National Exams May 2010

98-Comp-B5 Computer Communications

Note:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.

2. Candidates may use one of two calculators, the Casio or Sharp approved models. This is a Closed Book exam.

3. Any five questions constitute a complete paper. Only the first five questions as they appear in your answer book will be marked.

4. All questions are of equal value (20% each).

Question 1 (20 marks)

An analog signal (sine wave) of 100 Hz with a peak-to-peak amplitude of 2 Volt is sampled at the sampling frequency of 400 Hz. Find another two analog sinusoids (other than 100 Hz) which, when sampled at 400 Hz, will yield exactly the same sample values (as the 100 Hz sine wave). Explain why this is the case.

Question 2 (20 marks)

A communication channel is known to have a loss of 20 dB. If the input signal power is measured as 0.8 Watt, and the output noise level is measured as 3 μ Watt, what is the output signal-to-noise ratio in dB?

Question 3 (20 marks)

For a noise free communication channel with a bandwidth of 3kHz, what would be the maximal data transmission rate? If the channel SNR is 30dB, calculate the maximal data transmission rate.

Question 4 (20 marks)

Consider a baseband bus with a number of equally spaced stations with a data rate of 20 Mbps and a bus length of 4 km. Assume that the propagation speed is 200 m/μ s. Determine the mean time to send a frame of 1000 bits to another station, measured from the beginning of transmission and the end of reception.

Question 5 (20 marks)

A Pulse Code Modulation (PCM) based encoder converts an analog signal with a 10 V full-scale to generate 12-bit codes using uniform quantization. Determine (a) normalized step size, (b) actual step size in volts, (c) maximum quantized level in volts, and (d) actual voltage resolution.

Question 6 (20 marks)

Assume that you are to design a TDM (Time Division Multiplexing) carrier to support 30 voice channels using 6-bit samples and a structure similar to DS-1. If the bandwidth of per voice channel is assumed to be 4 kHz, determine the required bit rate.

Question 7 (20 marks)

The energy of a human voice signal is usually centred around 300 Hz. (a) If we transmit this voice signal directly at frequency of 300 Hz over a radio channel by using a one-half wavelength antenna, how long is this antenna going to be? and (b) If we have a half-wave antenna of 0.5 m long, what frequency would we modulate the voice signal at?