Digital Communication II – EADOM2B – Test 3

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:			
2.1	The frame duration.	2.2	The multi-frame duration.	
2.3	The slot duration.	2.4	The bit duration.	
2.5	The output gross line bit rate in bits/second.			(6)
3	In a document containing only 6 characters the character count was as follows: G – 22 ; F – 12 ; B – 34 ; M – 20 ; Q – 24 and L – 28.			
3.1	Determine the optimal Huffman code for each character and the Huffman average for the coding system.			
3.2	Calculate the compression ratio of the code.			(10)
4	Data was received from a transmission system using standard RS232 principles. The data contains 2 start bits, 8 data bits, a parity bit and 2 stop bits. The data is: F 8 A F E D 7 F 6 B 9 3 1			
4.1	Determine the values of the start and stop bits and the type of parity used.			
4.2	Determine the word received.			(8)
	TOTAL:			**/30/**

0010 1110	.	0010 0001	!	0100 0001	A	0110 0001	a	0100 1110	N	0110 1110	n
0010 1111	/	0010 0010	“	0100 0010	B	0110 0010	b	0100 1111	O	0110 1111	o
0011 0000	0	0010 0011	#	0100 0011	C	0110 0011	c	0101 0000	P	0111 0000	p
0011 0001	1	0010 0100	$	0100 0100	D	0110 0100	d	0101 0001	Q	0111 0001	q
0011 0010	2	0010 0101	%	0100 0101	E	0110 0101	e	0101 0010	R	0111 0010	r
0011 0011	3	0010 0110	&	0100 0110	F	0110 0110	f	0101 0011	S	0111 0011	s
0011 0100	4	0010 0111	‘	0100 0111	G	0110 0111	g	0101 0100	T	0111 0100	t
0011 0101	5	0010 1000	(	0100 1000	H	0110 1000	h	0101 0101	U	0111 0101	u
0011 0110	6	0010 1001	)	0100 1001	I	0110 1001	i	0101 0110	V	0111 0110	v
0011 0111	7	0010 1010	*	0100 1010	J	0110 1010	j	0101 0111	W	0111 0111	w
0011 1000	8	0010 1011	+	0100 1011	K	0110 1011	k	0101 1000	X	0111 1000	x
0011 1001	9	0010 1100	,	0100 1100	L	0110 1100	l	0101 1001	Y	0111 1001	y
0011 1010	:	0010 1101	-	0100 1101	M	0110 1101	m	0101 1010	Z	0111 1010	z

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1 (6)

Voice channels = 12.8.11.3 = 3168 BW = 3168x3.7 = 11.721 MHz
Can fit with very little free space
Channel separation of 3.7 kHz only 0.3 separation from voice up to 3.4 kHz

2 (6)

FD = 1/12k = 83.33 µs MFD = FDx20 = 1.67 ms
SD = FD/40 = 2.083 µs BD = SD/12 = 0.1736 µs
GLBR = 1/BD = 5.76 MB/s

3 (10)

In a document containing only 6 characters the character count was as follows: G – 22 ; F – 12 ; ; M – 20 ;

Chr	Cnt	P					Code	n	nP
B	34	0.243			0.569		11	2	0.486
L	28	0.200		0.429			10	2	0.400
Q	24	0.171	0.328			1	101	3	0.513
G	22	0.157					001	3	0.471
M	20	0.143	0.229				100	3	0.429
F	12	0.086					000	3	0.258
	140	1.000							2.557

CR = STD/HA = 3/2.557 = 1.173

4 (8)

F 8 A F E D 7 F 6 B 9 3 1
1111 1000 1010 1111 1110 1101 0111 1111 0110 1011 1001 0011 0001
1111 1000 1010 1 111 1110 1101 01 11 1111 0110 101 1 1001 0011 0001
11 1110 0010 1 01 11 1111 0110 1 01 11 1111 0110 1 01 11 0010 0110 0 01
Start = 11, Stop = 01 Parity = ODD
1110 0010 1111 0110 1111 0110 0010 0110
0100 0111 0110 1111 0110 1111 0110 0100
G o o d

TOTAL: /30/