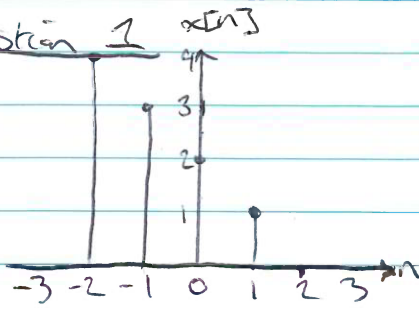


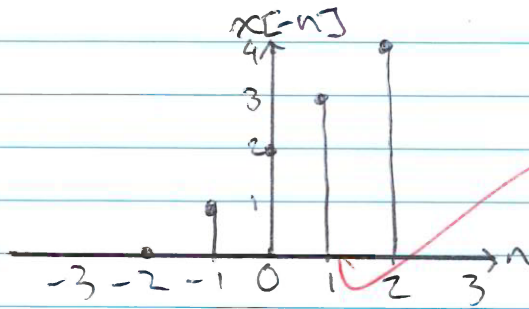
PLP

Question 1

a.)

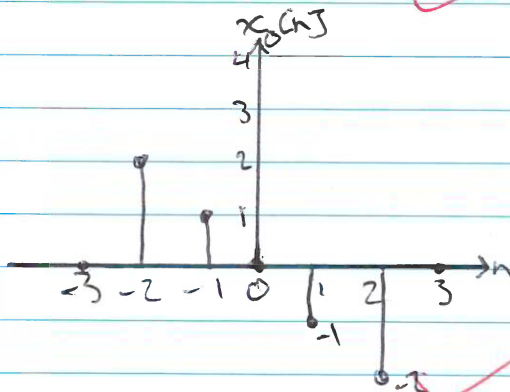
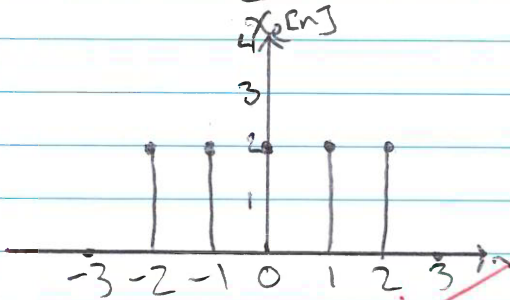


c.)



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

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



3 ✓

1 ✓

1 ✓

3 ✓

3 ✓

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

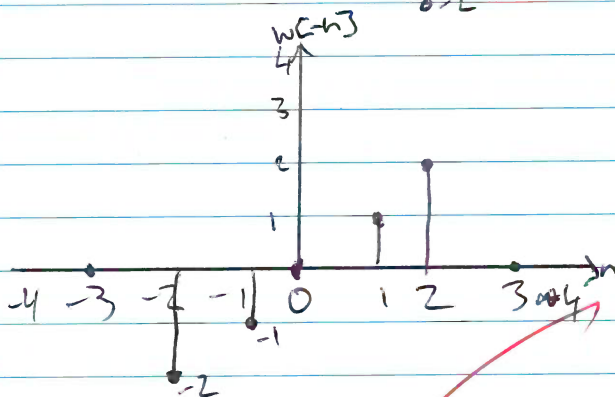
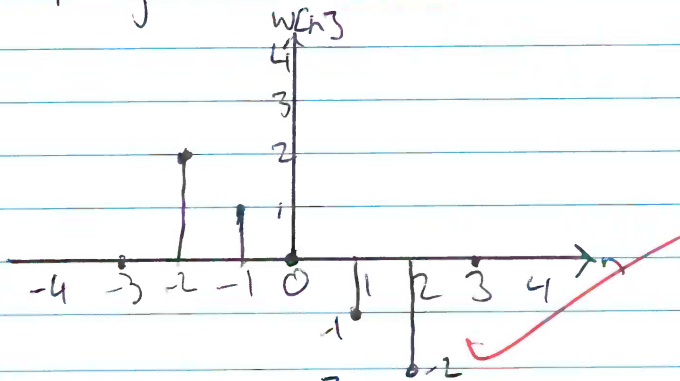
$$x_o[n] = \frac{1}{2} [x[n] - x[-n]]$$

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

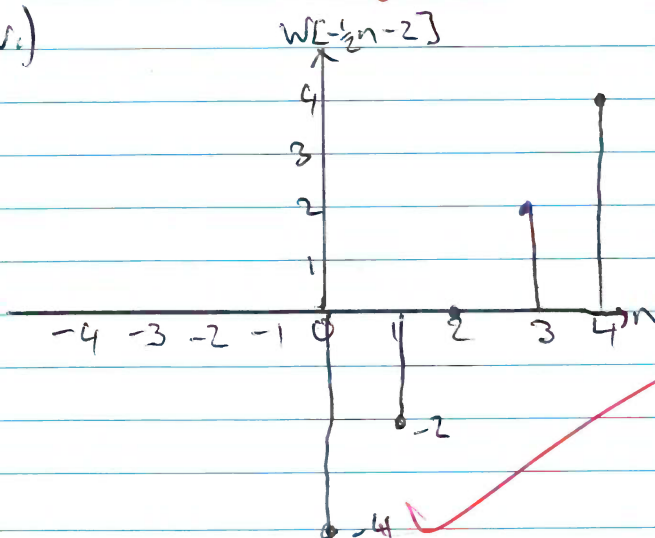
$$x_e[n] + x_o[n] = \frac{1}{2} [2x[n]]$$

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

iii) if $w[n] = x_o[n]$



iv)



2

2

1

1

3

2

3

25
25
25

14

Question 2

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

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

iii.) $x(t) = u(t)$

$$y(t) = \int_0^t h(t - \tau) d\tau \quad (1)$$

$$\alpha = t - \tau \quad (2)$$

$$d\alpha = 0 - d\tau$$

$$d\tau = -d\alpha \quad (3)$$

Sub (2) and (3) into (1)

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

finding limits:

upper limit when $\tau = t$

$$\alpha = 0$$

lower limit when $\tau = 0$

$$\alpha = t$$

$$\therefore y(t) = \int_t^0 h(\alpha) (-d\alpha)$$

however, figure 2(b) shows pulse between 0 and t

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

$$y(t) = \int_0^t h(\alpha) d\alpha$$

iv.) Case 1:

$y(t) = 0$ when $t < 0$ because $x(t)$ and $y(t)$ are 0 when $t < 0$

Case 2:

when $t \geq 0$

$$t \rightarrow \tau \quad x(t-\tau) = e^{t-\tau}$$

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

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

$$y(t) = e^t [-e^{-\tau}]_0^t$$

$$y(t) = e^t [-e^{-t} - (-e^0)]$$

$$y(t) = e^t [-e^{-t} + 1]$$

$$y(t) = -e^{t-t} + e^t$$

$$y(t) = -e^0 + e^t$$

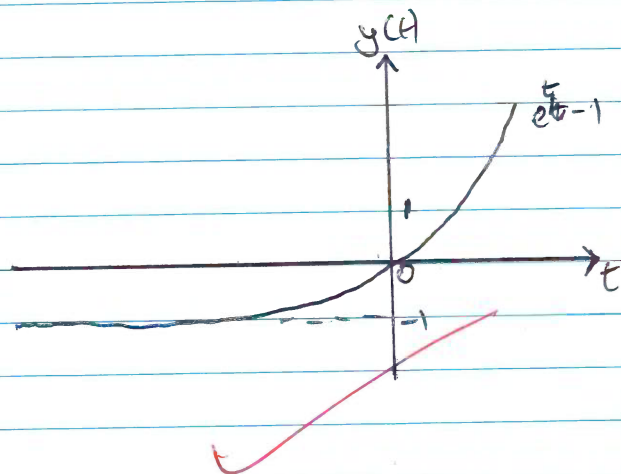
$$\therefore y(t) = e^t - 1$$

$$y(t) = e^t - 1 \quad \text{when } t \geq 0$$

v.)

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

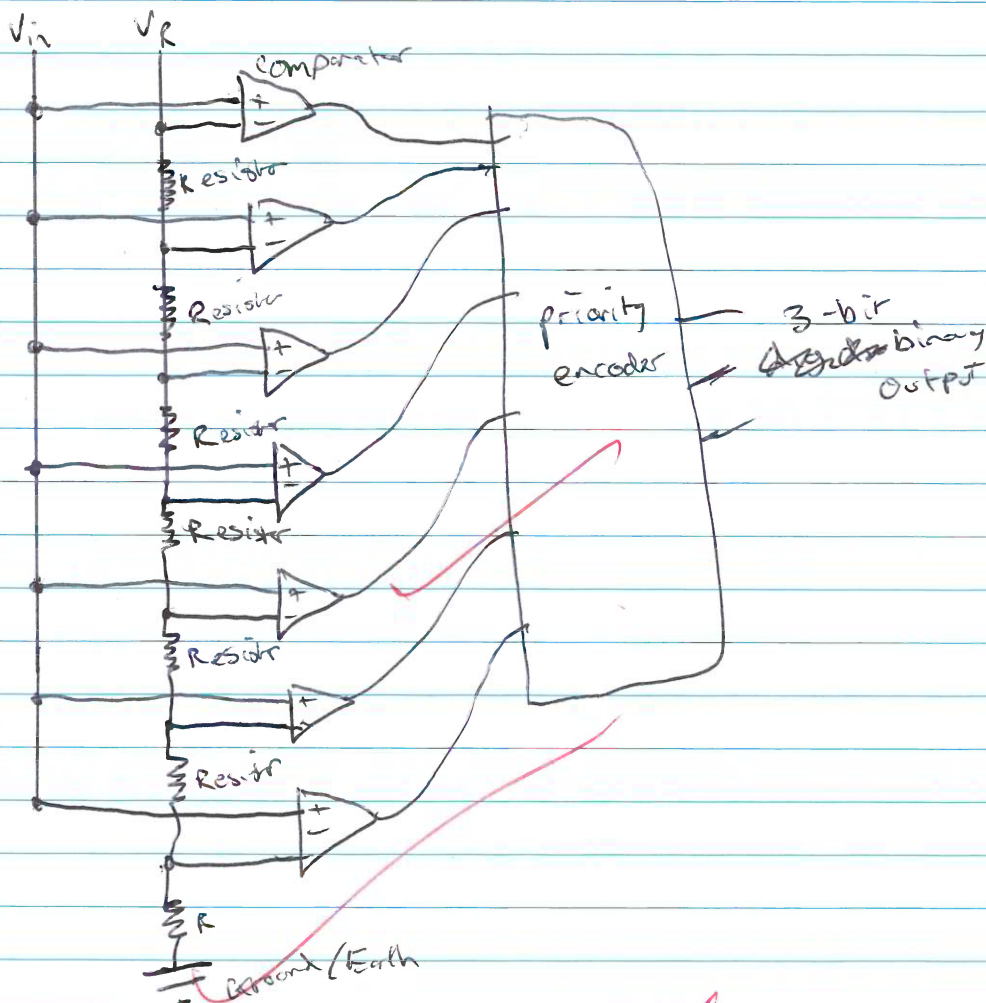
vi.)



Question 3ai.1 Flash type ADC

- Flash type ADC is an analogue to digital converter that consists of 2^n comparators, a resistor ladder and a priority encoder that produces a digital/binary output.
- it compares the input voltage (V_{in}) to the reference voltage (V_R)
- if $V_{in} > V_R$ then '1'
- if $V_{in} < V_R$ then '0'
- 2^n voltage levels

(ii.)



3a(iii)

- If $V_{in} > V_R$ then output is '1' ✓
- If $V_{in} \leq V_R$ then output is '0' ✓
- 2^n voltage levels, so $2^3 - 1 = 7$ comparators
- Because of resistor ladder each comparator has its own reference voltage $V_R = 8V$;

$$\frac{V_R}{8}, \frac{2V_R}{8}, \frac{3V_R}{8}, \dots, \frac{7V_R}{8}, V_R = 8V$$

- Outputs from comparator is then sent to priority encoder which then produces a 3-bit binary output

3a(iv.)

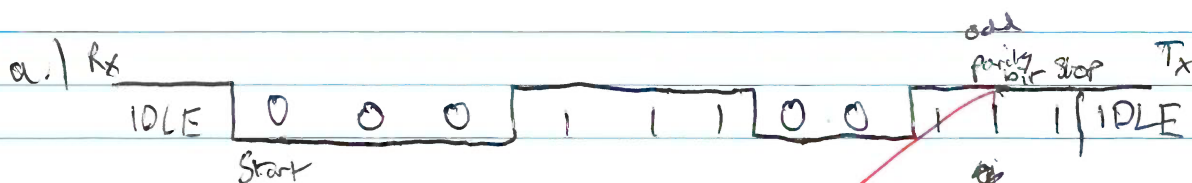
Input to priority encoder	3-bit output	Index value	Voltage
00000000	000	0	0-1V
00000001	001	1	1-2V
00000011	010	2	2-3V
00000111	011	3	3-4V
00011111	100	4	4-5V
→ 00111111	101	5	5-6V
01111111	110	6	6-7V
11111111	111	7	7-8V

- Input to priority encoder received is '00111111'
- This input is an index value 5 which leads to the 3-bit output of '101'

29
25

23
25

Question 4



- contains 8-11 bits consisting of start, stop, parity and information bits
 - can be received either from Receiver (Rx) to transmitter (Tx) side or other way round
- 3

bi.) "PRINT"

8421

hexadecimal

P = 50

50

0101 0000

= 01010000

R = 52

52

0101 0010

= 01010010

I = 49

49

0100 1001

= 01001001

N = 4E

4E

0100 1111

= 01001111

T = 54

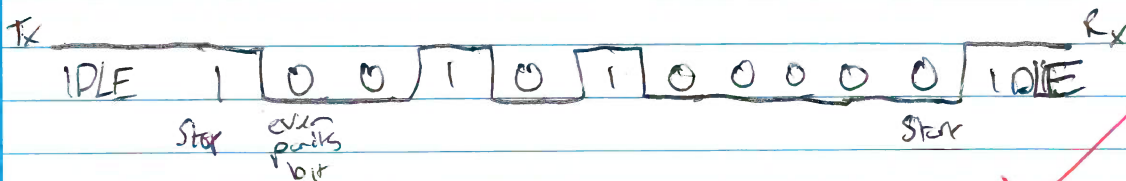
54

0101 0100

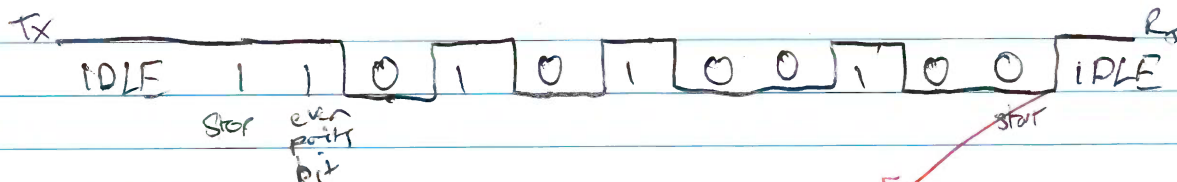
= 01010100

hex	bit value
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
A	11
B	12
C	13
D	14
E	15

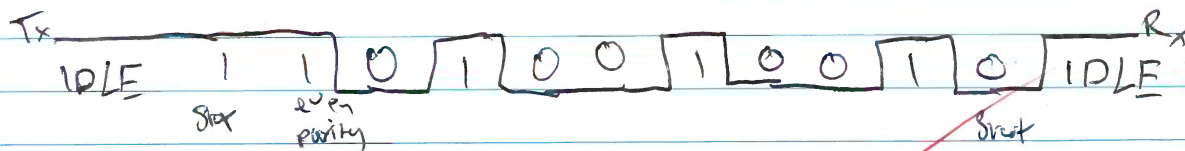
4b c.c.1 P = 01010000



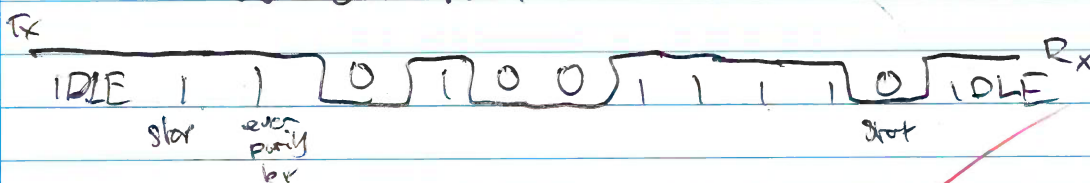
R = 01010010



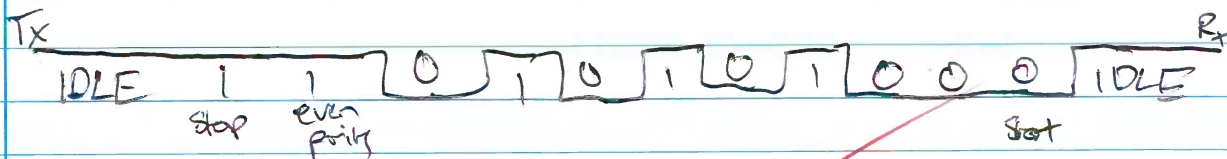
I = 01001001



N = 01001111



T = 01010100



25
25



Question No.

Examiner Only

Rhif y Cwestiwn

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