



Examination Answer Books

12 Pages

Instructions to Candidates

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	2506135
2	Title of Examination Paper	signals and systems.
3	Module Code	ACDA4009
4	Date and Time of Examination	9:30 11/05/2026
5	Examination Venue	301C
6	Seat Number	
7	Number of Answer Books handed in	

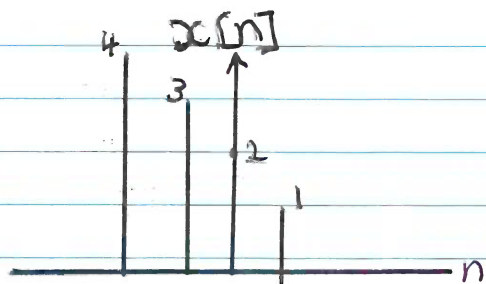
List the numbers of the questions you have attempted	Office Use
Q1	25
Q2	14
Q3	12 1/2
Q4	19 1/2
Total	71 1/2

(Gweler yr ochr arall am y fersiwn Cymraeg)

$\frac{71}{100}$ He.

Pl f

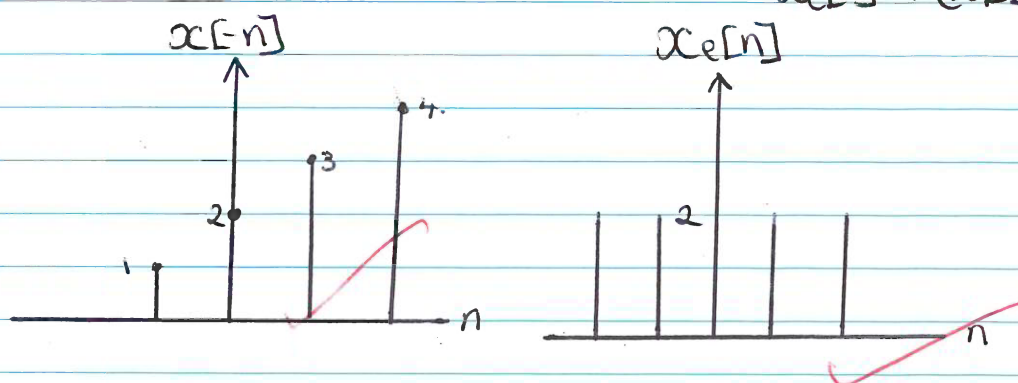
11 | 5 | 26

1.
a)

formula for $x_e[n]$

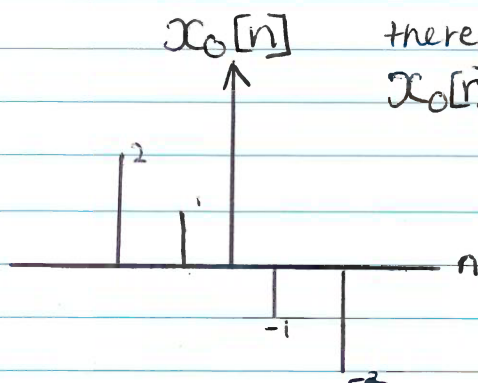
$$x_e[n] = \frac{1}{2}(x[n] + x[-n])$$

i)



therefore, formula for $x_o[n]$

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



ii) $x_e[n] + x_o[n] = x[n] \rightarrow (4)$

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

$x_o[n] = \frac{1}{2}(x[n] - x[-n]) \rightarrow (3)$

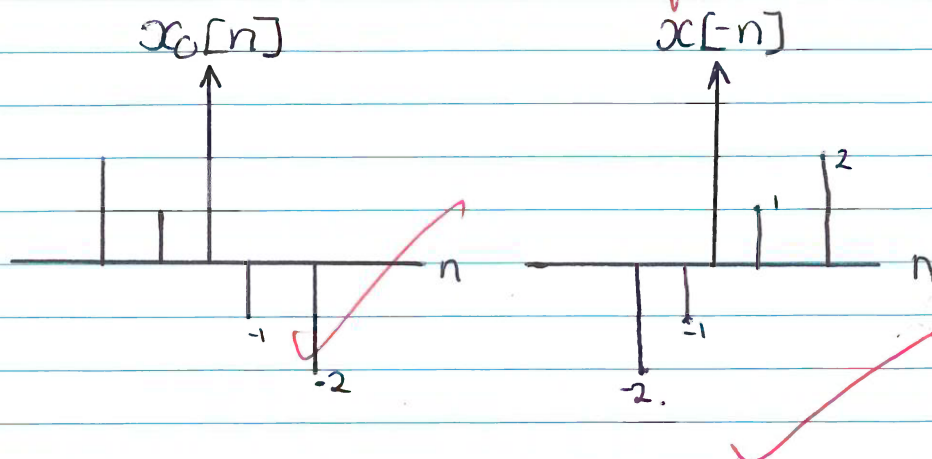
add equation (2) and (3)

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

hence the proof.



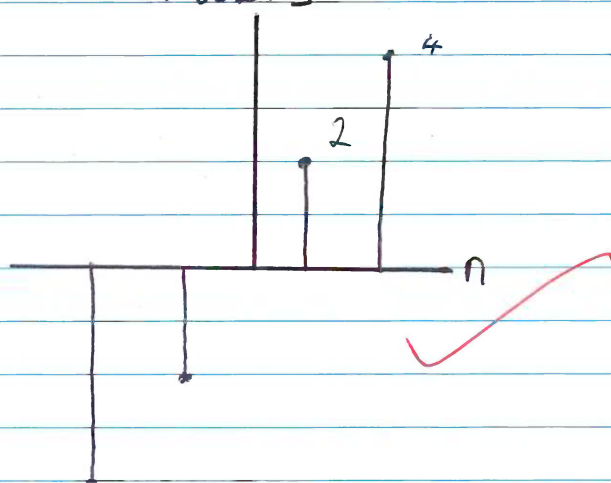
iii) $w[n] = x_0[n]$ find $w[-n]$



1 ✓

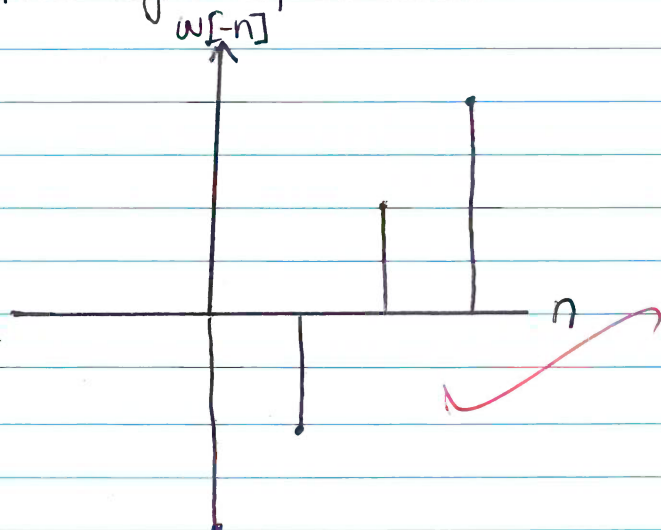
3 ✓

iv) $w[-n]$ scaled by a factor of 2.
~~or~~ $w[-n]$



2 ✓

Shifted right by 2 units.



25
25
25

3 ✓



2.

i) mathematical representation of $h(t)$.

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

ii) formula for convolution integral.

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

iii) simplify the unit step.

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

$$u(t) = x(t) = 1$$

substitute the limits in.

limits are

$$h(t) = h(0) - (0 - \tau) d\tau$$

 ∞ $-\infty$

$$h(t) = h + \tau(d\tau)$$

$$h(t) = h(\alpha) (d\tau)$$

 α alpha.

$$h(t) = h(t + e^t) - (e^t - \tau) d\tau$$

$$h(t) = h(t) - \tau(d\tau)$$

$$h(t) = h(\alpha) - \tau(d\tau)$$

$$\alpha = t - \tau$$

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

working on the limits.

$$\alpha = -t(d\alpha)$$

$$\therefore -t = \alpha$$

limit 1, limit = ∞

$$y(t) = \int_0^t (h(t) - (t-\tau) d\tau)$$

second limit

$$-\alpha = t < 0$$

$$-\alpha = 0$$

limit 2, limit = 0.

iv) Evaluate for different intervals.
case 1)

$$y(t) = t < 0$$

$$y(t) = 0 \quad h(t) = 0 \quad \text{in both cases} \quad t < 0.$$

case 2)

$$y(t) = \int_0^t (h(\tau) + (t-\tau)) d\tau$$

$$y(t) = \int_0^t (h(\tau e^{t-\tau}) + (e^{t-\tau})) d\tau$$

$$y(t) = \int_0^t (h(e^t) + (e^{t-\tau})) d\tau$$

$$= h(e^{t-\tau}) + 1$$

$$= e^{t-\tau} + 1$$

$$= 1 + e^t$$

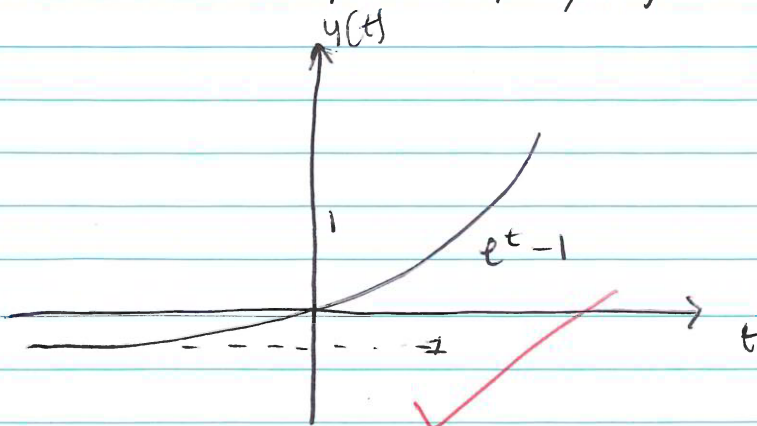
$$= e^t - 1$$

$$= e^t - 1$$

v) mathematical representation for $y(t)$

$$y(t) = \begin{cases} 0 & t < 0 \\ e^t - 1 & t \geq 0 \end{cases}$$

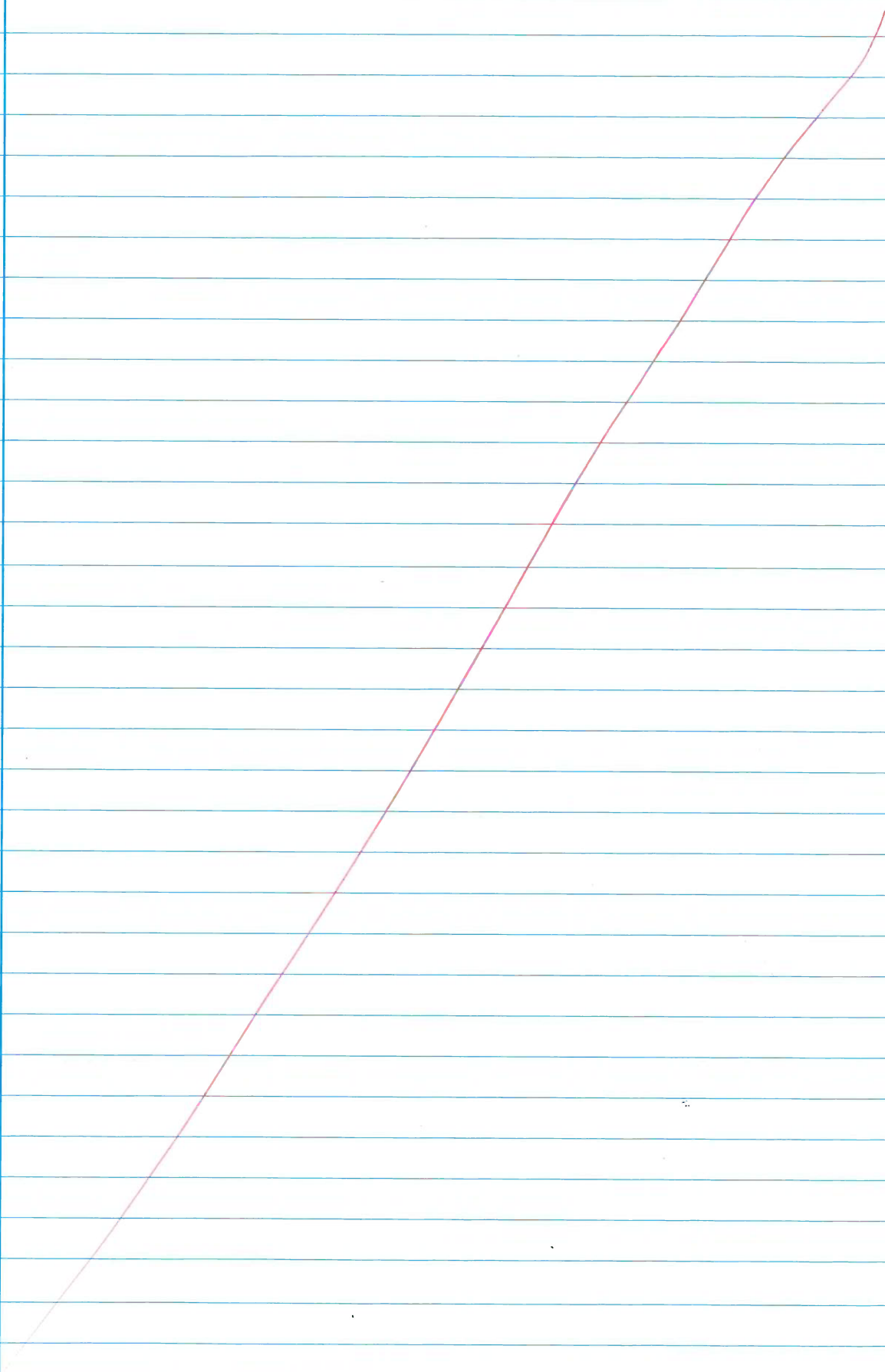
vi) Sketch the output of $y(t)$.





Question No.

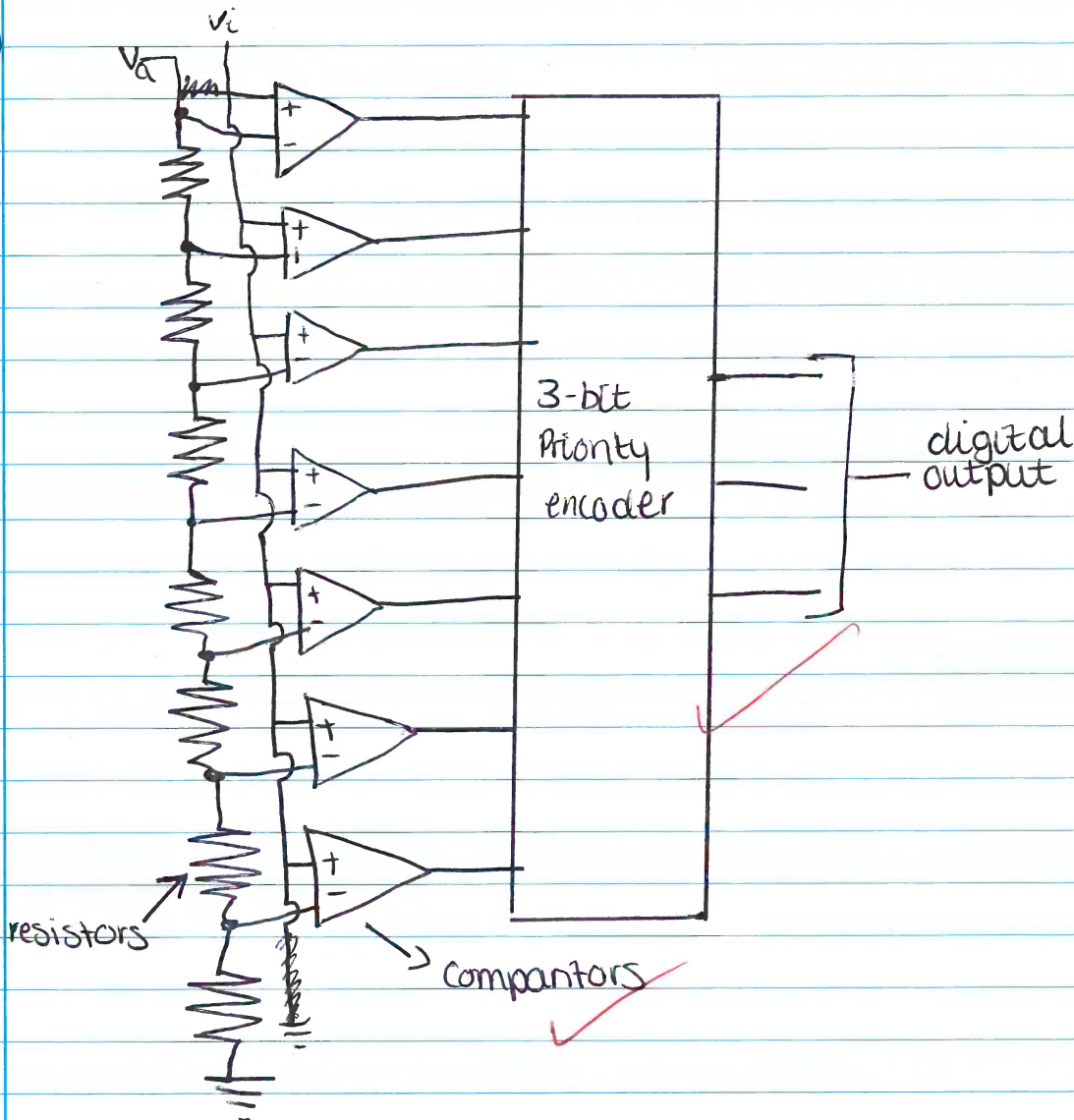
Examiner Only



3

- i) A flash type ADC is a parallel converter for analogue (binary) into digital converter, it works by simultaneously taking readings and converting them for a the relative output.

ii)



- iii) flash ADC works with 3-bit binary inputs as when the analogue input V_i reads '1' it will continue normal operation. when a '0' is read there will be no output from that comparator and it will move on down the line for the binary input.

the use of 7 comparators is down to this equation $2^n = 2^3 - 1 = 7$. 2^n bit is the

statement of how many bits are used in the conversion process of a flash ADC.

- iv) Due to the use of resistors the V_r is obtained in digital form as the signal will be received by the comparators and this will provide a binary code into the 3 bit ~~n~~-coder allowing for the V_r to be obtained.

$$\frac{12.5}{25}$$

4) a) the transmission and reception frame of UART works by receiving a data frame, this data frame will receive this code, converted into a UART data frame and create an output. On this frame will be of either even or odd parity and will consist of 8 different variations of '0' and '1' depending on what needs to be transmitted.

b) i) binary representation of PRINT

P = 50 = 01010000 ✓

8421

R = 52 = 01010010 ✓

15 = F.

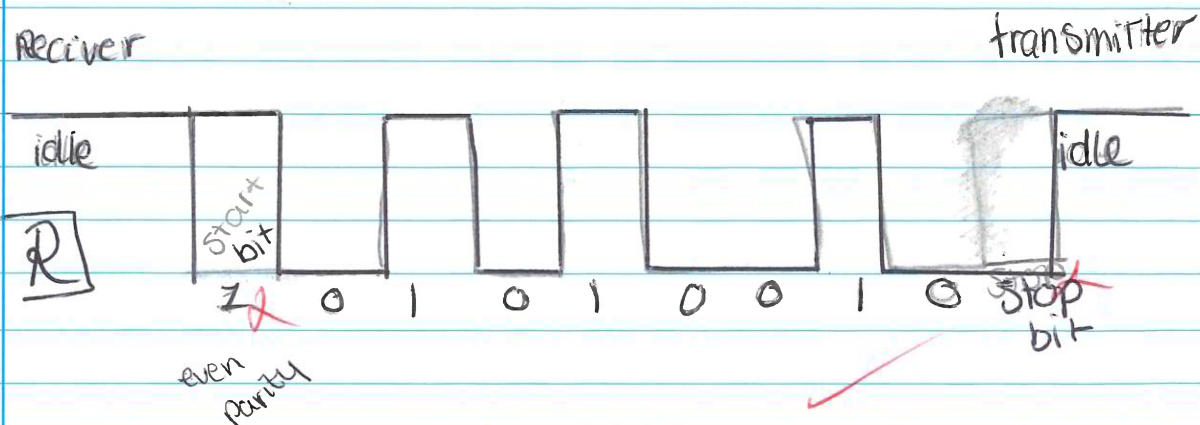
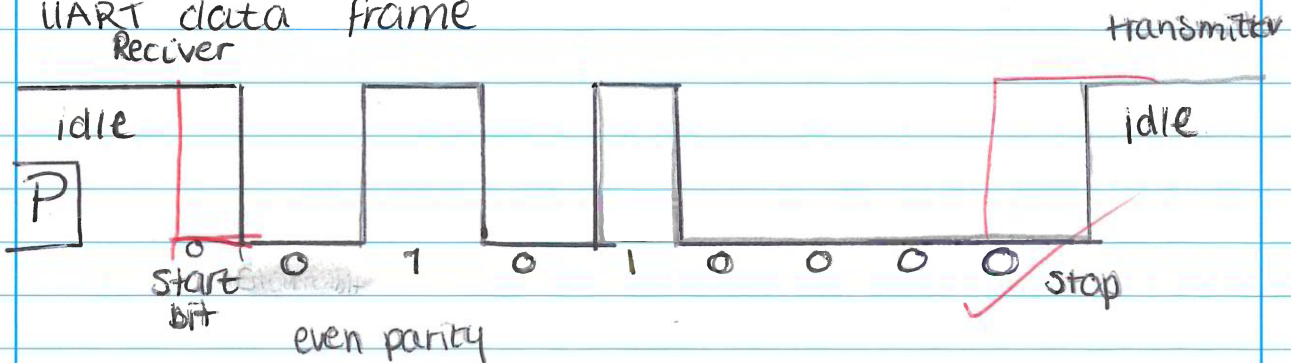
I = 49 = 01001001 ✓

14 = E

N = 4E = 01001110 ✓

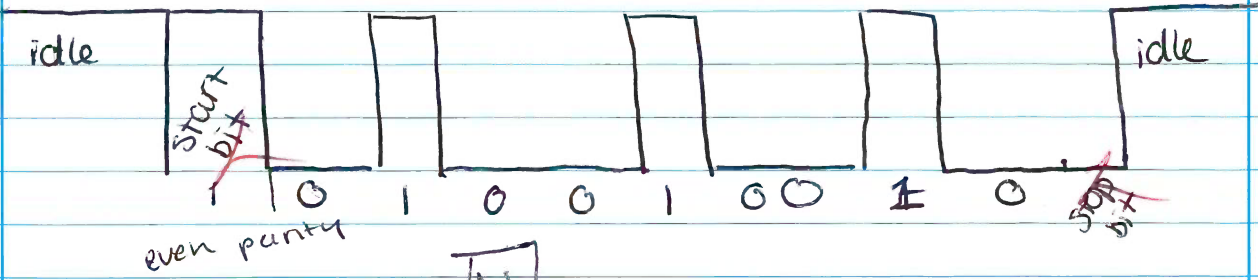
T = 54 = 01010100 ✓

ii) UART data frame

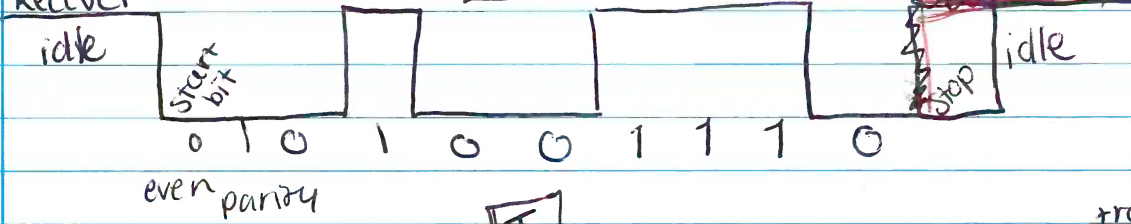


Receiver

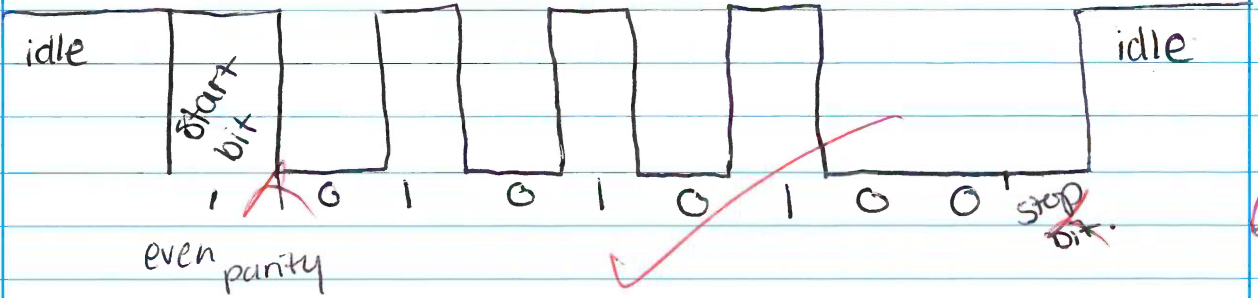
transmitter



Receiver



Receiver



2

19 1/2
25

