

94 學年度中央大學通訊工程學系碩士在職專班 【01】「機率」考題

考試日期：中華民國 94 年 3 月 19 日星期六，上午 08:30~10:10

考試地點：中央大學通訊館一樓 E1-109 教室

考試時間：100 分鐘

試題總分：100 分

1. A couple has 3 children. What is the probability that all children are boys if the eldest is a boy? (10%)
2. We have two coins; the first is fair and the second two-headed. We pick one of the coins at random. We toss it three times and the head shows three times. Find the probability that the coin picked is fair. (15%)
3. A card is selected at random from an ordinary deck of 52 playing cards. Let  $X$  be the event that the selected card is an ace and  $Y$  be the event that it is a heart. Show that  $X$  and  $Y$  are independent. (10%)
4. Three fair dice are rolled. Let  $X$  equal the sum of the 3 dice. Compute  $P\{X = i\}$  for  $i = 3, 4, \dots, 18$ . (15%)
5. A box contains  $n$  identical balls numbered 1 through  $n$ . Suppose  $k$  balls are drawn in succession. (a) What is the probability that  $m$  is the smallest number drawn? (b) What is the probability that the smallest number drawn is larger than  $m$ ? (20%)
6. If  $X$  is uniformly distributed in the interval  $(0,5)$ , find the probability density function of  $Y = 3X - 2$ . (10%)
7. If  $X$  and  $Y$  are independent random variables, both uniformly distributed in the interval  $(-1,1)$ , calculate the probability density function of (a)  $X + Y$  (b)  $X - Y$ . (20%)



94 學年度中央大學通訊工程學系碩士在職專班【02】「通訊系統」考題

考試日期：中華民國 94 年 3 月 19 日星期六，上午 10：30~12：10

考試地點：中央大學通訊館一樓 E1-109 教室

考試時間：100 分鐘

試題總分：100 分

1.(20%)A filter has transfer function  $H(f) = \prod(f/2B)$  and input  $x(t) = 2W \sin c(2Wt)$ .

(a)Find the output  $y(t)$  for  $W < B$ .

(b)Find the output  $y(t)$  for  $W > B$ .

(c)In which case does the output suffer distortion? What influenced your answer?

2.(20%)Five messages bandlimited to  $W, W, 2W, 4W$ , and  $4W$  Hz, respectively, are to be time-division multiplexed. Devise a commutator configuration such that each signal is periodically sampled at its own minimum rate and the samples are properly interlaced. What is the minimum transmission bandwidth required for this TDM signal?

3.(20%)Compare bandwidth requirements for noncoherent ASK and FSK and for DPSK for the following data rates  $R$ . Use null-to-null RF bandwidths. Assume that the FSK "tones"

must be separated by  $2/T$  Hz.

(a)  $R=10\text{kbps}$

(d)  $R=500\text{kbps}$

(b)  $R=50\text{kbps}$

(e)  $R=1\text{Mbps}$

(c)  $R=100\text{kbps}$

4.(20%)An MSK system has a carrier frequency of 100MHz and transmits data at a rate of 100kbps.

(a)For the data sequence 1010101010..., what is the instantaneous frequency?

(b)For the data sequence 000000000..., what is the instantaneous frequency?

5.(20%)A parity-check code has the parity-check matrix

$$[H] = \begin{bmatrix} 1101100 \\ 1110010 \\ 0111001 \end{bmatrix}$$

Determine the generator matrix and find all possible codewords.