



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 answers 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 do not write on this paper.
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).
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1	Student Number	2508067
2	Title of Examination Paper	Signal and Systems
3	Module Code	ACDA4009
4	Date and Time of Examination	11/05/2026
5	Examination Venue	310
6	Seat Number	13
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
Q1	25
Q2	09
Q3	17
Q4	16 1/2
Total	68 1/2 / 100

(Gweler yr ochr arall am y fersiwn Cymraeg)

Examiner Only



12 Pages

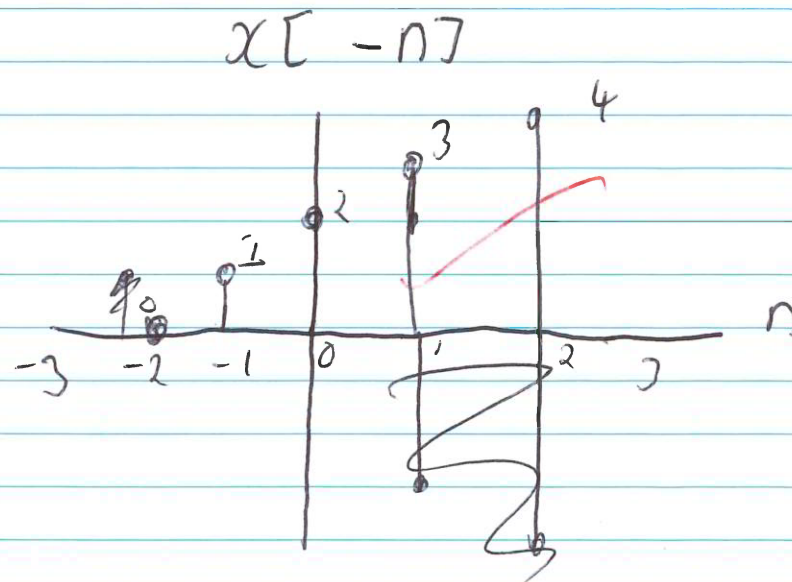
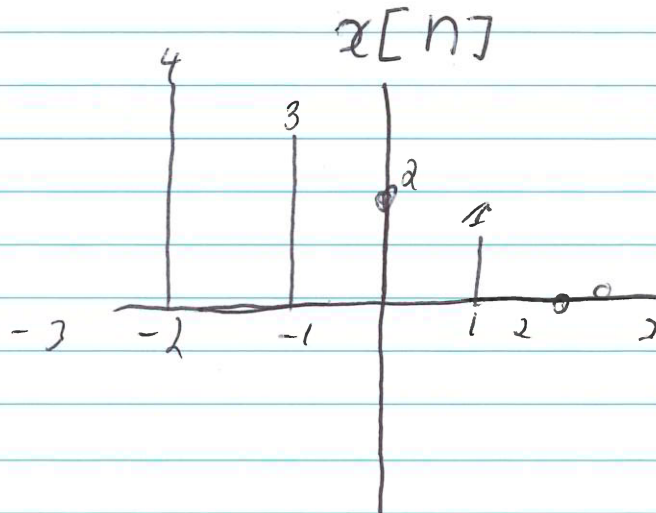
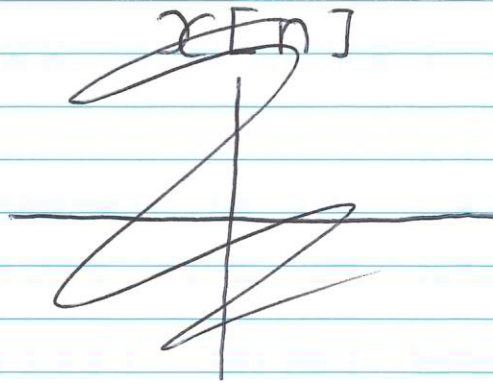
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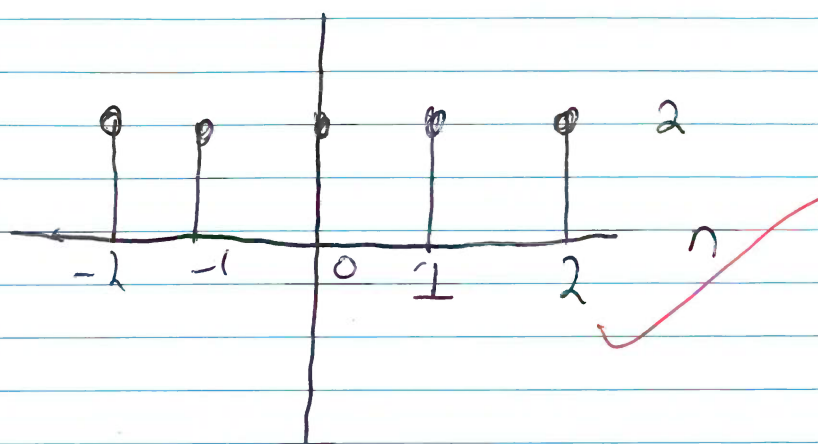
1
a)



$$x_e[n] = \frac{1}{2} (x[n] + x[-n])$$

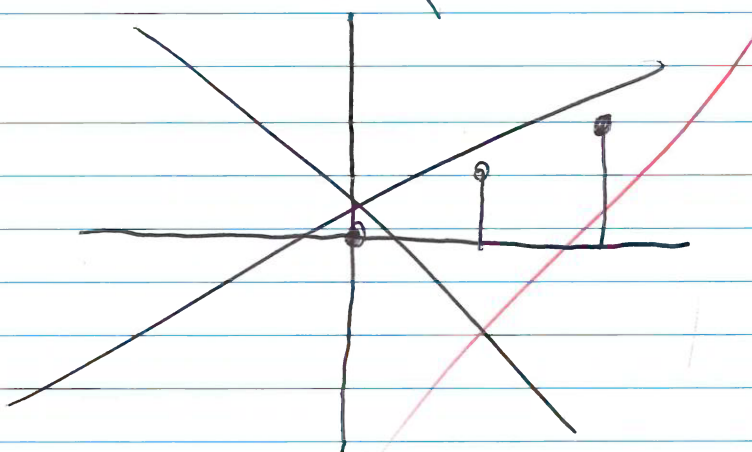
$$x_o[n] = \frac{1}{2} (x[n] - x[-n])$$

$$x_e[n]$$

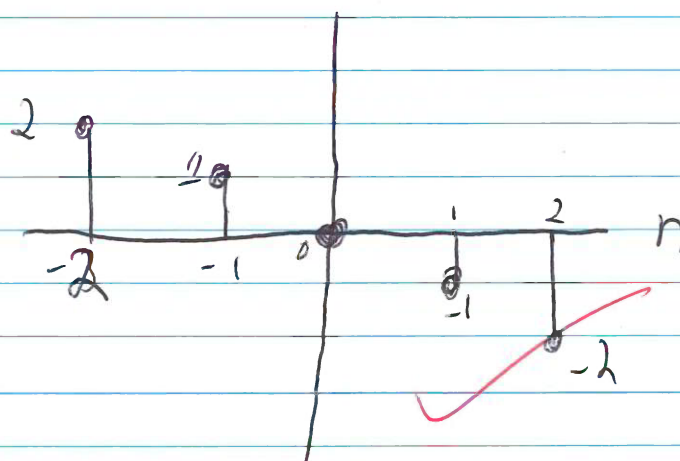


3 ✓

~~$$x_o[n]$$~~



$$x_o[n]$$



3 ✓

ii) $x_e[n] + x_o[n] = x[n]$ ✓

$$\frac{1}{2}(x[n] + x[-n]) + \frac{1}{2}(x[n] - x[-n]) = x[n]$$

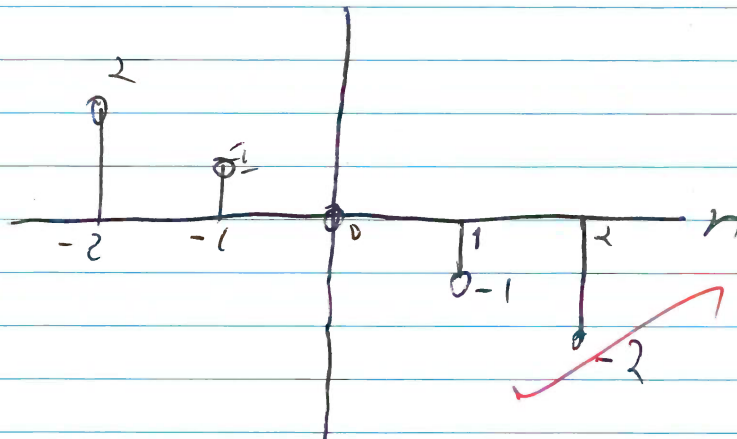
$$\frac{1}{2}(2x[n] + x[-n] - x[-n]) = x[n]$$

$$\frac{1}{2}(2x[n]) = x[n]$$

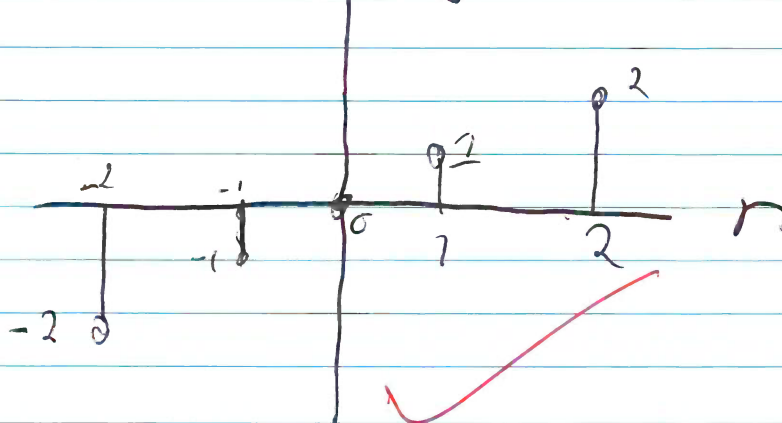
$$x[n] = x[n]$$

iii)

$$w[n]$$

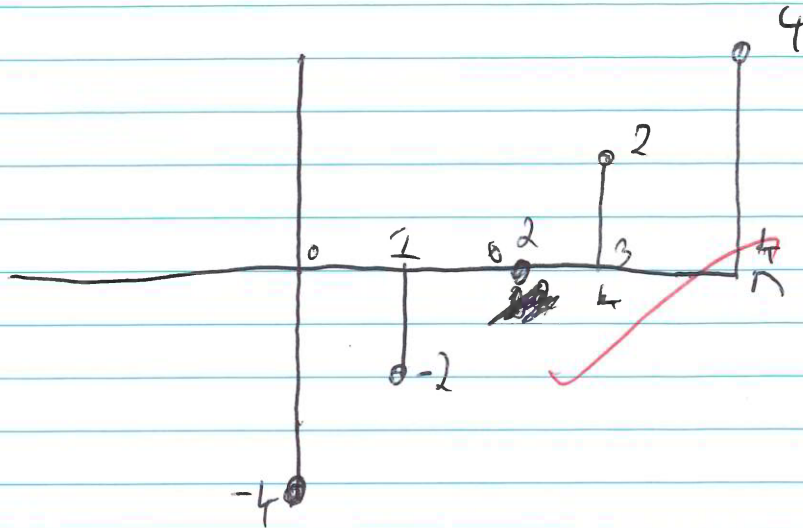


$$w[-n]$$



iv)

AE $W[-n]$ Scale by 2
and shift right by 2



2

3

25
25

2c)

i)

$$h(t) = \begin{cases} 0, & t < 0 \\ e^t & t \geq 0 \end{cases}$$

3

ii)

$$y(t) = \int_{-\infty}^{\infty} x(t) h(t-\tau) d\tau$$

$x(t) = 1?$

2

iii)

$$t - \tau = 0$$

$$d\sigma = 0 - d\tau$$

$$t = \tau$$

$$\tau = \sigma$$

$$\sigma = 0$$

$$= \int_0^t x(t) d\tau = \int_0^t x(t) d\tau$$

$$= \int_0^t x(\tau) d\tau$$

2

12

(Case I

iv)

$$t = \tau \quad t = 1$$

First limit = 1

Second limit = 0

$$y(t) = \int_0^1 x(\tau) d\tau$$

✓

0

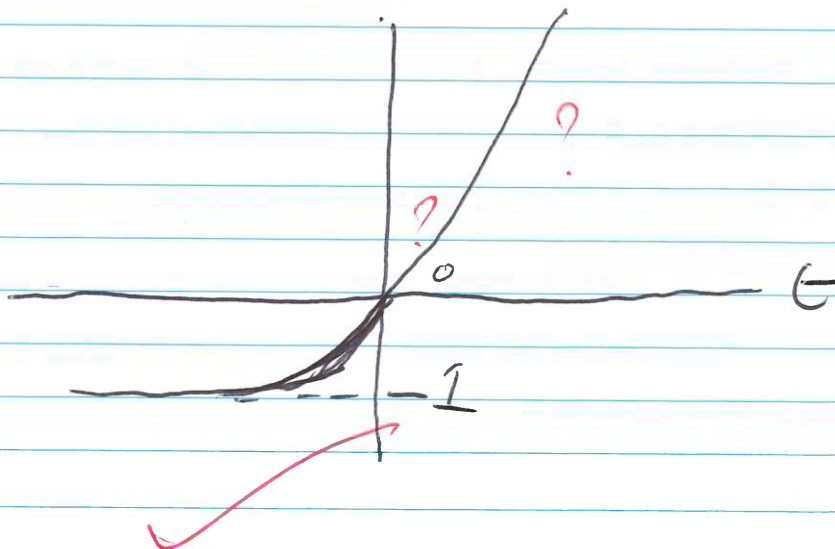
v)

✗

0

vi)

y(t)



2

69
25

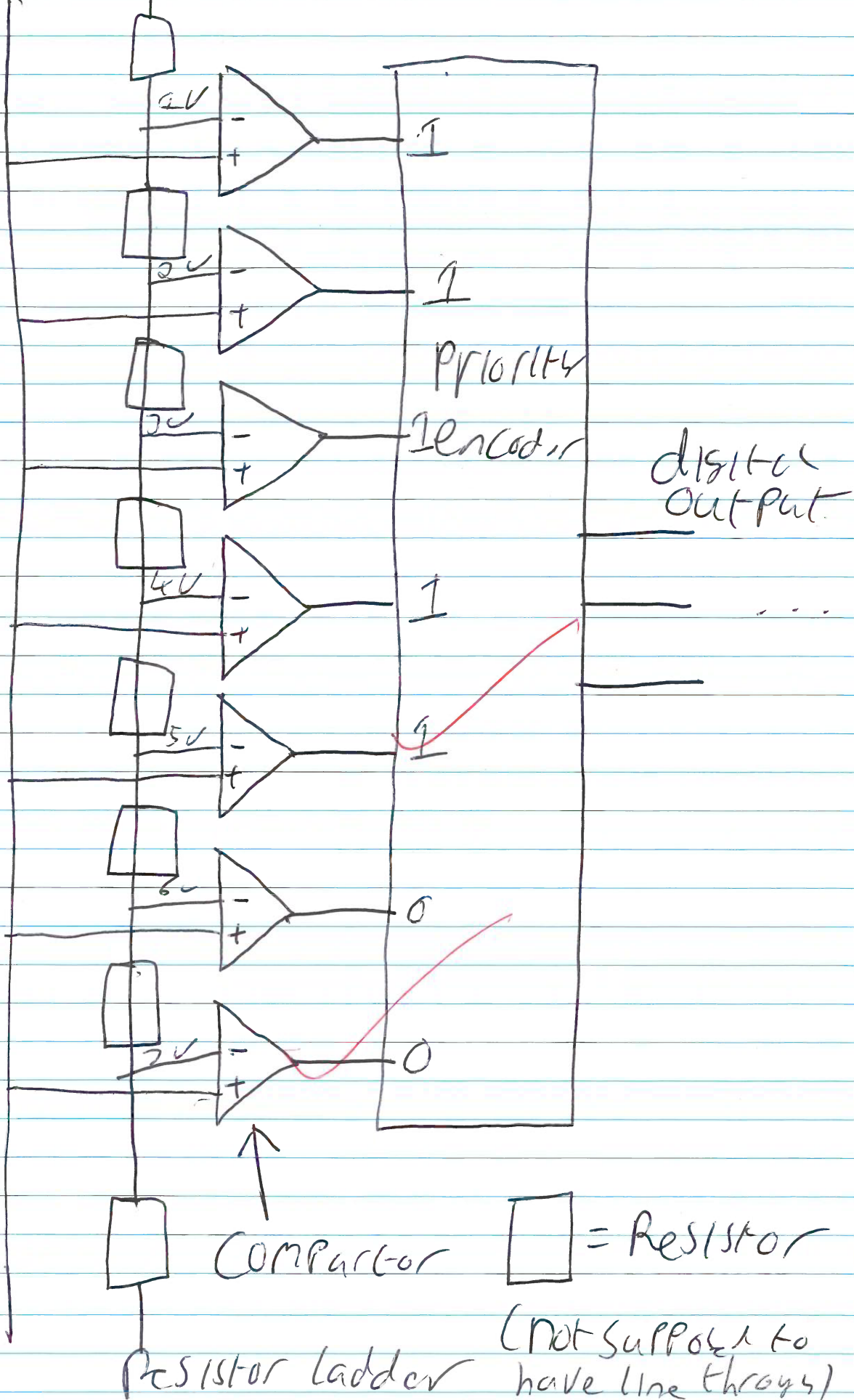
31

1 Flash type ADC is a combination of resistors comparators and a priority encoder. It is used for extremely fast communication in 0 time. It works by comparing an analogue input with a set of reference voltages that are different at each comparator. If the input voltage is less than the reference voltage the comparator will output 0. If it is greater it will output a 1. For example if there are 4 ones the digital output will be 4 volts or ~~1111000000000000~~.

(ii)

V_{Input}
5V

V_{Reference}



6

iii)

With a 3-bit binary input the Flash type ADC will use ~~$2^n - 1$~~ $2^n - 1$ comparators. So with this it will require $2^3 - 1 = 7$ comparators. Each comparator will compare the input voltage with the reference voltage. If the input is greater than or equal to the reference voltage the comparator will produce an output of 1. The priority encoder will determine the amount of ones present and use that information to determine the digital output all in one time.

4

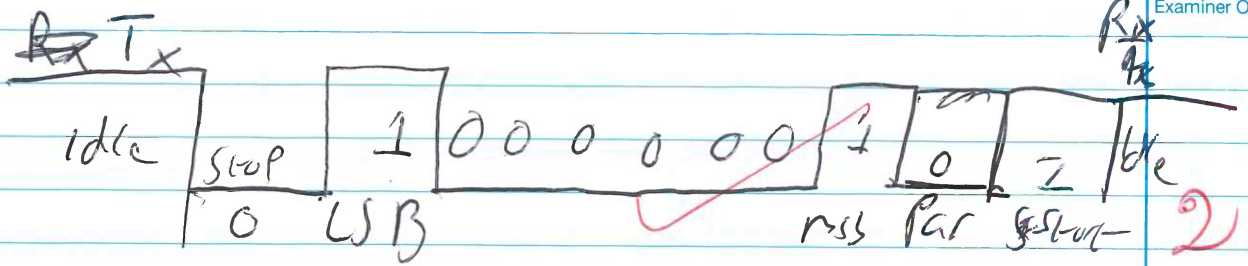
iv)

Shown in (ii) the diagram is labeled with 5V input and each reference voltage next to corresponding comparator. We can see the outputs next to the comparators of 1 and 0. The output is 1 when reference voltage is less than or equal to input voltage. The digital output is 1111100 with a maximum output of 7V.

17/25

3

4)
a)



this is an example of the transmission of 41 or 'A' where at the beginning the UART will be idle when a drop is detected it will transfer 8-11 bit

b)

PRINT

i)

$$P = 50 = 01010000$$

$$R = 52 = 01010010$$

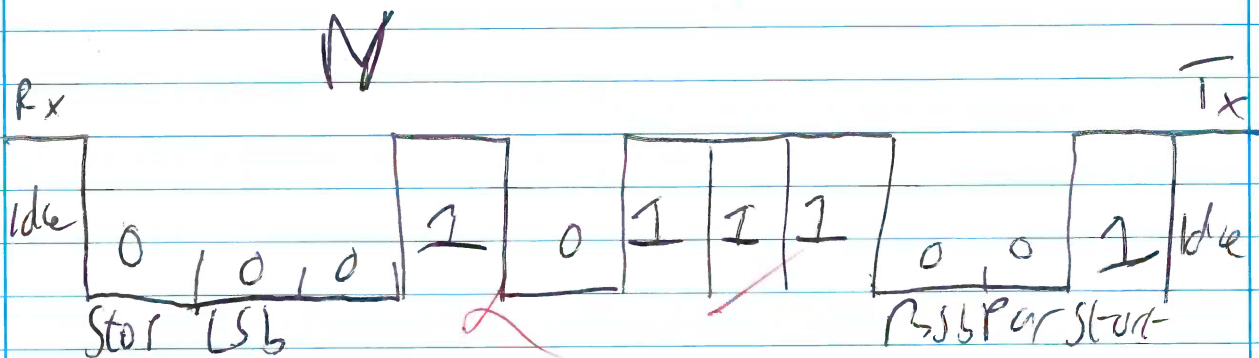
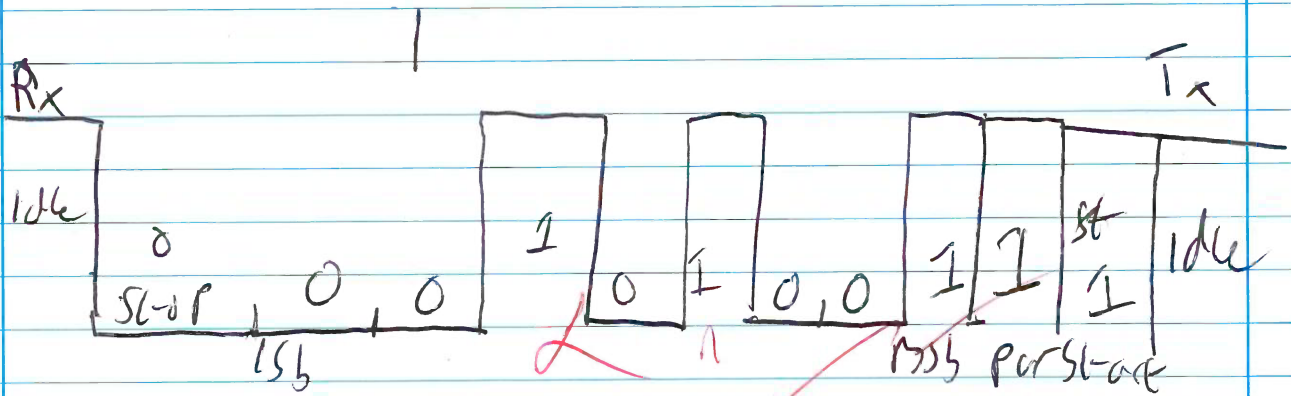
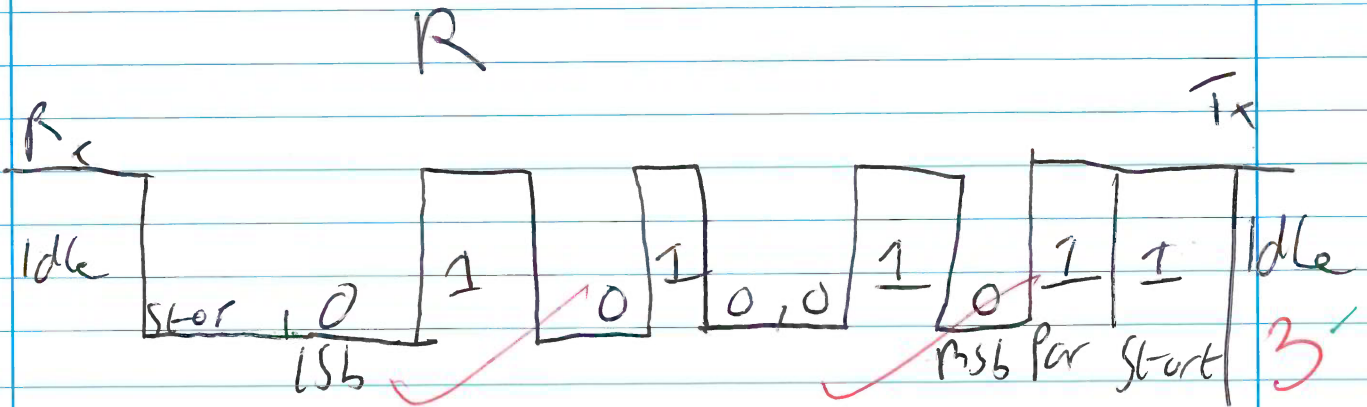
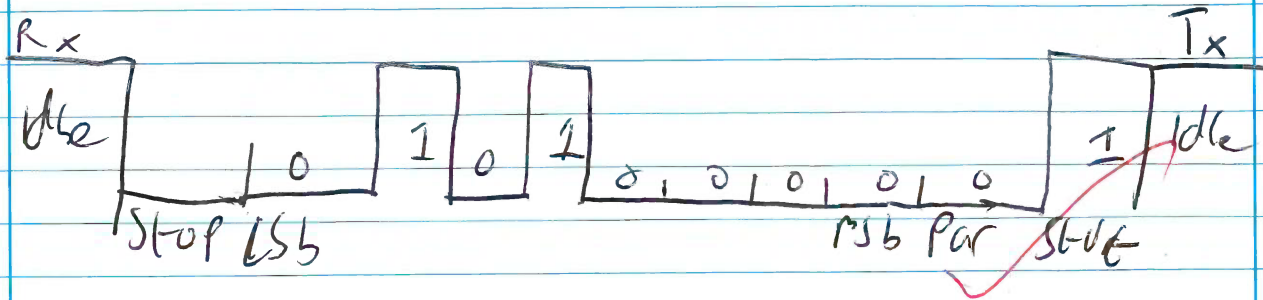
$$I = 49 = 00101001$$

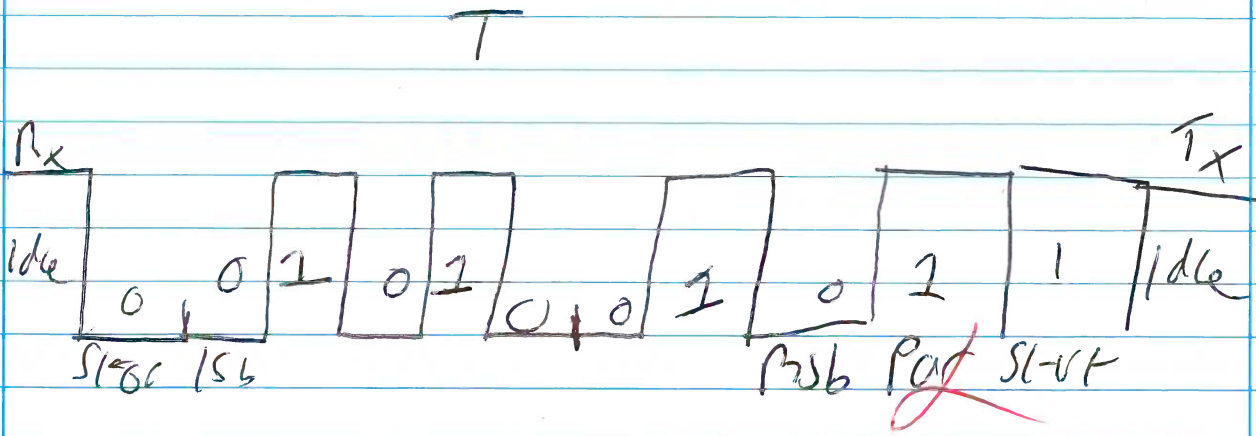
$$M = 4E = 00101110$$

$$T = 54 = 01010010$$

3 1/2

ii) UART data frame 'P'





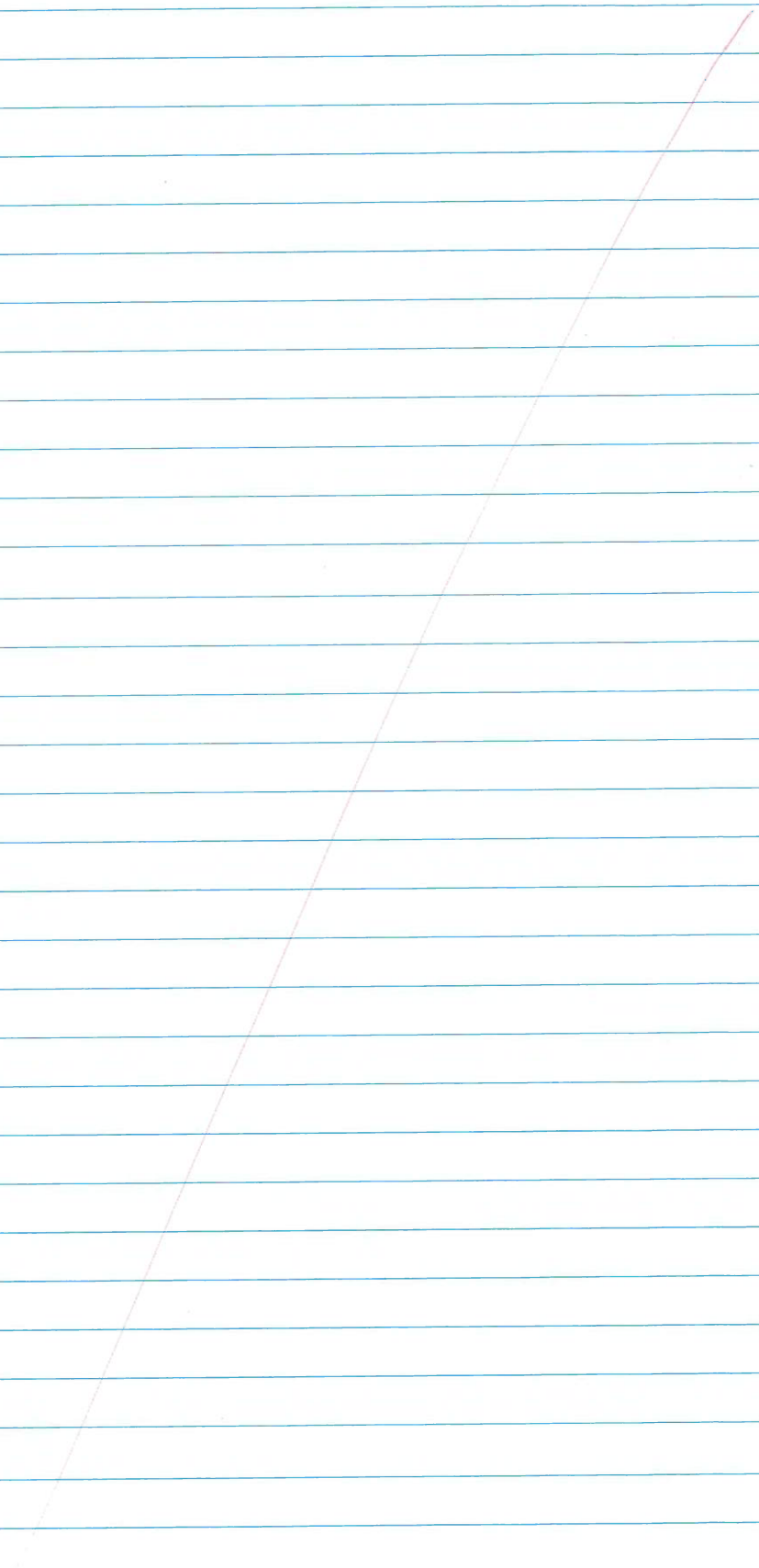
0

16 1/2
23



Examiner Only

Question No.



Rhif y Cwestiwn



Arholwr yn unig