

EECS 562
Homework 3

1. (Concept: Frame synchronization in TDM)

In TDM why is frame synchronization needed, how is it obtained, and what is its cost?

2. (Concept: Relationship between TDM system parameters)

A TDM system has a frame time = $T_f = 10$ ms. The frame is divided into 20 time slots. Each time slot carries 504 bits. (These are some LTE parameters).

- What is the slot time in ms?
- What is the T_b =bit time in μs ?
- What is the total bit rate in Mb/s?
- What is the minimum transmission bandwidth?
- Suppose a user gets 4 time slots, what is the user bit rate (in b/s)?

3. (Concept: TDMA)

Explain TDMA?

4. (Concept: TDD)

Explain TDD?

5. (Concepts: Multiplexing analog signals, sampling, PAM, to PCM, and associated bandwidth)

Consider the use of TDM for the transmission of 80 video channels. Assume each channel is bandlimited to 3.0 MHz.

- What is the minimum sample rate for each signal?
- What is the time between samples of one of the video signals?
- What is the frame time?
- TDM/PAM is used, what the symbol rate, assuming the minimum sample rate for each signal was used?
- What is the minimum bandwidth required for a TDM/PAM signal?
- Find the minimum bandwidth for a TDM/PAM signal required when each video signal is sampled at 9,000,000 samples/sec.
- Find the minimum bandwidth required when TDM/PCM is used with 12 bits/sample and 7,000,000 samples/sec.

6. (Concepts: Multiplexing analog signals, sampling, PAM, to PCM, and associated bandwidth)

Your company has baseband spectrum of 10 MHz. How many users can be supported using the following multiplexing techniques? Each user has a baseband bandwidth of 20kHz. Clearly state any assumptions.

- TDM/PAM
- TDM/PCM with 8 bits/sample
- Using the number users found in part b. find the additional bandwidth needed if a 32 bit synchronization pattern 101010101010101010101010101010 is used at the start of each frame.

7. (Concept: TDM/PCM signals with pulse shaping)

TDM is used to send 24 voice signals, each signal is sampled at 8000 samples/sec with 8bits/sample

- What is the TDM bit rate?
- If raised cosine pulse shaping is used with $\alpha = 0.75$ what is the required bandwidth.