# 國立臺北大學 107 學年度碩士班一般入學考試試題

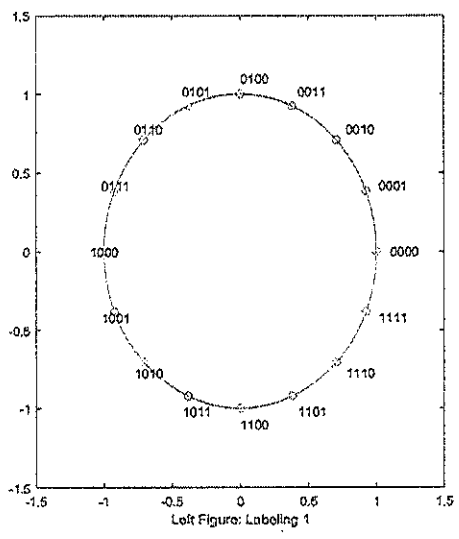
系（所）組別：通訊工程學系

科　　目：通訊原理

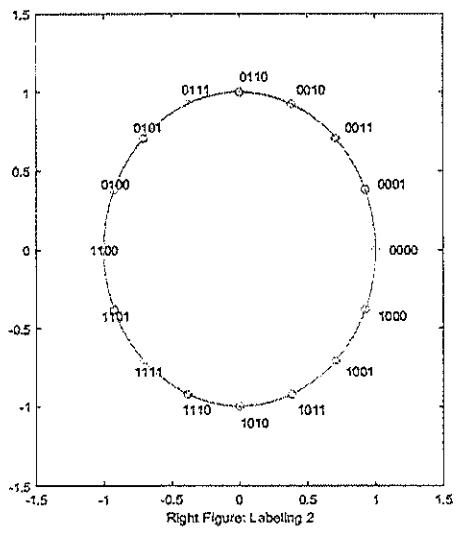


☐可 ☑不可使用計算機

1. (10%) In wireless communication systems, Additive White Gaussian Noise (AWGN) channel is often assumed. What do "Additive", "White", and "Gaussian" mean?
2. (20%) Constellations with two kinds of labeling are show as below. Symbols from the left and right figure, respectively, are transmitted over the AWGN channel.
   (a) (3 %) How many information bits can be carried per symbol for the left figure?
   (b) (3 %) How many information bits can be carried per symbol for the right figure?
   (c) (7 %) Which labeling (left figure one or right figure one) will result in lower symbol error rate? Why?
   (d) (7 %) Which labeling will result in lower bit error rate? Why?



Left Figure: Labeling 1



Right Figure: Labeling 2

3. (10%) A matrix H for a linear block code is defined such that each vector $v$ is a valid codeword if and only if $Hv^T = 0$.

   Assume that $H = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$.

   (a) Is the vector $v_1 = [1\ 0\ 1\ 0\ 1\ 1]$ a valid codeword vector? Why or why not?
   (b) How many valid codewords can be found?
4. (10 %) Given $\varphi_1(t) = 1,\ \varphi_2(t) = -t,\ \varphi_3(t) = 2t^2 - 1$,
   (a) Show that $\varphi_1(t)$ and $\varphi_2(t)$ are mutually orthogonal over the interval (-1, 1)
   (b) Are $\varphi_1(t)$ and $\varphi_3(t)$ mutually orthogonal over the interval (-1, 1)? Why or why not?
5. (15 %) Please answer the following questions with True(T) or False(F)
   (a) (3 %)The amplitude of Frequency Modulation (FM) is constant.
   (b) (3 %)The signal bandwidth of Amplitude Modulation (AM) is larger than FM.
   (c) (3 %)AM is an angle modulation scheme.
   (d) (3 %)For FM, the transmission power remains constant irrespective of modulation index.
   (e) (3 %)For Phase Modulation (PM), amplitude of carrier is varied according to the amplitude of modulation signals.
6. (10 %) Prove the following Fourier transform operation.

   $$v(t-\tau) \xrightarrow{F} e^{-j2\pi f\tau}\overline{V}(f)$$

7. (10%) A carrier is frequency modulated with a sinusoidal signal of 2 kHz resulting in a maximum frequency deviation of 5kHz. Find (a) (5%) modulation index (b) (5 %) Bandwidth of the modulated signal
8. (15 %) By giving the message m(t) and carrier $A_c\cos(2\pi f_c t)$
   (a) (5 %) Find the amplitude-modulated signal
   (b) (10 %) Explain how to demodulate the signal of (a) by equations.

試題隨卷繳交