國 立 臺 北 科 技 大 學

九十八學年第一學期電機系博士班資格考試

數位通訊理論試題

注意事項：

1. 本試題共【6】題，配分共 100 分，可使用計算機。
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. For the PCM system answer the following questions. (20%)

(a) Why the nonuniform μ-law (or A-law) quantization is commonly used in the PCM-based telephone network? (5%)

(b) Why the repeater is used in a PCM system? (5%)

(c) What are two major sources of noise in a PCM system? How to alleviate their effects in the PCM system? (5%)

(d) How to overcome the problem of aliasing in a PCM system? (5%)

2. An analog signal is sampled, quantized, and encoded into a binary PCM wave. The sampling rate and representation levels of the PCM system are 9000 samples/sec and 256 (i.e., 8-bit quantization), respectively. The PCM wave is transmitted over a baseband channel using discrete pulse-amplitude modulation (M-ary PAM). Determine the transmission bandwidth required for transmitting the PCM wave if rolloff factor $\alpha = 0.5$ and each pulse is allowed to take on the amplitude level of M=8. (10%)

3. The signal $x(t) = \cos(600\pi t)$ is sampled by an ideal sampler system and the sampled signal is represented by $x_s(t)$. Answer the following questions. (12%)

(a) Determine the minimum value of f_s (sampling frequency) such that $x(t)$ may be reconstructed without distortion. (2%)

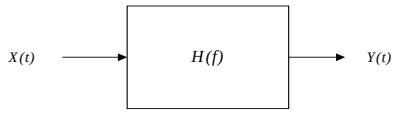
(b) Sketch $X_s(f)$ based on the sampling frequency determined in (a). (5%)

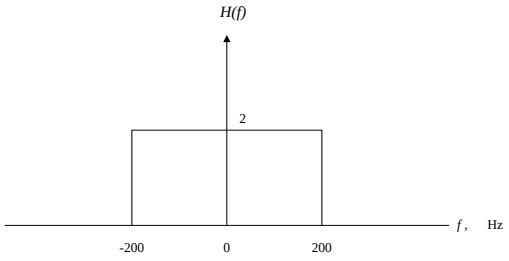
(c) Sketch $X_s(f)$ if $f_s = 300$ Hz. (5%)

4. The system shown below has an input signal $X(t) = \sqrt{2}\cos(2\pi 100t + \Theta)$ where Θ is a random variable that is uniformly distributed over the interval $(0, 2\pi)$. (Note: complete calculation process must be given) (8%)

(a) Find the autocorrelation function of $X(t)$, i.e., $R_X(t_1, t_2)$. (5%)

(b) Is $X(t)$ wide-sense stationary ? Why? (3%)





5. Given the UAC, UAS and SIP Proxy, please depict the SIP-based call flow of a complete call-setup. (25%)

6. In the SIP application, the RTP will be blocked by the NAT. As you know, please list the NAT traversal solution. Moreover, please give a brief description for each solution. (25%)