be displayed.
M cannot be displayed unless both L and R are also displayed.
If N is displayed, O must be displayed, and if O is displayed, N must be displayed.
If S is displayed, neither T nor U can be displayed.

1. Which of the following is an acceptable display?
(A) L, M, O, R, S
(B) K, M, N, O, R
(C) K, L, M, R, U
(D) M, N, O, T, U
(E) N, O, R, S, T

2. If K and T are the first two display items to be selected, how many acceptable groups of items are there that would complete the display?
(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

3. If T and U are displayed, which of the following must also be displayed?
(A) K (B) L (C) M (D) N (E) R

4. If N and O are not displayed, all of the following must be displayed EXCEPT
(A) K (B) M (C) R (D) T (E) U

The molecules of carbon dioxide in the Earth's atmosphere affect the heat balance of the Earth by acting as a one-way screen. Although these molecules allow radiation at visible wavelengths, where most of the energy of sunlight is concentrated, to pass through, they absorb some of the longer-wavelength, infrared emissions radiated from the Earth's surface, radiation that would otherwise be transmitted back into space. For the Earth to maintain a constant average temperature, such emissions from the planet must balance incoming solar radiation. If there were no car-bon dioxide in the atmosphere, heat would escape from the Earth much more easily. The surface temperature would be so much lower that the oceans might be a solid mass of ice. Today, however, the potential problem is too much carbon dioxide. The burning of fossil fuels and the clearing of forests have increased atmospheric carbon dioxide by about 15 percent in the last hundred years, and we continue to add carbon dioxide to the atmosphere. Could the increase in carbon dioxide cause a global rise in average temperature, and could such a rise have serious consequences for human society? Mathematical models that allow us to calculate the rise in temperature as a function of the increase indicate that the answer is probably yes. Under present conditions a temperature-of--18℃ can be observed at an altitude of 5 to 6 kilometers above the Earth. Below this altitude (called the radiating level), the temperature increases by about 6℃ per kilometer approaching the Earth's surface, where the average temperature is about 15℃. An increase in the amount of carbon dioxide means that there are more molecules of carbon dioxide to absorb infrared radiation. As the capacity of the atmosphere to absorb infrared radiation increases, the radiating level and the temperature of the surface must rise. One mathematical model predicts that doubling the atmospheric carbon dioxide would raise the global mean surface temperature by 2.5℃. This model assumes that the atmosphere's relative humidity remains constant and the temperature decreases with altitude at a rate of 6.5℃ per kilometer. The assumption of constant relative humidity is important, because water vapor in the atmosphere is another efficient absorber of radiation at infrared wavelengths. Because warm air can hold more moisture than cool air, the relative humidity will be constant only if the amount of water vapor in the atmosphere increases as the temperature rises. Therefore, more infrared radiation would be absorbed and reradiated back to the Earth's surface. The resultant warming at the surface could be expected to melt snow and ice, reducing the Earth's reflectivity. More solar radiation would then be absorbed, leading to further increase in temperature.

5. The primary purpose of the passage is to
(A) warn of the dangers of continued burning of fossil fuels
(B) discuss the significance of increasing the amount of carbon dioxide in the atmosphere
(C) explain how a constant temperature is maintained on the Earth's surface
(D) describe the ways in which various atmospheric and climatic conditions contribute to the Earth's weather
(E) demonstrate the usefulness of mathematical models in predicting long-range climatic change

6. According to the passage, the greatest part of the solar energy that reaches the Earth is
(A) concentrated in the infrared spectrum
(B) concentrated at visible wavelengths
(C) absorbed by carbon dioxide molecules

(D) absorbed by atmospheric water vapor
(E) reflected back to space by snow and ice

7. According to the passage, atmospheric carbon dioxide performs all of the following functions EXCEPT
(A) absorbing outgoing radiation from the Earth
(B) absorbing infrared radiation
(C) absorbing radiation at visible wavelengths
(D) helping to retain heat near the Earth's surface
(E) helping to maintain a constant average temperature on the Earth's surface

8. Which of the following best describes the author's attitude toward the increasing amount of carbon dioxide in the atmosphere and its consequences?
(A) Incredulous
(B) Completely detached
(C) Interested but skeptical
(D) Angry yet resigned
(E) Objective yet concerned

9. It can be concluded from information contained in the passage that the average temperature at an altitude of 1 kilometer above the Earth is about
(A) 15℃ (B) 9℃ (C) 2.5℃ (D) -12℃ (E) -18℃

10. It can be inferred from the passage that the construction of the mathematical model mentioned in the passage involved the formulation of which of the following?
(A) An assumption that the amount of carbon dioxide added to the atmosphere would in reality steadily increase
(B) An assumption that human activities are the only agencies by which carbon dioxide is added to the atmosphere
(C) Assumptions about the social and political consequences of any curtailment of the use of fossil fuels
(D) Assumptions about the physical conditions that are likely to prevail during the period for which the model was made
(E) Assumptions about the differential behavior of carbon dioxide molecules at the various levels of temperature calculated in the model

11. According to the passage, which of the following is true of the last hundred years?
(A) Fossil fuels were burned for the first time.
(B) Greater amounts of land were cleared than at any time before.
(C) The average temperature at the Earth's surface has become 2℃ cooler.
(D) The amount of carbon dioxide in the atmosphere has increased measurably.
(E) The amount of farmland worldwide has doubled.

Our visual perception depends on the reception of energy reflecting or radiating from that which we wish to perceive. If our eyes could receive and measure infinitely delicate sense-data, we could perceive the world with infinite precision. The natural limits of our eyes have, of course, been extended by mechanical instruments; telescopes and microscopes, for example, expand our capabilities greatly. There is, however, an ultimate limit beyond which no instrument can take us; this limit is

imposed by our inability to receive sense-data smaller than those conveyed by an individual quantum of energy. Since these quanta are believed to be indivisible packages of energy and so cannot be further refined, we reach a point beyond which further resolution of the world is not possible. It is like a drawing a child might make by sticking indivisible discs of color onto a canvas. We might think that we could avoid this limitation by using quanta with extremely long wavelengths; such quanta would be sufficiently
sensitive to convey extremely delicate sense-data. And these quanta would be useful, as long as we only wanted to measure energy, but a completely accurate perception of the world will depend also on the exact measurement of the lengths and positions of what we wish to perceive. For this, quanta of extremely long wavelengths are useless. To measure a length accurately to within a millionth of an inch, we must have a measure graduate in millionths of an inch; a yardstick graduated in inches is useless. Quanta with a wavelength of one inch would be, in a sense, measures that are graduated in inches. Quanta of extremely long wavelength are useless in measuring anything except extremely large dimensions. Despite these difficulties, quanta have important theoretical implications for physics. It used to be supposed that, in the observation of nature, the universe could be divided into two distinct parts, a perceiving subject and a perceived object. In physics, subject and object were supposed to be entirely distinct, so that a description of any part of the universe would be independent of the observer. The quantum theory, however, suggests otherwise, for every observation involves the passage of a complete quantum from the object to the subject, and it now appears that this passage constitutes an important coupling between observer and observed. We can no longer make a sharp division between the two in an effort to observe nature objectively. Such an attempt at objectivity would distort the crucial interrelationship of observer and observed as parts of a single whole. But, even for scientists, it is only in the world of atoms that this new development makes any appreciable difference in the explanation of observations.

12. The primary purpose of the passage is to
(A) discuss a problem that hinders precise perception of the world
(B) point out the inadequacies of accepted units of measurement
(C) criticize attempts to distinguish between perceiving subjects and perceived objects
(D) compare and contrast rival scientific hypotheses about how the world should be measured and observed
(E) suggest the limited function of sensory observation

13. According to the passage, quanta with an extremely long wavelength cannot be used to give complete information about the physical world because they
(A) exist independently of sense-data
(B) are graduated only in inches
(C) have an insignificant amount of energy
(D) cannot, with present-day instruments, be isolated from quanta of shorter wavelength
(E) provide an insufficiently precise means of measuring length and position

14. Which of the following describes a situation most analogous to the situation discussed in lines 5-7?
(A) A mathematician can only solve problems the solution of which can be deduced from known axioms.
(B) An animal can respond to no command that is more complicated syntactically than any it has previously received.
(C) A viewer who has not learned, at least intuitively, the conventions of painting, cannot

understand perspective in a drawing.
(D) A sensitized film will record no detail on a scale that is smaller than the grain of the film.
(E) A shadow cast on a screen by an opaque object will have a sharp edge only if the light source is small or very distant.

15. The author uses the analogy of the child's drawing (lines 9-10) primarily in order to
(A) illustrate the ultimate limitation in the precision of sense-data conveyed by quanta
(B) show the sense of helplessness scientists feel in the face of significant observational problems
(C) anticipate the objections of those scientists who believe that no instrumental aid to observation is entirely reliable
(D) exemplify the similarities between packages of energy and varieties of color
(E) disparage those scientists who believe that measurement by means of quanta offers an accurate picture of the world

16. The author implies that making a sharp division between subject and object in physics is
(A) possible in a measurement of an object's length and position, but not in a measurement of its energy
(B) still theoretically possible in the small-scale world of atoms and electrons
(C) possible in the case of observations involving the passage of a complete quantum
(D) no longer an entirely accurate way to describe observation of the universe
(E) a goal at which scientists still aim

17. The author's use of the phrase "in a sense" (line 17) implies which of the following?
(A) Quanta of extremely long wavelength are essentially graduated in inches.
(B) Quanta of one-inch wavelength are not precisely analogous to yardsticks graduated in inches.
(C) Quanta of extremely long wavelength, in at lest one respect, resemble quanta of shorter wavelength.
(D) Quanta of one-inch wavelength and quanta of extremely long wavelength do not differ only in their wavelengths.
(E) Quanta of one-inch wavelength must be measured by different standards than quanta of extremely long wavelength.

18. According to the passage, the quantum theory can be distinguished from previous theories of physics by its
(A) insistence on scrupulously precise mathematical formulations
(B) understanding of the inherent interrelationship of perceiver and perceived
(C) recognition of the need for sophisticated instruments of measurement
(D) emphasis on small-scale rather than on large-scale phenomena
(E) regard for philosophical issues as well as for strictly scientific ones

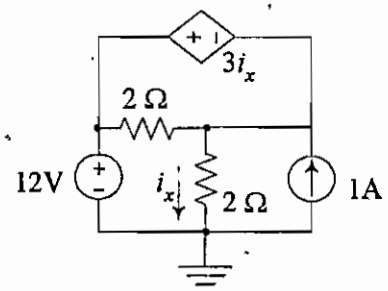
III、寫作 (28 分)

Some people believe that a college or university education should be available to all students. Others believe that higher education should be available only to good students. Discuss these views. Which view do you agree with? Explain why.

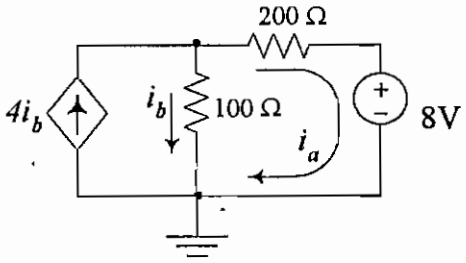
國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：電路學

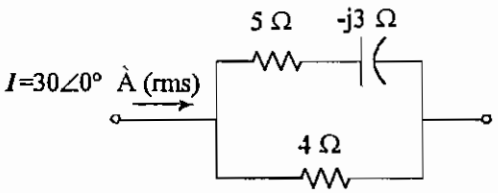
1. 求圖一中，電流 i_x之值。(15%)
2. 求圖二中，電流 i_a之值。(15%)
3. 求圖三電路所消耗的有效功率及無效功率；並計算功率因數。(20%)
4. 參考圖四之雙埠網路 (two-port network)，求其 Y 參數。(20%)
5. 參考圖五之電路，求 I_1、I_2及 V_x之值。(30%)



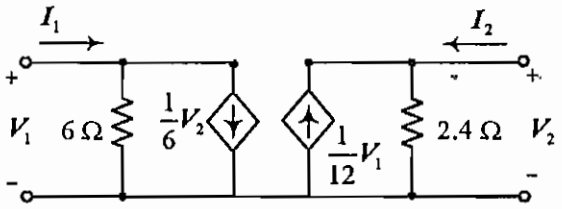
圖一



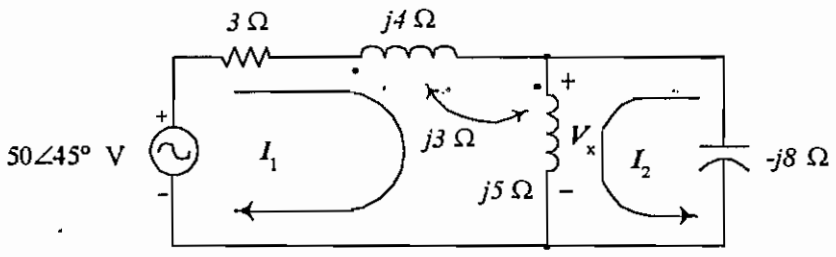
圖二



圖三



圖四



圖五

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：自動控制

1. The characteristic equation of a linear digital control system is

$$F(z) = z^3 + z^2 + 1.5Kz - (K + 0.5) = 0.$$

Determine the range of values of K for which the system is stable. (10%)

2. Find the state-transition matrix for the following state equation,

$$\begin{bmatrix} x_1(k+1) \\ x_2(k+1) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1(k) \\ x_2(k) \end{bmatrix} \qquad (10\%)$$

3. A controlled plant is represented by the following dynamical equation

$$\begin{bmatrix} \dot{x}_1(t) \\ \dot{x}_2(t) \end{bmatrix} = \begin{bmatrix} -1 & 5 \\ -6 & 0 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$$
$$y(t) = x_1(t)$$

The state feedback control is designed by

$$u(t) = -k_1 x_1(t) - k_2 x_2(t) + r(t)$$

where k_1 and k_2 are real constants and $r(t)$ is the reference input.

(a) Find the locus in the k_1 versus k_2 plane on which the overall system has a damping ratio $\zeta = 0.707$. (10%)

(b) Find the values of k_1 and k_2 such that $\zeta = 0.707$ and $\omega_n = 10$ rad/sec. (10%)

(c) Let the error be defined as $e(t) = r(t) - y(t)$. Find the locus in the k_1 and k_2 plane on which the steady-state error due to a unit-step input is zero. (10%)

4. (a) Figure 1 shows a single-loop control configuration of a dc servomechanism. Determine the sensitivity of the closed-loop transfer function $M(s) = \theta(s)/\theta_r(s)$ to the variations in K. The nominal value of $K = 1$. (10%)

(b) Change the control configuration of the system to the configuration shown in Figure 2 with feedback of θ and $\dot{\theta}$. Find K_1 and K_2 so that the closed-loop transfer function $M(s) = \theta(s)/\theta_r(s)$ of the two-loop system is equal to that of the single-loop system shown in Figure 1. Determine the sensitivity of the closed-loop transfer function $M(s)$ to the variations in K. (The nominal value of $K = 1$.) Comment on the result. (10%)

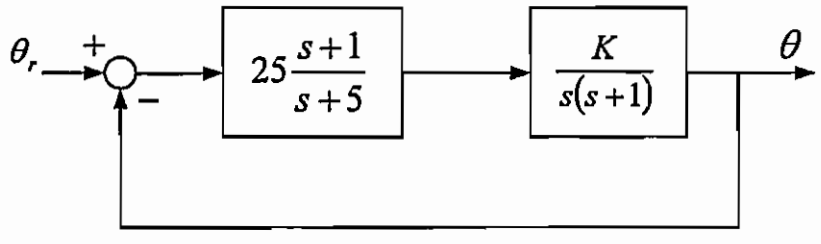


Figure 1. Single-loop configuration

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：自動控制

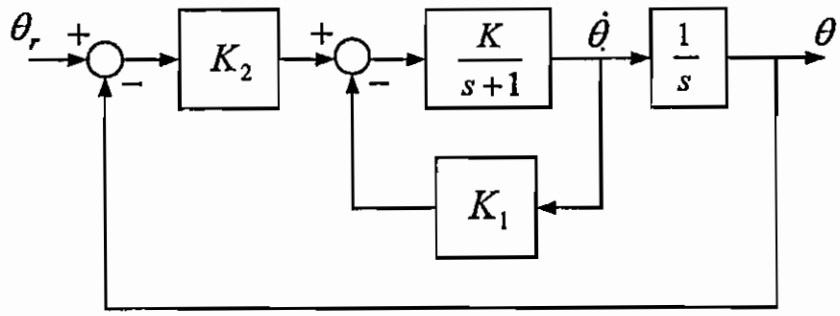


Figure 2. Two-loop configuration

5. A unity-feedback system has open-loop transfer function

$$G(s) = \frac{e^{-s\tau_d}}{s(s+1)}$$

Draw the Nyquist plot of $G_1(j\omega) = \frac{1}{j\omega(j\omega+1)}$, together with the critical plot of $e^{-j\omega\tau_d}$ (for ω varies from 0 to ∞). Using these curves, determine the maximum value of the delay time τ_d for the closed-loop system to be stable. (10%)

6. Consider the type-1 system of Figure 3. The compensator $C(s)$ will be designed to meet the following specifications: (*i*) Damping ratio $\zeta = 0.707$; (*ii*) Setling time $T_s \leq 2$ sec. (The time required for the system output to settle within 2% of the input final value.)

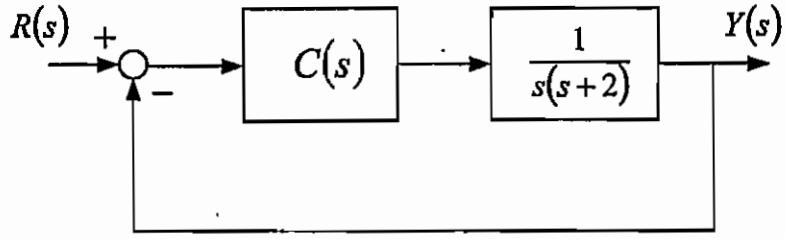


Figure 3.

(a) Show that the proportional control, $C(s) = K$, is not adequate. (10%)

(b) For $C(s) = K_P + K_D s$, find K_P and K_D to meet the design specifications. (10%)

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

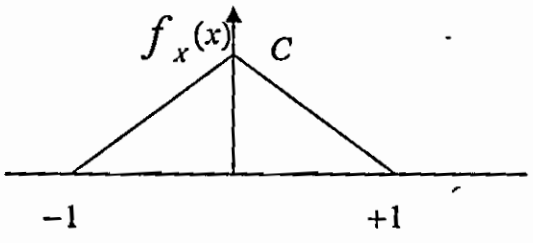
系所：電機系
科目：機率

20% 第一題

Suppose a coin is tossed n times. The probability that the coin appears as a head is p. The reward in obtaining X heads is a^x, where a > 0. Find the expected value and variance of the reward.

20% 第二題

A random variable X has the probability density function as follows.



10% (a) Find $f_x(x)$ and the value of C.

5% (b) Find the mean of X.

5% (c) Find b such that P[|X|<b]=0.5.

20% 第三題

Let X and Y be independent Poisson random variables with respective means λ_1 and λ_2, please calculate the conditional expected value of X given that X+Y=n.

20% 第四題

In a presidential election, candidate A receives n votes, and candidate B receives m votes where n>m. Assuming that all orderings are equally likely, show that the probability that A is always ahead in the count of votes is (n-m)/(n+m).

20% 第五題

Suppose that it is known that the number of items produced in a factory during a week is a random variable with mean 500.

10% (a) What can be said about that the probability that this week's production will be at least 1000? (Hint: using Markov's Inequality)

10% (b) If the variance of a week's production is known to equal 100, then what can be said about the probability that this week's production will be between 400 and 600? (Hint: using Chebyshev's Inequality)

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：計算機概論（丁）

1. (5%) a. 試將浮點數 8.3125 以二進制表達之。
   (5%) b. 試利用 Two's complement representation 完成下列加法: (-37) + (22)

2. (12%) 試說明快取記憶體 (Cache memory) 的工作原理。

3. 利用 Mask bit pattern 與 Target bit pattern 可做 bit-by-bit logic operations，

   例如：
   Target 10100110 AND
   Mask 00000111
   Result 00000110

   (5%) a. 試選一組 Mask bit pattern 及 logic operation，使得 Result bit pattern 的最後三個位元全部爲 0，其餘的位元與 Target bit pattern 相同。
   (5%) b. 試選一組 Mask bit pattern 及 logic operation，使得 Result bit pattern 與 Target bit pattern 恰好相反。

4. (8%) 一般所稱 32-bit CPU 所指的 32 位元代表何意義？

5. (10%) 試寫一個程式，能判定輸入年份是否爲閏年 (leap year)。

   閏年判定方式：是 4 的倍數，但不是 100 的倍數；或者是 400 的倍數
   例如：Year 1800 非閏年，Year 2000 是閏年
   (不拘何種程式語言，但以 C 爲佳，程式必須包括輸入與輸出)

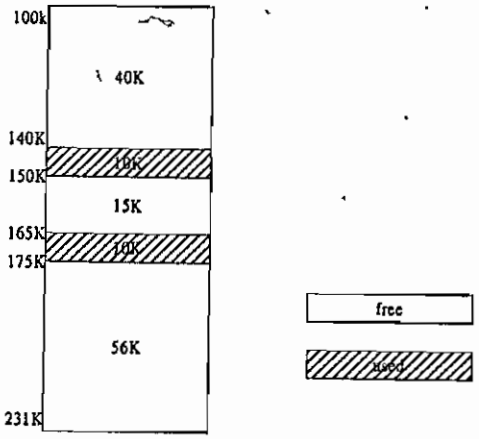
6. (8%) 描述下列通訊協定的操作原理： (1) ARP (2) CSMA/CD

7. 考慮某一個磁碟，共有 200 個磁軌，由 0 至 199 編號且最內圈磁軌編號爲 199。如果目前讀寫頭的位置是在第 72 個磁軌，且磁碟要求佇列中有如下的磁軌等待排程： 96，182，36，120，14，124 及 65。
   (6%) a. 何謂循環掃瞄法(Circular_SCAN)？ 若採用循環掃瞄法且讀寫頭是先朝最內圈磁軌移動時，試問讀寫頭移動的總磁軌數爲多少？
   (6%) b. 何謂觀察法(Look)？ 若採用觀察法且讀寫頭是先朝最內圈磁軌移動時，試問讀寫頭移動的總磁軌數爲多少？

8. (3%) a. 描述下列記憶體之動態配置法的操作原理： (1) 最先適合法 (first fit) (2) 最佳適合法 (best fit) (3) 最不適合法 (worst fit)
   (7%) b. 考慮某一個記憶體，其上有 40k, 15k 和 56k 等 3 塊可用的記憶體空間，如圖(一)所示。若要將四個大小分別爲 20k,40k,15k 和 x k 的行程(process)作配置(按此排列順序作配置)，試討論當 x 值在那些範圍時，那一種(或那幾種)動態配置法可以將此四個行程同時配置在此記憶體？

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：計算機概論（丁）



圖(一)

9. (6%) a. 試寫一個遞迴演算法(recursive algorithm)來計算階乘函數 $n!$，$n \geq 1$
(4%) b. 分析你的遞迴演算法的時間複雜度(time complexity)

10. (10%) 試分析圖(二)之 C 語言程式，並且試問當它執行後，它將印出的 x 值爲何？

```
#include <stdio.h>
int f( int [], int, int );
int main()
{
    int x, A[7] = {51, 23, 100, 41, 16, 33, 88};
    x = f(A, 0, 6);
    printf("\nx = %d\n", x);
    return 0;
}
int f(int A[], int i, int j)
{
    static int x = 100;
    if (A[i] < x) x = A[i];
    if (i == j) return x;
    else return f(A, i + 1, j);
}
```

圖(二)

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：計算機概論 (戊)

1. (10%) 試說明將類比訊號 (analog signal) 轉換至數位訊號 (digital signal) 的過程。

2. (a) (7%) 試說明如何以 'sign-exponent-mantissa' format 表達浮點數 (floating-point number)，舉一例說明之。 (註：Format 可自行定義)
   (b) (6%) 利用上述表達法完成下列減法:

$$\begin{array}{r} 1.1001\times 2^4 \\ -\ 1.001\ \times 2^2 \end{array}$$

3. 利用 Mask bit pattern 與 Target bit pattern 可做 bit-by-bit logic operations，例如：

Target	10100110	AND
Mask	00000111	
Result	00000110	

   (a) (5%) 試選一組 Mask bit pattern 及 logic operation，使得 Result bit pattern 全部為 1。
   (b) (5%) 試選一組 Mask bit pattern 及 logic operation，使得 Result bit pattern 與 Target bit pattern 恰好相反。

4. (7%) 試說明 CPU 執行指令 (instructions) 的 Machine cycles。

5. (a) (5%) 何謂指令集 (instruction set)。
   (b) (5%) 何謂 CISC 與 RISC，二者主要差異為何？

6. The minterm expansion for the Boolean function G is

$$G(a,b,c,d)=\sum m(0,4,5,6,7,10,13,14,15).$$

   (a) (5%) Find a minimum sum-of-product expression for G.
   (b) (5%) Implement G with a 8-to-1 multiplexer, where the control signals are a,b, and c.

7. Consider a 2-bit counter which counts in the sequence: $AB=00,11,10,00,11,10,\cdots$. A and B are the outputs of flip-flop A and flip-flop B, respectively.
   (a) (5%) Design this counter using clocked D flip-flops. The characteristic equation of the D flip-flop is $Q^+=D$, where Q^+ and D represent the output and the input of the D flip-flop, respectively.
   (b) (5%) Draw the logic diagram in (a).
   (c) (5%) What will happen if the designed counter starts in state 01?

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：計算機概論 (戊)

8. A sequential network has one input and one output. The output Z is 1 if the input X is a 0 which terminates a group of an odd number (at least three) of consecutive 1's.
   (a) (5%) What is the difference between a Mealy machine and a Moore machine?
   (b) (5%) Derive a Mealy type state graph with a minimum number of states.
   (c) (5%) Derive a Moore type state graph with a minimum number of states.

9. (10%) Consider the linear feedback shift register (LFSR) consisting of three clocked D flip-flops and two exclusive-OR (XOR) gates in Fig. P9. Draw a complete state graph showing all states.

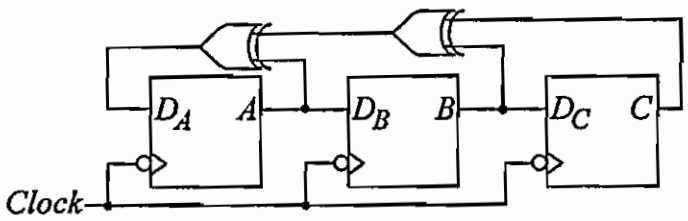


Fig. P9

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：工程數學 (在)

1. 求下列方程式之一般解

(a) $y'+\frac{1}{x}y=3x^2, \quad (x\neq 0)$ (10%)

(b) $y''-y'-6y=12xe^x$ (10%)

(c) $y''+10y'+24y=1,\ y(2)=-3,\ y'(2)=5$ (10%)

2. 使用拉氏變換(Laplace transformation)，求下列方程式之解

$$y''+4y=f(t),\quad f(t)=\begin{cases}1, & 0\le t<1\\ 0, & t\ge 1\end{cases},\quad y(0)=0,\ y'(0)=-1 \qquad (15\%)$$

3. $f(t)=te^{-2t}\cos(3t)$，求函數$f(t)$的拉氏變換(Laplace transformation)？ (10%)

4. $F(s)=\frac{e^{-2s}}{s^2(s-1)}$，求函數$F(s)$的反拉氏變換(inverse Laplace transformation)？ (10%)

5. 求解下列線性微分方程組 (20%)

$$\begin{cases}y_1'=3y_1+2y_2\\ y_2'=6y_1-y_2\end{cases}$$

6. 求解下列線性方程組之所有解集合 (15%)

$$\begin{cases}x_1 \quad -2x_3+x_4=5\\ 3x_1+x_2-5x_3 \quad =8\\ x_1+2x_2 \quad -5x_4=-9\end{cases}$$

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：電力電子學

1. In Fig. 1, R=4Ω, L=10mH, V_{dc}=12V, and $v_s(t)$=50+30cos(4π60t)+10cos(8π60t)V. Determine the power absorbed by each element. (25%)

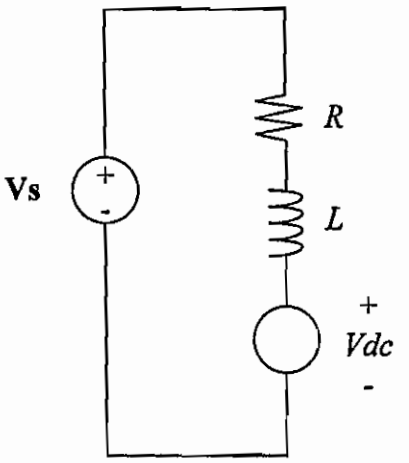


Fig. 1

2. The full-bridge inverter of Fig. 2 has a switching sequence which produces a square-wave voltage across a series R-L load. The switching frequency is 60Hz, Vdc=100V, R=10 Ω, and L=25mH. Determine the THD of the load voltage and the load current for the square-wave inverter. (The Fourier series for the square wave: $v_o(t) = \sum_{n,odd} \frac{4V_{dc}}{n\pi}(\sin n\omega_0 t)$) (25%)

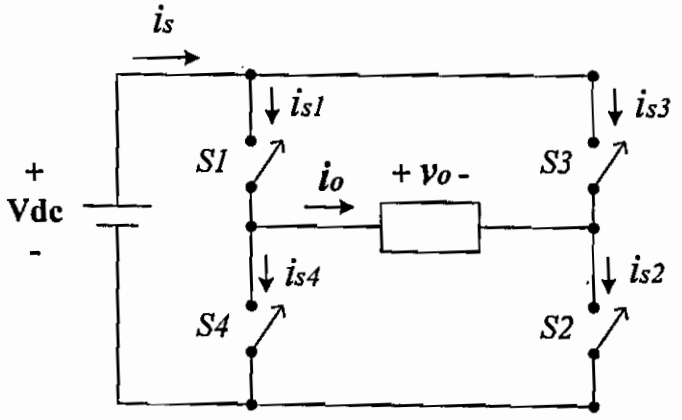


Fig. 2

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：電力電子學

3. A buck-boost converter. The input voltage is 12V. The transistor duty ratio is set to 50%, while the load is a large capacitor in parallel with a 0.6Ω resistor. The switching frequency is 100 kHz. If the inductor is $0.5\,\mu H$, please calculate the output voltage. (25%)

4. Two IGBT devices are used to a dc drive application, shown in Fig. 3. The drive input voltage is 500 V, and the output current is 100 A. The slow IGBT has a forward drop of 1.5 V at 100 A. Its current tail generates loss of $12\,mJ$ per switching at 500 V and 100 A. The fast IGBT has a forward drop of 2.7 V at 100A, but current tailing consumes only $4\,mJ$ per switching. At what switching frequency will the total loss of the slow device equal to the total loss of the fast device? (25%)

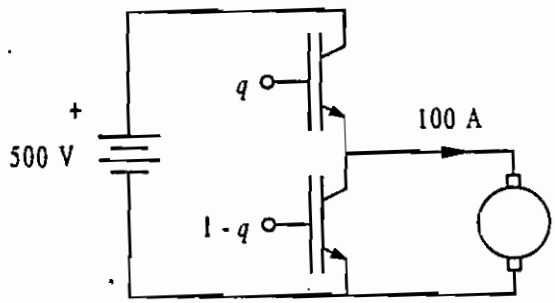


Fig. 3

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：電力系統

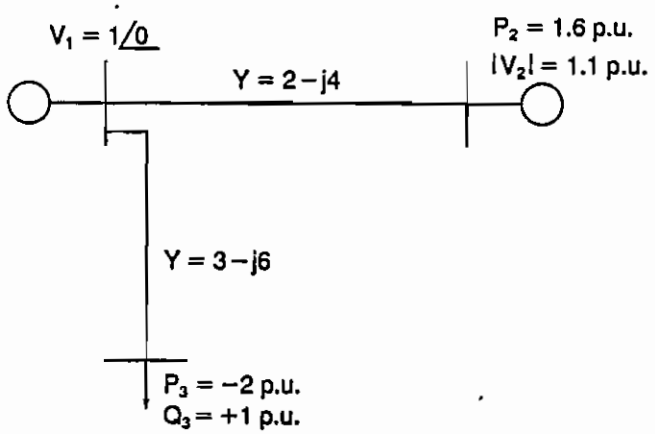
1. 說明改善功率因數的效益。(10%)
2. 說明變壓器的差動保護原理。(10%)
3. 何謂“負載-頻率控制”(Load-Frequency Control, LFC)？在互連電力系統中 LFC 的目標爲何？(10%)
4. 何謂“絕緣協調”(Insulation Coordination)、“基本絕緣水準”(Basic Insulation Level)？(10%)

5. A single-phase 50-kVA, 2400/240-volts, 60-Hz distribution transformer is used as a step-down transformer at the load end of a 2400-volt feeder whose series impedance is (1.0+*j*2.0) ohms, The equivalent series impedance of the transformer is (1.0+*j*2.5) ohms referred to the high-voltage (primary) side. The transformer is delivering rated load at 0.8 power factor lagging and at rated secondary voltage. Neglecting the transformer exciting current, determine (a) the voltage at the transformer primary terminals, (b) the voltage at the sending end of the feeder, and (c) the real and reactive power delivered to the sending end of the feeder. (15%)

6. A 150-km, 230-kV, 60-Hz three-phase line has a positive-sequence series impedance $z = 0.08 + j0.48\,\Omega/\text{km}$ and a positive-sequence shunt admittance $y = j3.33\times10^{-6}$ S/km. At full load, the line delivers 250 MW at 0.99 p.f. lagging and at 220 kV. Using the nominal π circuit, calculate: (a) the *ABCD* parameters, (b) the sending-end voltage and current, and (c) the percent voltage regulation. (20%)

7. Consider the simplified electric power system shown in Figure 1 for which the power-flow solution can be obtained without resorting to iterative techniques. (a) Compute the elements of the bus admittance matrix Y_{bus}. (b) Calculate the phase angle δ_2 by using the real power equation at bus 2 (voltage-controlled bus). (c) Determine $|V_3|$ and δ_3 by using both the real and reactive power equations at bus 3 (load bus). (d) Find the real power generated at bus 1 (swing bus). (e) Evaluate the total real power losses in the system. (25%)

Figure 1



國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：電子學

(1) Fig. 1 is the block diagram representation of the internal circuit of the 555 IC timer.

(a) By adding two external resistors and an external capacitor, use the 555 timer to implement an astable multivibrator. (10%)

(b) For the designed circuit in (a), determine the duty cycle of the output square wave. (15%)

(2) The transfer function of a filter is given by $T(s)=\dfrac{110s}{(s+10)(s+100)}$.

(a) Draw the Bode plot of the filter. (10%)

(b) Use a resistor, an inductor, and a capacitor to implement the filter. What are the values of these components? (15%)

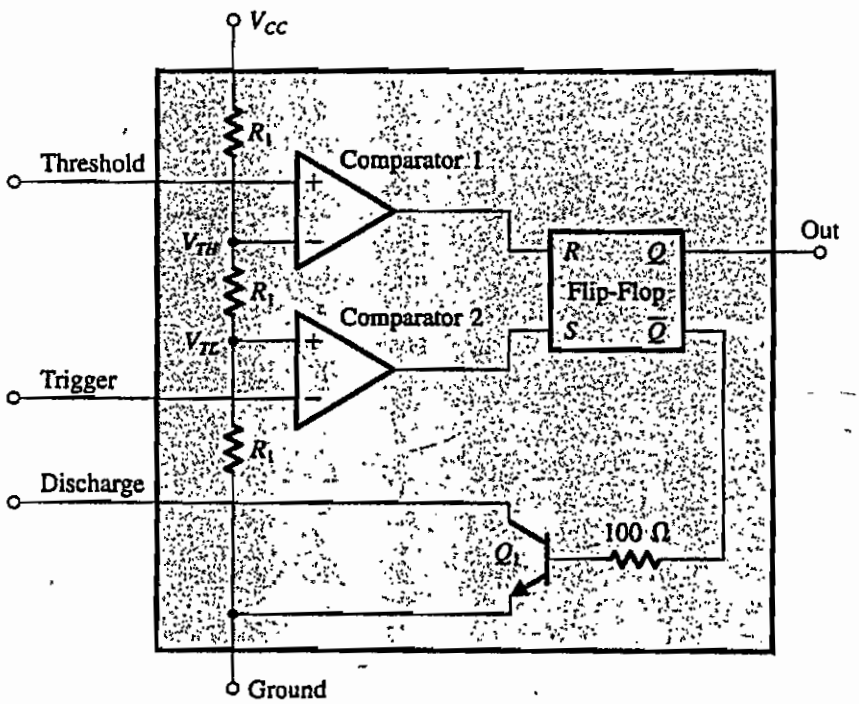


Fig. 1

(3) Assume the transistor parameters are: $\beta = 100$, $V_{BE(ON)} = 0.7V$, *and* $V_A = 80V$.

(a) Calculate the small-signal voltage gain of an emitter-follower circuit (Fig. 2). (13%)

(b) Calculate the input and output resistance of this emitter-follower circuit. (13%)

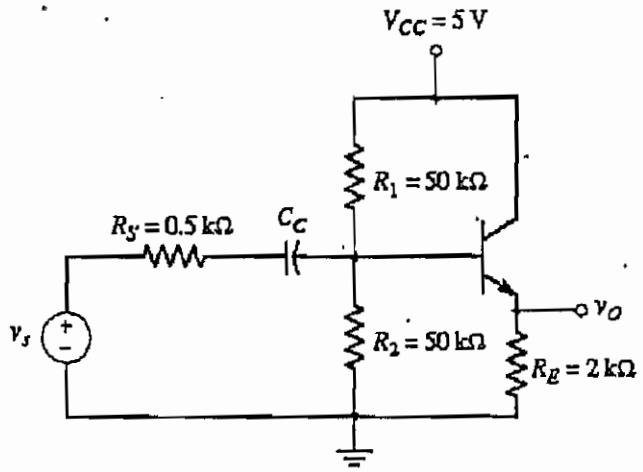


Fig. 2

(4) Consider the circuit in Fig. 3, with transistor parameters $\beta = 100$, $V_{BE(ON)} = 0.7V$, *and* $V_A = 100V$.

Determine the differential- and common-mode input resistances of the differential amplifier. (24%)

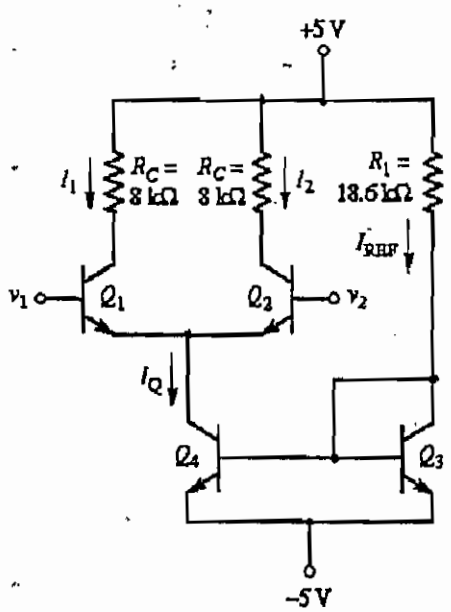


Fig. 3

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：通信理論

1. (15%) The output signal-to-noise ratio and channel signal-to-noise ratio of an AM system using envelope detector are already known to be

$$(\mathrm{SNR})_{O,\mathrm{AM}} \cong \frac{A_c^2 k_a^2 P}{2WN_0}, \quad \text{and} \quad (\mathrm{SNR})_{C,\mathrm{AM}} = \frac{A_c^2(1+k_a^2 P)}{2WN_0},$$

where k_a is the amplitude sensitivity of the AM modulator, A_c denotes the carrier amplitude, $N_0/2$ is the noise spectral density, P and W are the transmitted power and bandwidth of the message signal, respectively.

(a) (5%) What is the figure of merit for amplitude modulation?

(b) (10%) Suppose the message is $m(t) = \cos(2000\pi t) + 2\cos(6000\pi t)$. Find the maximum value of the figure of merit under the requirement that overmodulation does not occur.

2. (20%) Consider the FM signal $s(t) = A_c \cos[2\pi f_c t + 2\pi k_f \int_0^t m(\sigma)d\sigma]$ with $m(t) = 2\cos(2000\pi t)$ and $f_c = 100$ MHz.

(a) (12%) Assume the transmission bandwidth of the FM signal is strictly restricted to be under 10 kHz. Find the maximum allowable value of the frequency sensitivity, k_f.

(b) (8%) When k_f is chosen to be its maximum allowable value, determine whether the modulated output is an NBFM signal or a WBFM signal.

3. (20%) Consider the signal given by

$$s(t) = \begin{cases} 2, & 0 < t < T_b/3 \\ -1, & T_b/3 < t < T_b \end{cases},$$

(a) (4%) Calculate the transmitted energy of the signal.

(b) (10%) Determine and sketch the impulse response of a filter matched to this signal. Plot the block diagram of the receiver.

(c) (6%) Plot the matched filter output as a function of time.

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：通信理論

4. (25%) The transmitted signals of a quaternary system (i.e. $M = 4$) are defined as

$$s_i(t) = a_i\phi_1(t) + b_i\phi_2(t), \quad 0 < t < T,$$

where $\phi_1(t)$ and $\phi_2(t)$ are a set of orthonormal basis functions. The four possible (a_i, b_i) pairs are (2, 1), (1, −2), (−2, −1), and (−1, 2).

(a) (5%) Draw the signal constellation and point out the decision region for each of the signals.

(b) (10%) Assume the signals are Gray encoded. Calculate the average probability of bit error when the signals are transmitted through an AWGN channel.

(c) (10%) Design and plot the structure of the coherent detector.

5. (20%) Consider a discrete memoryless source with source alphabet $S = \{ s_1, s_2, s_3, s_4, s_5\}$ with respective probabilities { 0.3, 0.2, 0.2, 0.15, 0.15 }.

(a) (5%) Calculate the entropy of the source.

(b) (10%) Compute the Huffman code for this source. Then evaluate the average codeword length and the efficiency of the code.

(c) (5%) Calculate the entropy of the second-order extension of the source.

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：資料結構

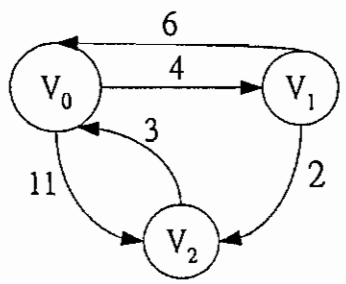
1. (a) 某一演算法之時間複雜度可用遞迴(recursive)關係式 $T(n)=T(\frac{n}{2})+1$，$n>1$，$T(1)=1$，來表示，試問此一演算法之時間複雜度爲何？(n 爲資料總筆數) (6%)
   (b) 寫出一個演算法的名稱並說明爲什麼它的時間複雜度可用上述遞迴關係式來表示。(4%)

2. (a) 若一棵二元樹之前序追蹤(preorder traversal)爲 1 2 4 7 3 5 8 9 6；中序追蹤(inorder traversal)爲 4 7 2 1 8 5 9 3 6，則其後序追蹤(postorder traversal)爲何？(5%)
   (b) 証明前序追蹤(preorder traversal)與後序追蹤(postorder traversal) 不一定可以決定唯一的二元樹。(5%)

3. 假設三維陣列 A[1:3, 1:4, 1:5]之第一個元素 A[1, 1, 1]在記憶體之位址爲 1234，假設每一個元素佔 1 個 byte，那麼
   (a) 當採用 row major 時，A[2, 3, 3]之位址爲何？(5%)
   (b) 當採用 column major 時，A[2, 3, 3]之位址爲何？(5%)

4. (a) 撰寫一個演算法來描述如何用堆疊(stack)計算一個後置算術式子(postfix expression)的值。(6%)
   (b) 以後置算術式子：8 4 / 5 − 3 6 × + 說明你的演算法的執行情況 (請注意，所有數字皆爲個位數)。(4%)

5. 給定一個加權圖形 $G=(V,E)$，$|V|=n$，頂點之註標(index)爲0, 1, 2, …, $n-1$，G 之成本相鄰矩陣爲 $C[i,j]$。令 $A^k[i,j]$ 爲頂點 i 至 j 花費最小的路徑值，且除了起始點 i 與終點 j 之外，這條路徑經過的頂點註標均≤ k。很明顯地，$A^{-1}[i,j]$ 等於 $C[i,j]$，並且 $A^{n-1}[i,j]$ 代表 G 上頂點 i 到 j 的真正花費最小的路徑值
   (a) 解釋下列式子之意義。(4%)
   $A^k[i,j]=\min\{A^{k-1}[i,j], A^{k-1}[i,k]+A^{k-1}[k,j]\}, k\geq 0$
   (b) 以圖(一)之圖形爲例子，試寫出它的 $A^{-1}[i,j]$ $A^0[i,j]$ $A^1[i,j]$ $A^2[i,j]$ 之值。(6%)



圖(一)

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：資料結構

6. (a) (單選題)給定 n 筆資料，任何以比較爲主（comparison-based）的排序演算法的時間複雜度之理論下限值爲下列何者? (5%)

① $O(\log n)$ ② $\Omega(\log n)$ ③ $\Theta(\log n)$

④ $O(n \log n)$ ⑤ $\Omega(n \log n)$ ⑥ $\Theta(n \log n)$

(b) 論述或證明你的答案。 (5%)

7. (a) 考慮快速排序法（quick sort）。若取第一個數字作爲控制鍵（control key 或 pivot key），依遞增方式排列下列資料：

7, 4, 14, 8, 6, 11, 8, 5

若 Pass 1 爲 6, 4, 5, 7, 8, 11, 8, 14，則 Pass 2 爲何？ (5%)

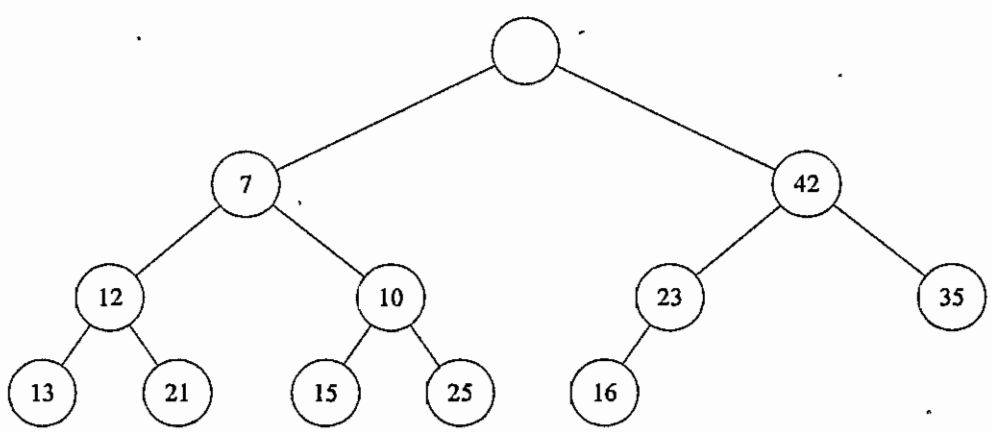
(b) 有那些方式可加快快速排序法的執行速度？（5%）

8. 使用散置函數(hashing function) $f(x) = x \% 11$，其中%爲模數 (modulo) 運算。若發生 bucket overflow 情形時，使用二次方探測（quadratic probing）方法來處理。考慮表(一)之散置表，且一 bucket 僅有一 slot 的狀況下，數值 15 將被置於此表中那個位置？（10%）

	0	1	2	3	4	5	6	7	8	9	10
Hash table	77	969		25	323	38		458			340

表(一)

9. 考慮圖(二)所示之雙堆集樹（deap）。



圖(二)

(a) 若於圖(二)插入節點 30，則此雙堆集樹將變成如何？（3%）

(b) 若不考慮(a)小題，而直接自圖(二)刪除節點 7，則此雙堆集樹將變成如何？（3%）

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：電機系
科目：資料結構

(c)（複選題)關於雙堆集樹與最小-最大堆集樹(min-max heap)之間的比較，下列那些選項爲真？（4%）

①二者均爲 double-ended priority queue，支援插入任意鍵值、刪除最大鍵值及刪除最小鍵值動作

②僅雙堆集樹屬 double-ended priority queue

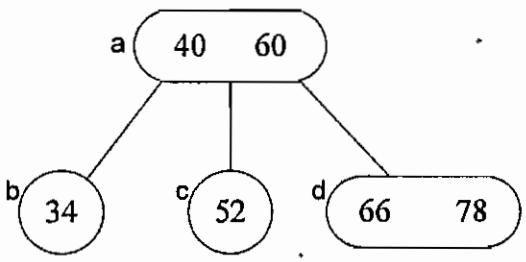
③僅最小-最大堆集樹屬 double-ended priority queue

④針對①中所述的三種動作，此二種堆集樹均可於對數(logarithmic)時間內完成

⑤針對①中所述的三種動作，雙堆集樹可比最小-最大堆集樹快常數倍時間

⑥針對①中所述的三種動作，最小-最大堆集樹可比雙堆集樹快常數倍時間

10. (a) 若於圖(三)之 2-3 樹插入鍵值 63，則新生成的 B-tree (order 仍爲 3)爲何？（5%）



圖(三)

(b) 假設原 2-3 樹存於磁碟機上，且磁碟機一次僅能存取一節點，則欲達到(a)小題的插入動作將需要多少次的磁碟機存取？（5%）