Example 1

A TDM PCM system consists of 4 analog signal sources and four digital sources.

On the analog side, signal $m_1(t)$ is bandlimited to 3.6 KHz, and three other signals; $m_2(t)$, $m_3(t)$ and $m_4(t)$ are bandlimited to 4.0 KHz each. The signals are to be sampled at the Nyquist rate, quantized, and multiplexed. The sampler output is quantized using 1024 levels.

Each digital source consists of a 9600 bps stream of bits.

(a). Provide a diagram showing a suitable multiplexing arrangement, clearly showing all the components of the multiplexer up to the TDM output. On your diagram show the signal at each stage, including the sampling frequency, the sampled signal rate and the quantizer output data rate.

(b). What is the quantizing error.

Example 2

"Software radios" are devices that can demodulate and decode any radio signal regardless of format or standard. The basic idea in software radio is to immediately convert the transmitted radio signal into digital form so that digital signal processing software can be used to do the particular required processing. Suppose that a software radio is to demodulate FM radio and television. What sampling rate is required in the A/D conversion? The transmission bandwidth of FM radio is 200 kHz and the transmission bandwidth of television is 6 MHz

Example 3

A television transmission channel occupies a bandwidth of 6 MHz.

a. How many two-way 30 kHz analog voice channels can be frequency-division multiplexed in a single television channel?

b. How many two-way 200 kHz GSM channels can be frequency-division multiplexed in a single television channel?

c. Discuss the tradeoffs involved in converting existing television channels to cellular telephony channels?