國立雲林科技大學
99學年度碩士班暨碩士在職專班招生考試試題

系所：通訊所
科目：線性代數與機率學

1. (10%) Given a matrix $A_{3x3}=\begin{bmatrix}2 & 3 & 1\\ -4 & 0 & 5\\ 1 & 6 & 5\end{bmatrix}$, please list all the principal submatrix of matrix A.

2. (13%) For a matrix $A_{3x3}=\begin{bmatrix}1 & 1 & 1\\ 1 & 2 & 0\\ 1 & 0 & 3\end{bmatrix}$, find two nonsingular matrices P and Q such that PAQ is a diagonal matrix. Please show all the steps derivation.

3. (12%) For a system of linear equations $AX=B$, where

$$A=\begin{bmatrix}0 & a & 1\\ a & 0 & b\\ a & a & 2\end{bmatrix},\quad B=\begin{bmatrix}b\\ 1\\ 2\end{bmatrix}$$

Determine the values or conditions of (a,b) for the system to have
(a) a unique solution
(b) a one-parameter solution
(c) a two-parameter solution
(d) no solution

4. (15%) Given the matrix

$$C=\begin{bmatrix}1 & -2 & -1\\ 1 & 3 & 5\\ 2 & 3 & 2\\ 2 & 0 & 1\end{bmatrix}$$

Find the QR-factorization of the matrix C.

5. (25%)一個隨機變數 X 分別以機率： {0.1, 0.2, 0.1, 0.4, 0.2} 取得一組對應值：{-1, -0.5, 0.7, 1.5, 3}。請畫出它的機率分配函數 $F_X(x)$ 以及密度函數 $f_X(x)$。

6. (25%)某同學做一個有 5 個答案的單選題的考試題目。答對得十分，答錯倒扣五分而未答則得零分。假設其真正會解而對答案的機率是 p=1/2，不會解或解不出來而用猜的之機率是 1-p。當其用猜測的而選對答案的機率是 1/5。
(A) (10%)若其答對了，則其是真正會做而不是用猜測的機率為何？
(B) (15%)不管會不會解該題假設其都做答了，預期會得幾分？

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系所：通訊所
科目：通信系統

1. (20%) Given c(t)=a(t)b(t), where a(t)= $\cos\omega_0 t$ and the Fourier transform of b(t) is B(ω) where B(ω) = 1 for $|\omega| < \omega 1$ and B(ω) =0 for $|\omega| > \omega 1$
   (a) (6%) Find C(ω) the Fourier transform of c(t).
   (b) (7%)Let d(t)=c(t)a(t), find D(ω) the Fourier Transform of d(t).
   (c), (7%)What is the minimum value of ω_0 which guarantees a complete recovery of B(ω).

2. (20%) Given x(t)=$\cos\omega_0 t$ which is sampled by $p(t)=\sum_{K=-\infty}^{+\infty}\delta[t-KT]$ to obtain the sampled function $x_p(t)$. $X_r(t)$ is obtained by passing $x_p(t)$ through an ideal lowpass filter H(ω) with cutoff frequency $\omega_c = \frac{\omega_s}{2}$, where $\omega_s = \frac{2\pi}{T} = 800$. Find $X_r(t)$ in the following:
   (a) ω_0=200; (b) ω_0=300; (c) ω_0=600; (d) ω_0=800; (e) ω_0=1000. (4% each, explain your reasons)

3. (20%) A certain symmetry is required for the transfer function of the filter in a vestigial sideband (VSB) transmitter.
   (a) (10%) Describe the symmetry and give an example to explain (in detail) why it is required.
   (b) (6%) What are the advantages of VSB modulation over single sideband (SSB) and double sideband (DSB) modulation?
   (c) (4%) Explain why VSB is generally more popular in the transmission of TV signals than SSB and DSB?

4. (20%) A ternary system has the signal constellation as shown in Figure 1. Assume the signals are transmitted through an AWGN channel and the source symbols are equiprobable. Plot the decision regions for the coherent receiver and determine its average symbol error probability.

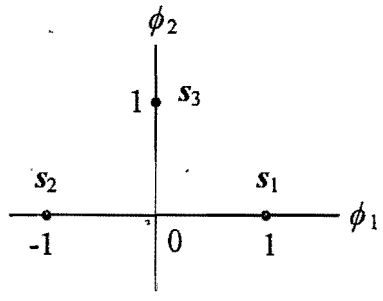

Figure 1

5. (20%) Consider the differential pulse code modulation (DPCM) system.
   (a) (10%) Describe DPCM and discuss how it differs from conventional PCM.
   (b) (6%) Discuss its advantages and disadvantages relative to conventional PCM.
   (c) (4%) In what extreme cases will DPCM systems provide little advantage over conventional PCM systems?