

SURNAME: Stone lake

FORENAME(S): Christopher

12 Pages

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

1	Student Number	170844011 ST04546785
2	Title of Examination Paper	Digital Signal Processing + Communication
3	Module Code	MA2X8515
4	Date and Time of Examination	10.05.19 13:30
5	Examination Venue	Hall
6	Seat Number	35

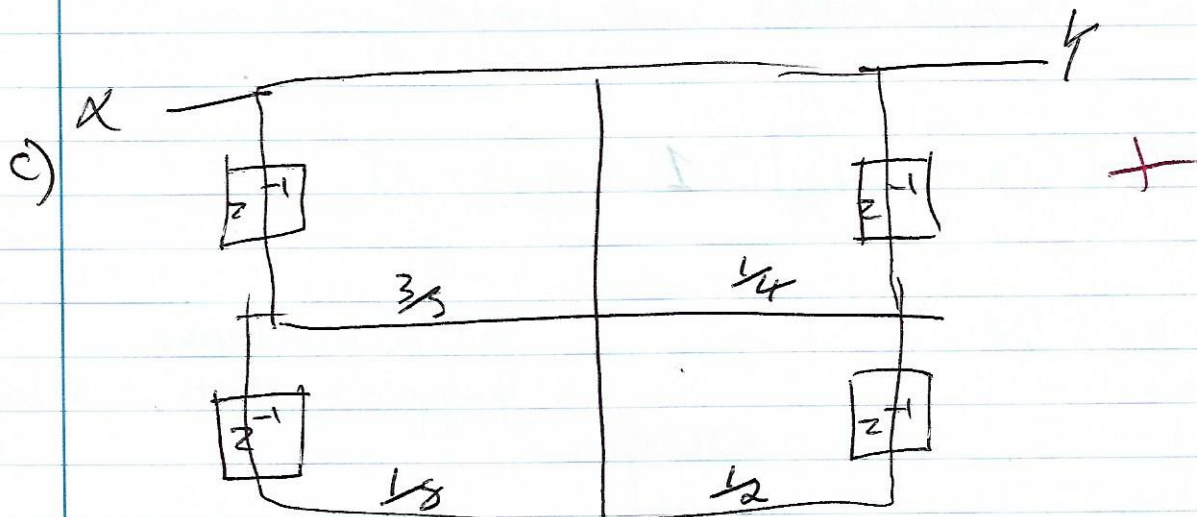
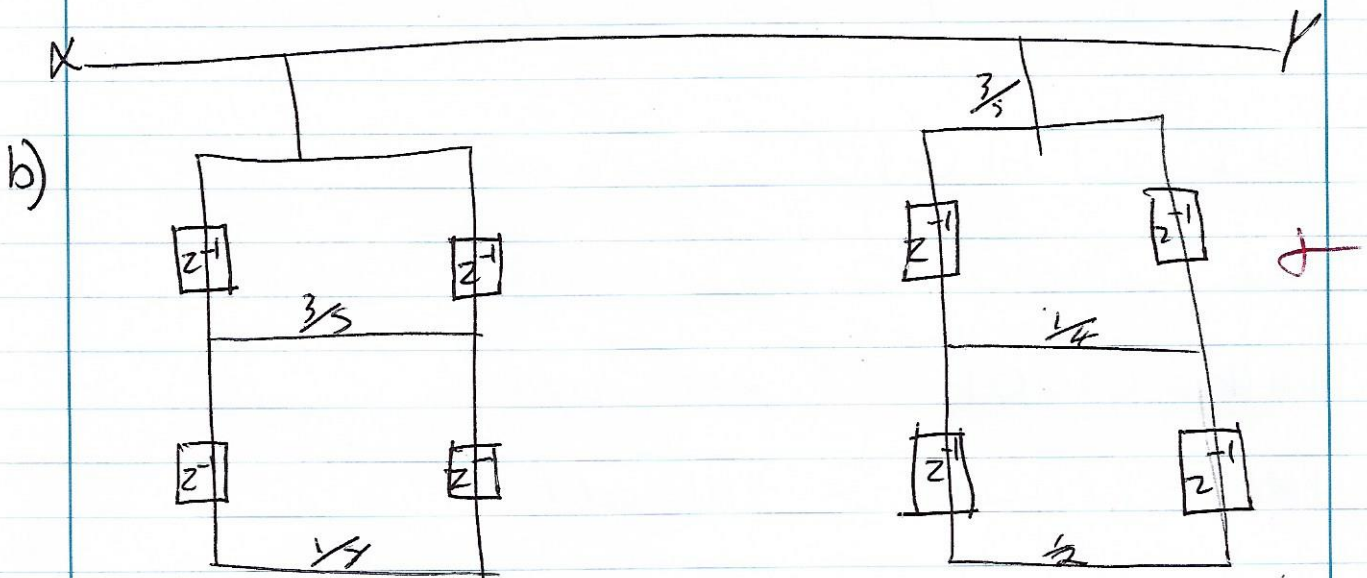
7	Number of Answer Books handed in	
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[illegible]

24% ✓

Q1

$$a) Y_n = \frac{3}{5} Y(z_1) + \frac{1}{8} Y(z_2) = \frac{3}{5} Y(z_1) + \frac{1}{4} Y(z_1) + \frac{1}{2} Y(z_1)$$



d) less margin for error.

e)

Q2

- 2 a. Channel code do made the code more efficient. Source code do protect the code via the addition of additional parity bits. ✓

2 b.

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

$$P\#1 = 111010 = 4 \times 1 \text{ even}$$

$$P\#2 = 010000 = 1 \times 1 \text{ odd}$$

$$P\#4 = 01001 = 2 \times 1 \text{ even}$$

$$P\#8 = 11001 = 3 \times 1 \text{ odd}$$

~~multiply~~ the add the odds $2+8=10$

Parity bit 10 is the mistake code should read as follows:

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

2 c)

S L O W ^ D N

number of times

S - 1	S - 000
L - 1	L - 001
O - 111	O - 011
W - 111	W - 100
^ - 11	^ - 110
D - 1	D - 101
N - 11	N - 111

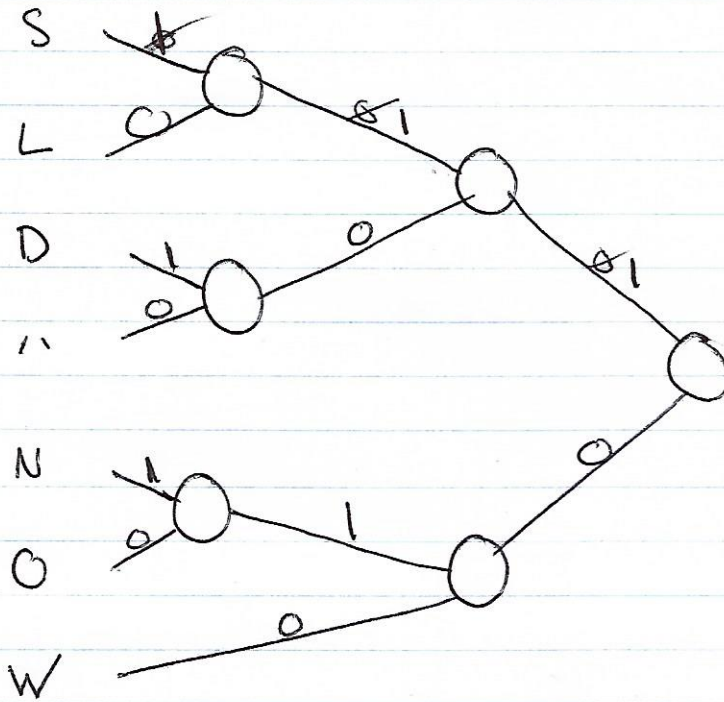
= 3 bits per word/space

13 characters = $3 \times 13 = 39$ bits

2C)

rearrange in order to size / small to largest.

1	1	1	2	2	3	3
S	L	D	"	N	O	W



S	=	3b x 1	-	3
L	=	3b x 1	-	3
D	=	3b x 1	-	3
"	=	3b x 2	-	6
N	=	3b x 2	-	6
O	=	3b x 3	-	9
W	=	2b x 3	-	6

 36 bits

reduction of 36 bits by using the Huffman code.

$$2\pi n$$

Q3

a)

$$x_t = 4 \cos(4000\pi t) + 5 \cos(10000\pi t) + 2 \sin(6000\pi t)$$

$$T = 2\pi n$$

$$f = \frac{5000}{2\pi} = 10000$$

$$f_1 = 2000$$

$$f_2 = 5000$$

$$f_3 = 3000$$

$$4 \cos \frac{2000 \cdot 2\pi n}{4000}$$

$$+ \frac{5 \cos 5000 \cdot 2\pi n}{4000}$$

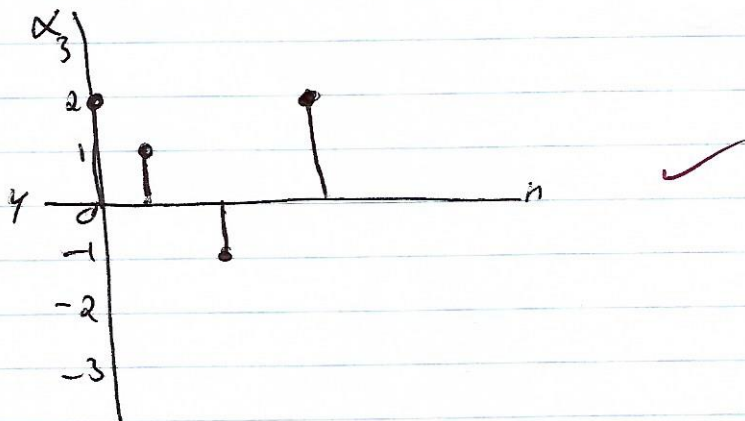
$$+ 2 \sin \frac{3000 \cdot 2\pi n}{4000}$$

$$(4 \cos) \frac{2}{4} \cdot 2\pi n (10000) + 5 \cos \frac{5}{4} \cdot 2\pi n (4000) + 2 \sin \frac{3}{4} \cdot 2\pi n$$

d) Avoid the generation of alias signals, the pre processing step would normally be to pass the signal through a filter.

Q4

a)

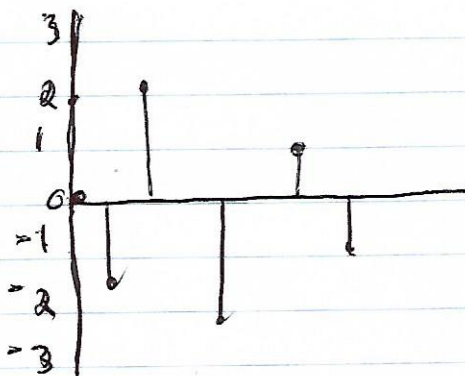


1 ✓

b)

2 1 -1 2
0 0 -2 0 -1
0 0 1 -1 2

X



③

$$5) \quad B \log_2 \left(1 + \frac{S}{N} \right) = e$$