

國立臺北科技大學

103 學年第一學期電機系博士班資格考試

數位通訊理論 試題

第一頁 共二頁

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注意事項：

1. 本試題共【5】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間：二小時。

1. (20%)

The random process $X(t)$ is defined by $X(t) = X \cos(2\pi f_0 t) + Y \sin(2\pi f_0 t)$, where X and Y are two zero-mean independent Gaussian random variables each with the variance σ^2 .

Please find the autocorrelation function and power spectral density of $X(t)$.

2. (20%)

For a BFSK system, the two signals are defined by $s_1(t) = \sqrt{\frac{2E_b}{T_b}} \cos(2\pi f_1 t)$ and

$s_2(t) = \sqrt{\frac{2E_b}{T_b}} \cos(2\pi f_2 t)$, $0 \leq t \leq T_b$. In the presence of additive white Gaussian noise of

zero mean and power spectral density $\frac{N_0}{2}$, calculate the average probability of error.

3. (20%)

Consider the signal constellation as shown in Figure P-3. The *a priori* probabilities for \bar{s}_1 , \bar{s}_2 , and \bar{s}_3 are 0.5, 0.3, and 0.2, respectively.

- (a) Find the translation vector to translate the signal constellation into a new signal constellation with minimum average energy.
- (b) Calculate the average energy of the new signal constellation.

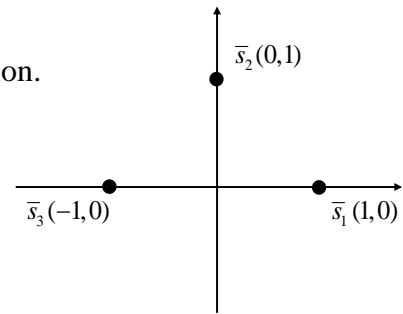


Figure P-3

4. (20%)

A source emits one of three symbols s_1 , s_2 , and s_3 with probabilities 0.5, 0.25, and 0.25, respectively. The successive symbols emitted by the source are statistically independent. Calculate the entropy of the source.

5. (20%)

The trellis diagram of a (2,1,2) convolutional code is shown in Figure P-5. If the received sequence is 11 00 01 00. Using the Viterbi algorithm, compute the decoded sequence.

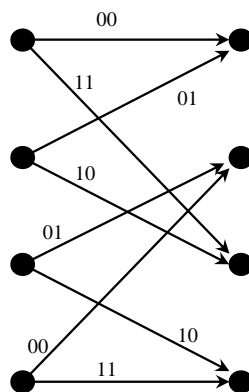


Figure P-5