Assignment - 4

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Section: 32

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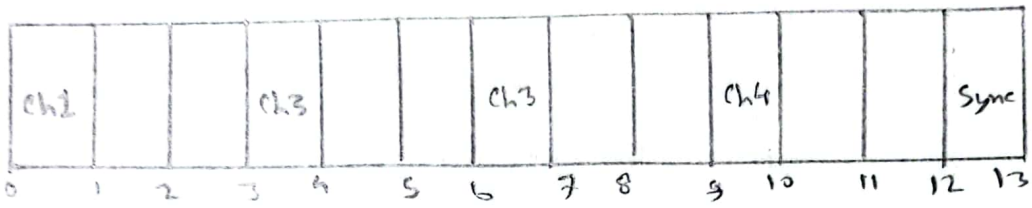
Ans. to the Ques. No-2

a



TDM Frame structure

b

$$\text{Input Bit Duration} = \frac{1}{\text{Bit rate}}$$

$$\therefore \text{Channel 1} = \frac{1}{300000} = 3.33\ \mu s$$

$$\therefore \text{channel 2} = \frac{1}{200,000} = 5\ \mu s$$

$$\therefore \text{Channel 3} = \frac{1}{200,000} = 5\ \mu s$$

$$\therefore \text{Channel 4} = \frac{1}{100,000} = 10\ \mu s$$

c

Input slot Duration = 3x Input Bit Duration

$\therefore$ Channel 1 = $3 \times 3.33 = 10\ \mu s$

$\therefore$ Channel 2 = $3 \times 5 = 15\ \mu s$

$\therefore$ Channel 3 = $3 \times 5 = 15\ \mu s$

$\therefore$ Channel 4 = $3 \times 10 = 30\ \mu s$

d

$$\text{frame rate} = \frac{\text{output data rate}}{\text{frame rate (in bits)}}$$

Total output bit rate = 300 + 200 + 200 + 100 kbps

= 800 kbps

frame size = 13 bits / frames

[4 channels × each has 3 bits + 1 sync bit

= 13 bits]

$$\text{frame rate} = \frac{800{,}000}{13} = 61538.46 \text{ frames/s}$$

e

frame size = 4 channel × 3 bits each + 1 sync bit

= 13 bits / frames

f

output data rate = frame rate × frame size

= 61538.46 × 13

≈ 800,000 bps

≈ 800 kbps

g

Output bit duration $= \frac{1}{\text{output data rate}}$

$= \frac{1}{800{,}000 \text{ bps}}$

$= 1.25 \ \mu s$

h

Output sbt duration = 3x output bit duration

$= 3 \times 1.25$

$= 3.75 \ \mu s$

i

Frame duration $= \frac{1}{\text{frame rate}}$

$= \frac{1}{61538.46}$

$= 16.25 \ \mu s$

Ans. to the Ques. No. 3

i

The hamming distance between two codewords is the number of bit positions at which they differ. The minimum hamming distance is the smallest hamming distance between any two codewords in the set

Codewords : 00000, 01011, 10101, 11110

* 00000 and 01011 : 3
* 00000 and 10101 : 3
* 00000 and 11110 : 4
* 01011 and 10101 : 4
* 01011 and 11110 : 3
* 10101 and 11110 : 3

minimum humming distance, $d_{min} = 3$

ii

Maximum detectable errors = $d_{min} - 1 = 3 - 1 = 2$ bits

Maximum correctable errors = $\lfloor \frac{d_{min} - 1}{2} \rfloor = \lfloor \frac{3-1}{2} \rfloor$

= 1 bit

iii

Received code: 01001

∴ 01001 and 00000 : 2

∴ 01001 and 01011 : 1

∴ 01001 and 10101 : 3

∴ 01001 and 11110 : 4

∴ closest codeword : 01011 (1 difference)

∴ correctible because 1-bit error falls within the correction limit.

iv

Receiven codeword: 01000

* 01000 and 00000 : 2
* 01000 and 01011 : 2
* 01000 and 10101 : 3
* 01000 and 11110 : 4

∴ no codeword is within 1 bit diffenence

∴ Not connectable because 2bit ennor exceeds connection limit.