

Examiner Only

FORENAM

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.**

List the numbers of the questions you have attempted	Office Use
1	07
2	05
3	25
4	23
Total	60 PL 100

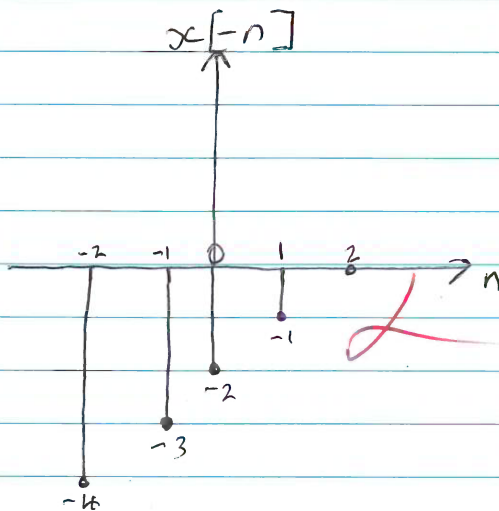
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$\frac{60}{100}$
~~HE~~

1)

a)

i)



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

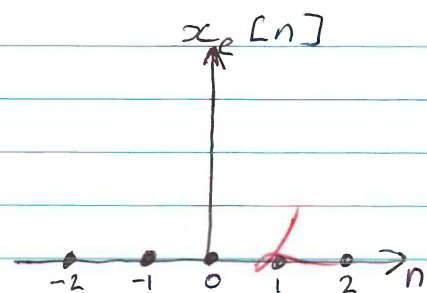
$$n = -2 \quad x_e[n] = \frac{1}{2} [4 + -4] = 0$$

$$n = -1 \quad x_e[n] = \frac{1}{2} [3 + -3] = 0$$

$$n = 0 \quad x_e[n] = \frac{1}{2} [2 + -2] = 0$$

$$n = 1 \quad x_e[n] = \frac{1}{2} [1 + -1] = 0$$

$$n = 2 \quad x_e[n] = \frac{1}{2} [0 + 0] = 0$$



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

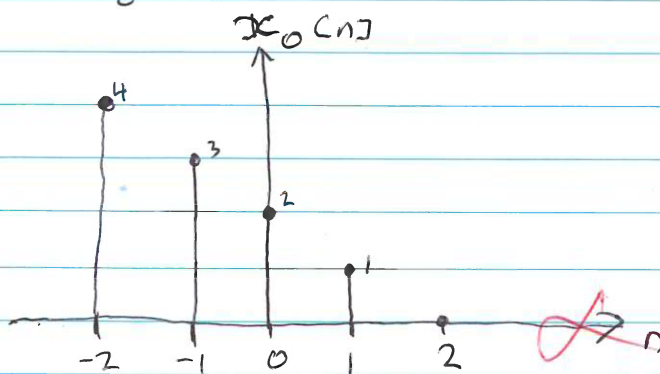
$$n = -2 \quad x_o[n] = \frac{1}{2} [4 - -4] = 4$$

$$n = -1 \quad x_o[n] = \frac{1}{2} [3 - -3] = 3$$

$$n = 0 \quad x_o[n] = \frac{1}{2} [2 - -2] = 2$$

$$n = 1 \quad x_o[n] = \frac{1}{2} [1 - -1] = 1$$

$$n = 2 \quad x_o[n] = \frac{1}{2} [0 - 0] = 0$$



07
25

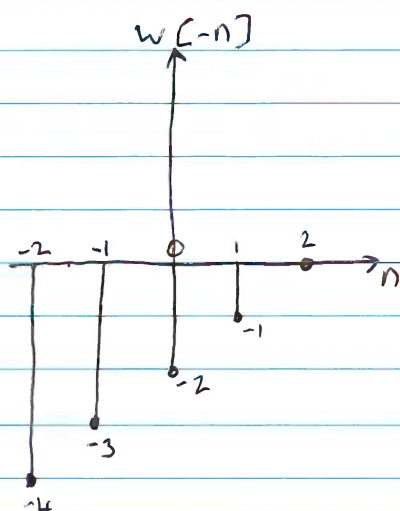
2

2

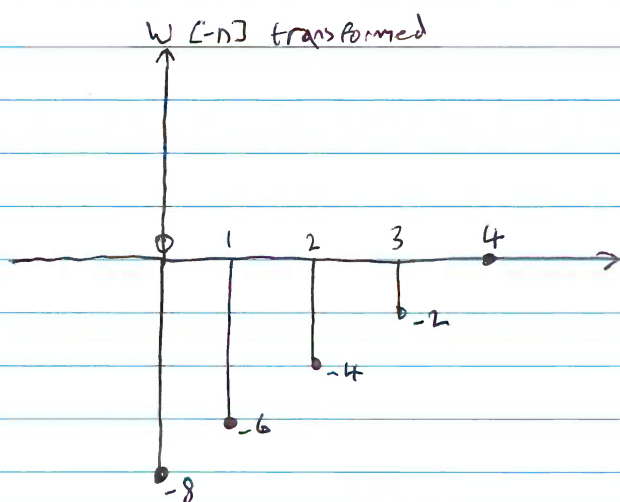
$$\begin{aligned}
 \text{ii)} \quad x_e[n] + x_o[n] &= \frac{1}{2} [x[n] + x[-n]] + \frac{1}{2} [x[n] - x[-n]] \\
 &= \frac{1}{2} [x[n] + x[-n] + x[n] - x[-n]] \\
 &= \frac{1}{2} [2x[n]]
 \end{aligned}$$

$$x_e[n] + x_o[n] = x[n]$$

iii)



iv)



2)

a)

i)

$$h(t) = \begin{cases} 1 & t \geq 1 \\ 0 & t < 0 \end{cases}$$

ii)

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

iii)

$$t - \tau = \alpha$$

$$d\alpha = -d\tau$$

$$\int_0^e x x dx = \int_0^e x x dx$$

$$\int_0^e x x dx$$

05
25

3)

a)

- i) Flash type ADC also known as a parallel ADC is an analog to digital converter which uses a bank of comparators to simultaneously generate a digital signal.

A flash type ADC has $2^n - 1$ comparators for an n -bit input signal.

Each comparator has an input V_a which is the input signal. And it compares to the signal coming from the resistor ladder, V_r or voltage.

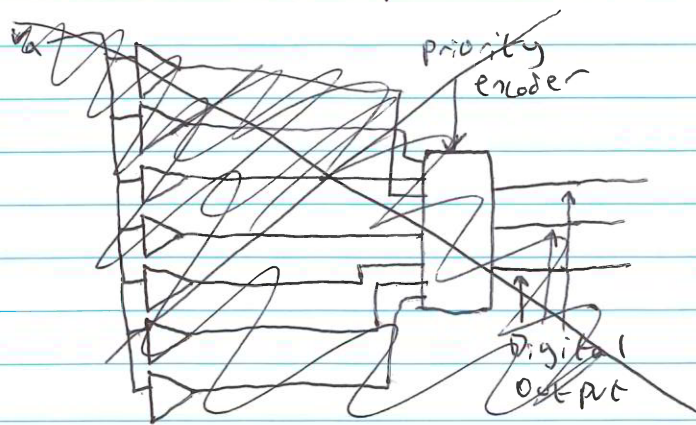
If V_a is greater than V_r then the comparator will output a 1.

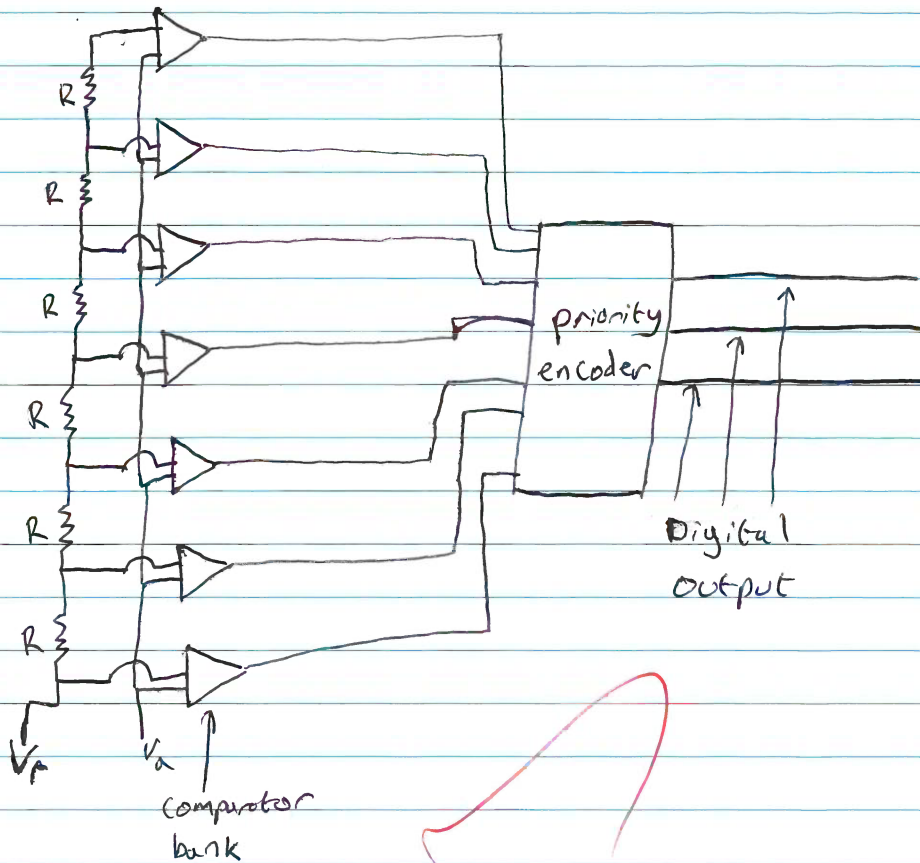
If V_a is less than V_r the comparator will output a 0.

All comparators do this simultaneously.

The signal from the comparator is then sent to the priority encoder, which then outputs the equivalent digital signal.

- ii) $2^3 - 1 = 7$ comparators





iii)

The input signal is inputted into V_a .
 3 bit input so $2^3 = 8$ 8v reference ~~step~~ signal.
 is applied to the resistor ladder. at each comparator
 the reference voltage is changed by ~~given~~ 1v
~~at each comparator~~ e.g. at comparator 7 $V_r = 1v$.
 at comparator 6 $V_r = 2v$
 and so on.

Each ~~comparator~~ comparator compares the signals simultaneously.
 they then output a binary signal. either a 1 if
~~if~~ $V_a > V_r$ or a 0 if $V_a < V_r$

each signal is sent to the priority encoder and
 then the priority encoder will send out the
 equivalent digital signal to the analogue input.

iv)	priority encoder	Digital output	Voltage (V)
	0000000	000	0-1
	0000001	001	1-2
	0000011	010	2-3
	0000111	011	3-4
	0001111	100	4-5
5V →	0011111	101	5-6
	0111111	110	6-7
	1111111	111	7-8

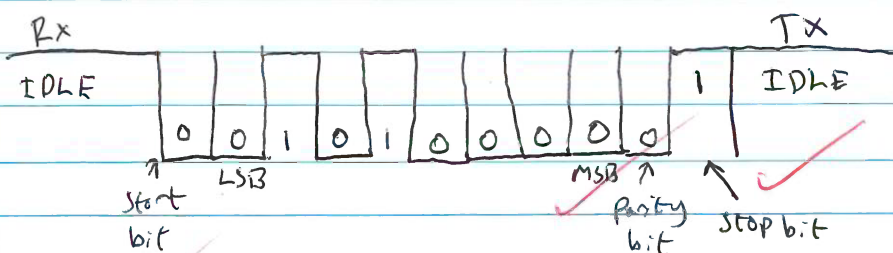
4)

- a) The transmission and reception frame of UART (Universal Asynchronous Receiver Transmitter) is made up of 8 to 11 bits. It has 1 Start bit, 8 bits for data, an optional parity bit, and 1 Stop bit.

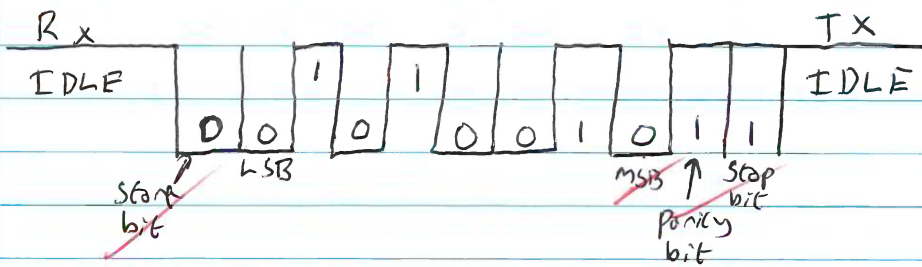
b

- i) P 50
P: 01010000
R 52
R: 01010010
I 49
I: 01001001
N 4E
N: 01001110
T 54
T: 01010100

- ii) for P Even parity used for all

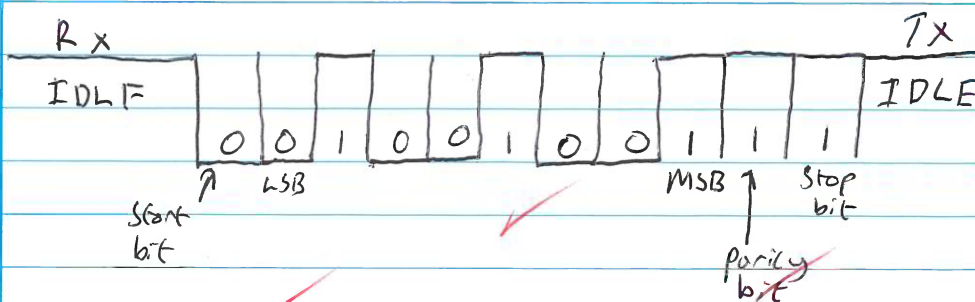


for R



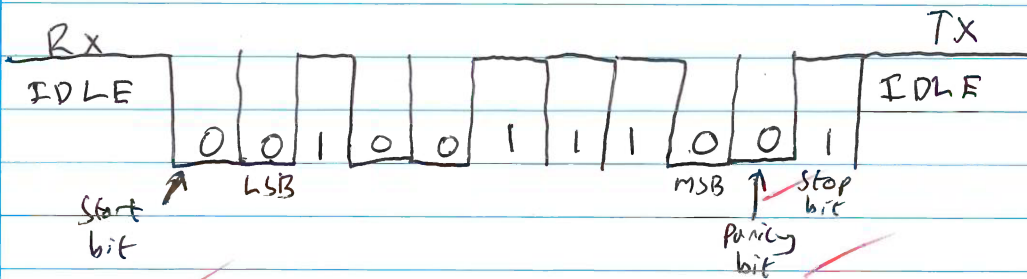
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for I



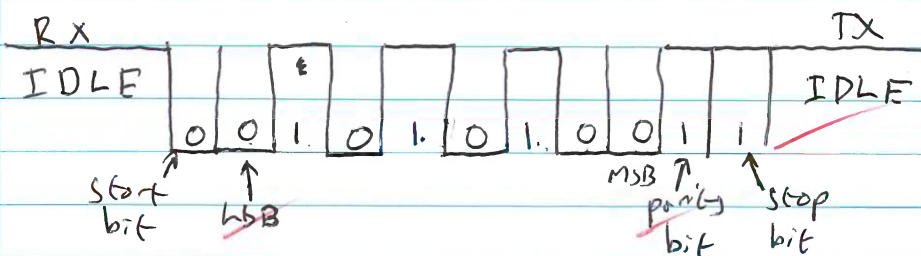
3 ✓

for N



3 ✓

for T



3 ✓

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25



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Question No.

