93 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 93 年 3 月 13 日星期六，上午 08:30~10:10
考試地點：中央大學電機館一樓 E1-120 教室
考試時間：100 分鐘
試題總分：100 分

1. A box contains six identical balls numbered 1 through 6. Suppose two balls are drawn in succession. (a) What is the probability that the largest number drawn is less than or equal to 4? (b)What is the probability that 3 is the smallest number drawn? (20%)

2. A group of individuals containing twelve boys and eight girls is lined up in random order. That is, each of the 20! permutations is assumed to be equally likely. What is the probability that the person in the sixth position is a boy? (10%)

3. Box 1 contains 1 white and 99 black balls. Box 2 contains 99 white and 1 black balls. A ball is picked from a randomly selected box. If the ball is black, what is the probability that it came from box 1? (15%)

4. Let p represent the probability of an event A. What is the probability that A occurs at least once in n independent trials? (10%)

5. Two fair dice are rolled. Let $\mathbf{X}$ equal the product of the 2 dice. Compute $P\{\mathbf{X} = i\}$ for $i = 1, 2, \cdots$. (15%)

6. If $\mathbf{X}$ is uniformly distributed in the interval (0,1), find the probability density function of $\mathbf{Y} = \mathbf{X^2}$. (15%)

7. If $\mathbf{X}$ and $\mathbf{Y}$ are independent random variables, both uniformly distributed in the interval (0,1), calculate the probability density function of $\mathbf{X} + \mathbf{Y}$. (15%)

通訊系碩士在職專班

93 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 93 年 3 月 13 日星期六，上午 10:30~12:10
考試地點：中央大學電機館一樓 E1-120 教室
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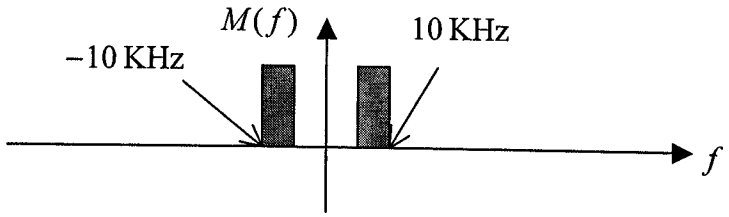
試題總分：100 分

1. (a) Plot the block diagram of a superheterodyne receiver; (10%)
   (b) Plot the block diagram of a digital communication system. (10%)

2. For an audio signal $m(t)$ with a power spectrum shown below to be transmitted,
   (a) express the amplitude-modulated signal $s(t)$ when the carrier frequency is 1 MHz; (6%)
   (b) plot the spectrum of the amplitude-modulated signal $s(t)$; (7%)
   (c) express a demodulation method to derive $m(t)$ from $s(t)$. (7%)



3. For a signal $m(t)=\cos(2000\pi t)$ to be transmitted in a Frequency Modulation (FM) system,
   (a) express the FM signal $s(t)$ with a maximum frequency deviation of 5000 Hz and a carrier frequency of 1 MHz; (8%)
   (b) plot the spectrum of the FM signal $s(t)$. (7%)

4. For a BPSK (Binary Phase Shift Keying) digital communication system,
   (a) plot the transmitted waveform if the transmitted data is [1 0 1 1 0], the symbol rate is 1 K symbols/sec, and the carrier frequency is 4 KHz; (6%)
   (b) plot the spectrum of the BPSK signal when the data is assumed to be identical independent distribution with probability(data=0)=probability(data=1)=0.5; (7%)
   (c) when the receiver of the BPSK system has a detection error probability of $p_e=0.1$ for each received symbol, find the probability of the event that there are more than one error (*i.e.*, 2 or 3 errors) occurred in three consecutive(連續) received symbols. (7%)

5. For a linear time invariant system with an impulse response of $h(t)$,
   (a) express the output of the system in time domain when the input is $s(t)$; **(5%)**
   (b) express the output of the system in frequency domain when the input has a spectrum of $S(f)$. **(5%)**

6. Explain the following terms: (a) Frequency Division Multiplexing; (b) Sampling Theorem; (c) Channel Equalization. (15%)