Test 3 – Friday 11/05/2018 at 08h00

1 A FDM system is constructed with 12 channels per group, 8 groups per major group, 11 major groups per super group and 3 super groups in the final stage. The channel separation is 3,7 kHz. Determine the number of voice channels in this system and explain if it is possible to use this structure in a co-axial transmission system. Show all calculations. Give criticism on the system. (6)

2 For a 38/40 TDM system using the same standards as a 30/32 system and a sampling frequency of 12 kHz with 12 bits slots, calculate:

- The frame duration.
- The multi-frame duration.
- The slot duration.
- The bit duration.
- The output gross line bit rate in bits/second. (6)

3 The following characters must be transmitted using Huffmann coding. The count of each character is shown in the table.

Character	Count
P	30
Q	20
R	15
S	25
T	45
U	15

Determine:

- The code for each character
- The compression ratio
- The efficiency of the code (10)

4 Insert Hamming bits in the standard positions for the character 0110 1011 (4)

5 Find and fix the error in the received data containing Hamming bits in the standard positions. The code is 0100 1101 1010 (4)

Total = 30

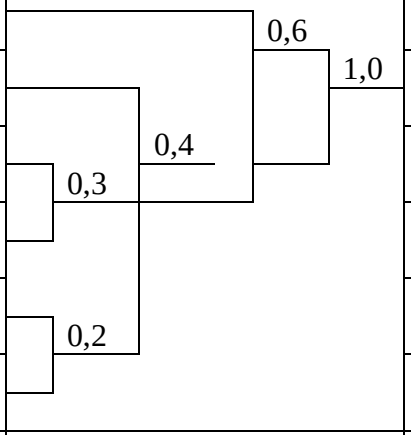
Test 3 – Friday 11/05/2018 Memo

1 Channels = 12x8x11x3 = 3168 - 1
Bandwidth = 3168x3,7 = 11,7216 MHz - 1
Can be used as it is < 12 MHz - 2
Criticism: (a) only 200 kHz separation in channels - 1
(b) very close to bandwith of the cable. - 1 (6)

2 The frame duration. = 1/12kHz = 83,33 µs; The MFD = 83,33 x 20 = 1,67 ms
The slot duration. = 83,33/40 = 2,08 µs; The bit duration. = 2,08/12 = 0,174 µs
The output gross line bit rate in bits/second. = 1/0,174 = 5,76 MB/s (6)

3

Chr	cnt	P(x)	Huffmann	Code	n	nP(x)	S(x)
T	45	0,3		11	2	0,6	-0,52
P	30	0,2		01	2	0,4	-0,46
S	25	0,17		101	**3**	0,51	-0,43
Q	20	0,13		001	3	0,39	-0,38
R	15	0,1		100	3	0,3	-0,33
U	15	0,1		000	3	0,3	-0,33
	150	1,00			HA	2,5	2,45
	1		2	1	1		3



CR = 3/2,5 = 1,2 1 eff = 2.45/2,5 = 98% 1

4 0110 1011

D	**D**	**D**	**D**	**H**	**D**	**D**	**D**	**H**	**D**	**H**	**H**
12	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
0	**1**	**1**	**0**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**0**

11 = 1011 10 = 1010 7 = 0111 5 = 0101 3 = 0011 H = 0000

5 0100 1101 1010

D	**D**	**D**	**D**	**H**	**D**	**D**	**D**	**H**	**D**	**H**	**H**
12	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
0	**1**	**0**	**0**	**1**	**1-0**	**0**	**1**	**1**	**0**	**1**	**0**

11 = 1011 7 = 0111 5 = 0101 H = 1110 E = 0111 = 7

Digital communication Test 4 (optional) – Friday 18/05/2016 at 08h00

1 For a 40/42 TDM system using the same standards as a 30/32 system and a sampling frequency of 10 kHz with 8 bits slots, calculate:

- The frame duration.
- The multi-frame duration.
- The slot duration.
- The bit duration.
- The output gross line bit rate in bits/second. (5)

2 The following characters must be transmitted using Huffmann coding. The count of each character is shown in the table.

Character	Count
M	60
C	40
Z	30
A	50
E	90
F	30

Determine the efficiency of the best possible code. (9)

3 The following data was received with standard Hamming code included. Decode the character after correcting any error in the data.
Data: 0 1 1 0 0 0 1 0 1 1 1 1 (4)

4 Compile the RS232 transmission code using "01" start bits, "10" stop bits and odd parity. The word to be transmitted is: Fine. (6)

5 The following data was received: $BA890AA3AB1A_H$
It contains two start bits, 8 data bits, one stop bit and a parity bit. Find:

- the start bits
- the stop bit
- the type of parity
- the data characters (6)

Total = 30

Digital communication Test 4 (optional) – Friday 18/05/2018 - memo

1 (5)

The frame duration. = 1/10kHz = 100 µs; The MFD = 100 x 21 = 2,1 ms
The slot duration. 100/42 = 2,38 µs; The bit duration. = 2,38/8 = 0,298 µs
The output gross line bit rate in bits/second. = 1/0,297 = 3,36 MB/s

2 (9)

Chr	cnt	P(x)	Huffmann	Code	n	nP(x)	P(x).log(P(x))
E	90	0,3	0,6 / 1,0	11	2	0,6	-0,521
M	60	0,2	0,4	01	2	0,4	-0,454
A		0,17	0,3	101	**3**	0,51	-0,435
C	40	0,13		001	3	0,39	-0,383
Z	30	0,1	0,2	100	3	0,3	-0,332
F	30	0,1		000	3	0,3	-0,332
	300	1,00			HA	2,5	S(x)=2,457
	1		2	1	1		3

Efficiency = S(x)/HA = 2,457/2,5.100 = 98,28% (1)

3 (4) 12 11 10 9 8 7 6 5 4 3 2 1
0 1 1 0 0 0 1 0 1 1 1 1
0 1 1 0 0 0 1 0 1 0 1 1

11 = 1011
10 = 1010
6 = 0110
3 = 0011
H = 0111
E = 0011 = 3

Data = 0110 0100 = d

4 (6)

F i n e
0100 0110 0110 1001 0110 1110 0110 0101 2
01 0110 0010 0 10 01 1001 0110 1 10 01 1110 0110 0 10 01 1010 0110 1 10
0101 1000 1001 0011 0010 1101 1001 1110 0110 0100 1101 0011 0110 2
5 8 9 3 2 D 9 E 6 4 D 3 6 2

5 (6) Length = 8 +1 + 2 + 1 = 12 1

B A 8 9 0 A A 3 A B 1 A
1011 1010 1000 1001 0000 1010 1010 0011 1010 1011 0001 1000
10 11101010 0 (5) 0 10 01000010 1(3) 0 10 10001110 1 (5) 0 10 11000110 1 (5) 0 1
Start = 10 and stop = 0 Parity is ODD 3
0101 0111 0100 0010 0111 0001 0110 0011
W B q c 1