NTR Solution:

# Assignment - 3

**Semester: Spring2024**

**Submission: 06/04/2024 (in Google form link)**

**Total Marks: 20**

**Total Questions: 5**

**[CO3]**

1. a) We have a digital medium with a data rate of 20 Mbps. How many 32-kbps voice channels can be carried by this medium if we use DSSS with the Barker sequence?

   b) **Explain** how FHSS achieves bandwidth spreading and privacy in brief.

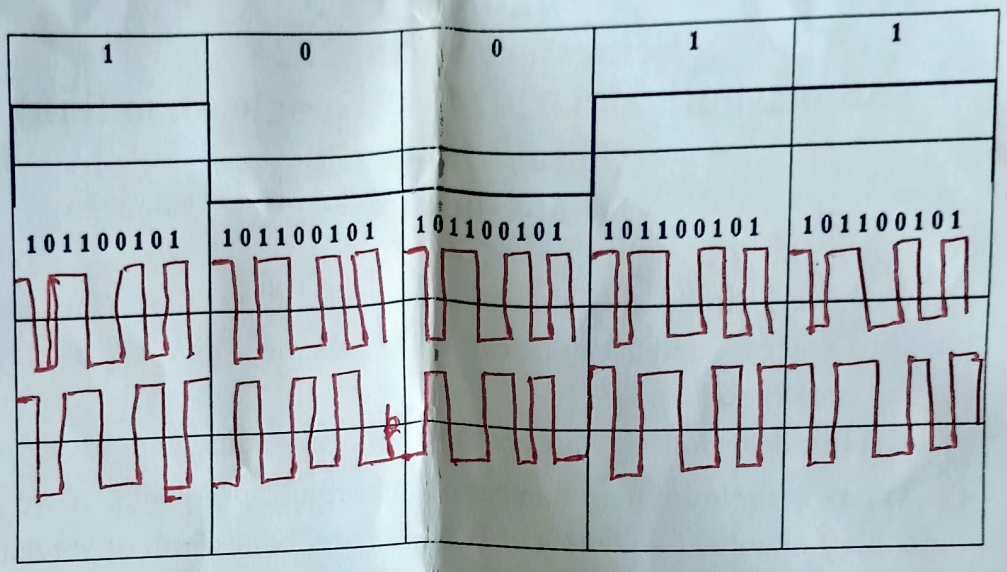
   c) **What** is the minimum number of bits in a PN sequence if we use FHSS with a channel bandwidth of B = 5Hz and bandwidth of spread spectrum Bss = 250 KHz? [2*3=6 points]

2. Suppose, you have 9 channels, each of 64 MBps. You have to use synchronous TDM to multiplex these channels. If each channel passes 3 characters during each input slot, answer the following: [5 points]
   a. What is the size of a frame in bits?
   b. What is the input bit duration?
   c. What is the output bit duration?
   d. What is the frame rate?
   e. What is the output data rate?

3. Suppose a telephone company uses a FDM hierarchy where, 8 voice channel with 3Khz bandwidth (each) are multiplexed on to a higher bandwidth line to create a **group** and in next level up to 6 groups will be multiplex which also required 2Khz of guard band to create a composite signal called a **super group.** At the next level 10 super groups are multiplexed with 3Khz guard band to create a **master group.** How many voice channels can be multiplexed together in the master group? What is the required bandwidth for the multiplexing? [4 points]

Answer of 3 In Group = 8 channels,
In super group = 8×6 = 48 channels
In master group = 48×10 = 480 channels (Ans)
Required Bandwidth
In a group = 8×3 kHz = 24kHz
In a super group = {(24×6) + (5×2)} = 144 + 10 = 154 kHz
Now In master group = {(154×10) + (3×9)} = 1540 + 27 = 1567 kHz (Ans)

4.




**Sketch** the spread signal from the above original signal and the given spread code. [2]

5. **Distinguish** between the two basic multiplexing techniques (FDM and TDM) using appropriate diagrams.[3]

Q1. Answer

a) No of voice channel $= \frac{20 \times 10^6}{32 \times 10^3 \times 11}$

$= \frac{20 \times 10^3}{352}$

$= 56.81$

or 56 or, 57.

c) $\frac{B_{ss}}{B} = \frac{250 kHz}{5 kHz}$

$= \frac{250 \times 10^3}{5}$

$= 50000$

∴ number of bits $= \log_2 L$

$= \log_2 50000$

$= 15.60$ bits

$\simeq 16$ bits.

Question Answer 2

Here, n = 9, Unit of data = 3 character
= 3 × 8
= 24 bits

input data rate = 64 MBps
= 64 × 8 × $10^6$ bps
= 512 × $10^6$ bps

a) frame size = (24 × 9) bit = 216 bits.

b) Input slot duration = $\frac{24}{512 \times 10^6}$ = $4.687 \times 10^{-8}$ s

∴ input bit duration = $\frac{4.687 \times 10^{-8}}{24}$

= $1.953125 \times 10^{-9}$ second

or, 1.95 ns.

or ≃ 2 ns.

c) Output slot duration = $\frac{4.687 \times 10^{-8}}{9}$

= $5.2083 \times 10^{-9}$ second

∴ Output bit duration = $\frac{5.2083 \times 10^{-9}}{24}$

= $2.17013 \times 10^{-10}$ S Ans.

= $0.2170 \times 10^{-9}$ S Ans.

= 0.2170 ns Ans.

d) frame rate = $\frac{512 \times 10^6}{24}$

= $\frac{1}{4.687 \times 10^{-8}}$ = 21335609 fps.

e) Output datarate = $512 \times 10^6 \times 9$

= $4608 \times 10^6$ bps

or 4608 000000 bps.