

Sheet 2: Physical Layer

1. The bit rate of a digital communication system is 34 Mbps. The modulation scheme is QPSK. The baud rate of the system is

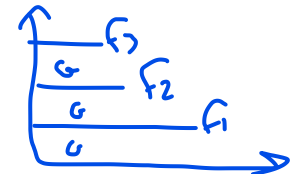
- a. 68 Mbps
b. 34 Mbps
c. 17 Mbps
d. 8.5 Mbps

$$\text{bit rate} / \log_2 M$$

$$M \rightarrow \# \text{ symbols}$$

$$34 / \log_2 (4) = 17$$

00 01 10 11



2. In an FDMA system, each user is allocated a duplex channel i.e. one for uplink and other for downlink voice communication. Also, these channels need to be guarded from each other for interference by providing sufficient separation in the spectrum through the use of guard bands.

- a. If a US cellular operator is allocated 25 MHz of spectrum, and guard band must be at least 10 KHz and each voice channel is 30 KHz, then Find the number of channels in an FDMA system.

- b. Find the number of users FDMA can support at the same time. Now suppose the cellular operator decides to use TDMA system and the TDMA system can support maximum of 8 time slots per TDMA frame, then what is the total number of users supported per TDMA frame?

3. If TDMA uses a frame structure where each frame consists of 8 time slots, and each time slot contains 156.25 bits, and data is transmitted at 270.833 Kbps in the channel, Find:

- a. The time duration of a bit 0.17 sec
b. The time duration of slot 87 sec
c. The time duration of a frame 216.0
d. How long a user must wait between two successive transmissions? Give the worst case and best case (assume each user is guaranteed transmission opportunity in each frame) solutions.

4. A CDMA receiver gets the following chips: (+1 +1 +1 +1 +3 -1 -1 +3). Assuming the chip sequences for three stations as defined below, which stations transmitted, and which bit did each one send

- A: (-1 +1 +1 -1 -1 +1 +1 -1) -9 \rightarrow sent 0
B: (-1 +1 -1 +1 +1 -1 +1 -1) 0 \rightarrow didn't
C: (-1 +1 +1 -1 +1 -1 -1 +1) 8 \rightarrow sent 1