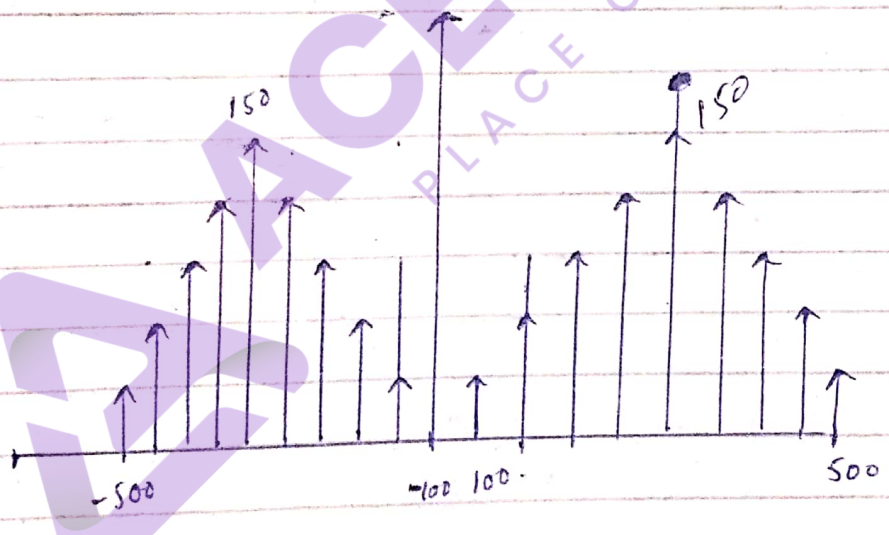
(Question 1)

frequency	100	140	180	220	300	340	380	420
max^m amp	100	140	180	220	300	260	220	180

frequency	460	500
max^m amp.	140	100

Now, let's construct frequency Spectrum



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(Question 2)

Distance = 2×10^5 m
Speed = 2×10^8 m/s
So,
frame size in bits is 12,000 (1500×8) bits

(b) Time = $\frac{2 \times 10^5 \text{ m}}{2 \times 10^8 \text{ m/s}}$
= 0.001 seconds

(c) Queuing Time = Router × Queuing time/router
= 10 × 2 μs
= 0.00002 s

Transmission Time = $\frac{\text{Message Size}}{\text{Bandwidth}}$
= $\frac{12{,}000 \text{ bits}}{5 \times 10^6 \text{ bits/s}}$

= 0.0024 s

Processing Time = No. of routers × processing/router
= 10 × 1 μs = 0.00001 s

ACE LOCALE PLACE OF EXPERTS

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Total time Delay = 0.001s + 0.0024s + 0.000025s + 0.0008s

= 0.00343s

= 3.43×10^{-3} ms

- Most Dominant factor is transmission time'

- Processing time is comparatively negligible.

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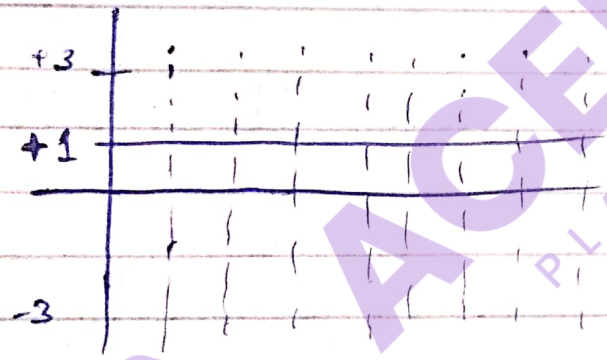
Total time /Delay = 0.005s + 0.002us + 0.00002s + 0.005s

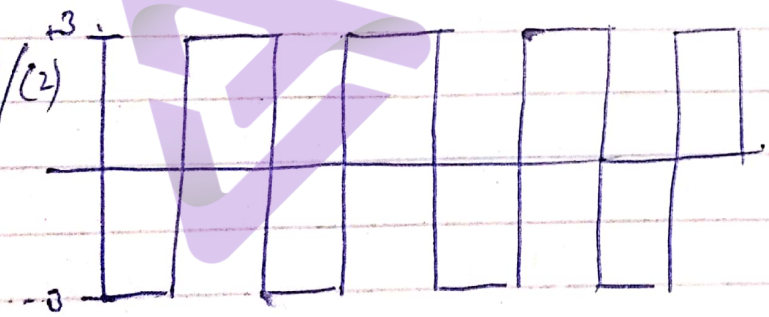
Question 3

@ bits	level	prev. level
00	+1	-1
01	+3	-3
10	-1	+1
11	-3	+3

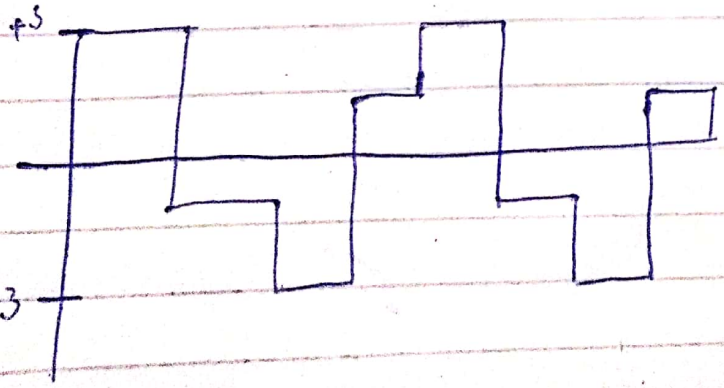
Sol for (a)



(b)/(2)



(c)/(3)



ACELOCALE PLACE OF EXPERTS

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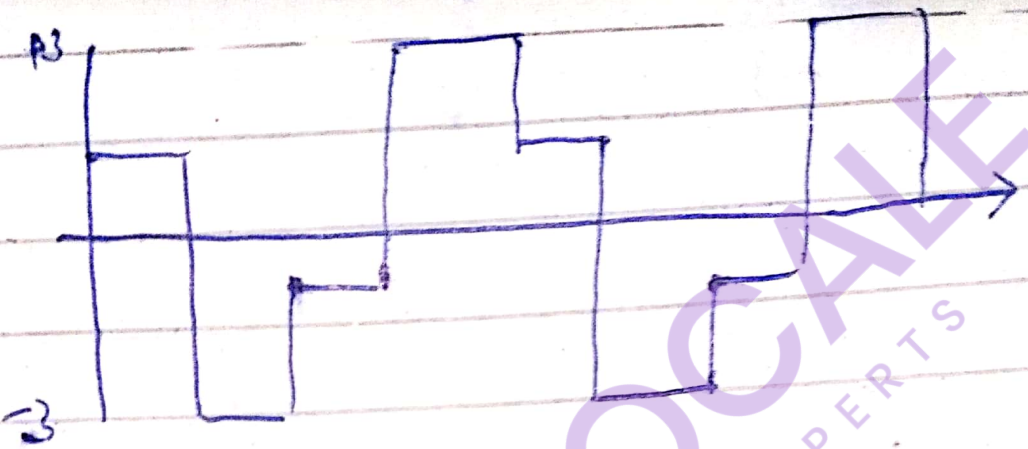
(4)



ACELOCALE
PLACE OF EXPERTS
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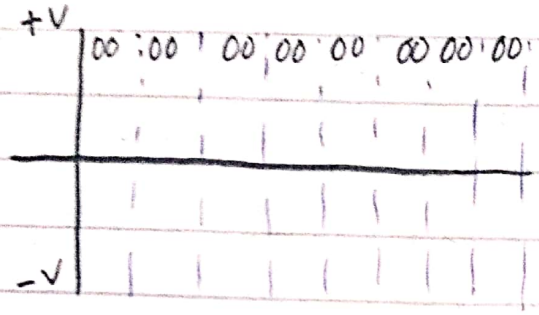
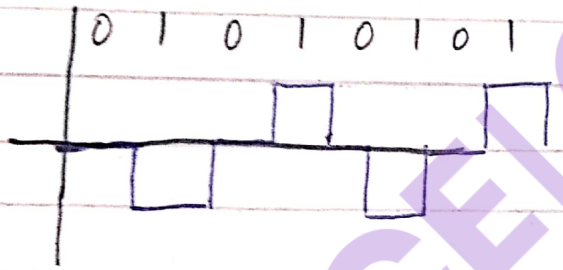
Question 4

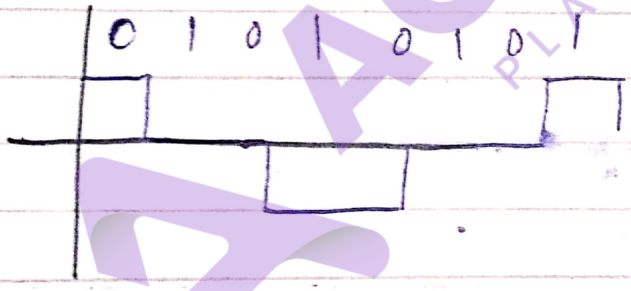
(a)/(1)



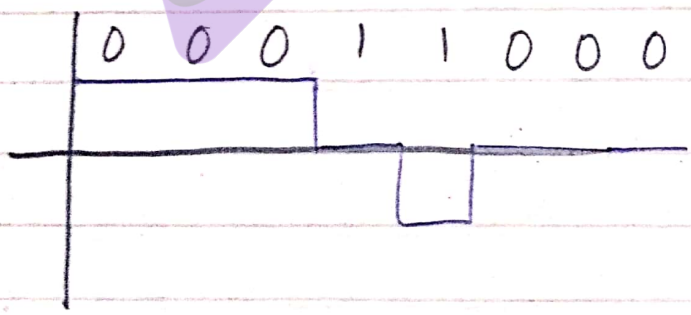
(b)



(c)



d)



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PLACE OF EXPERTS

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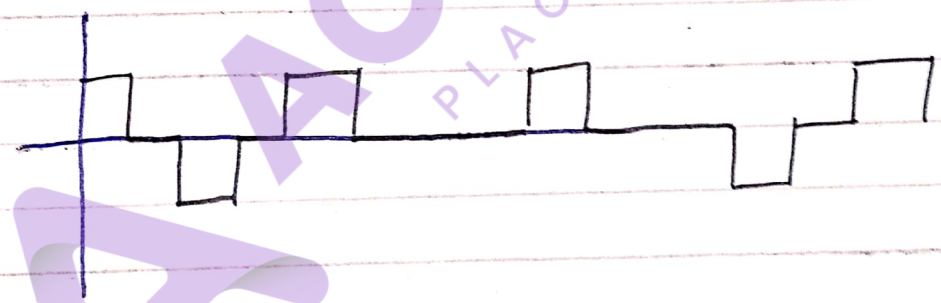
(Question 5)

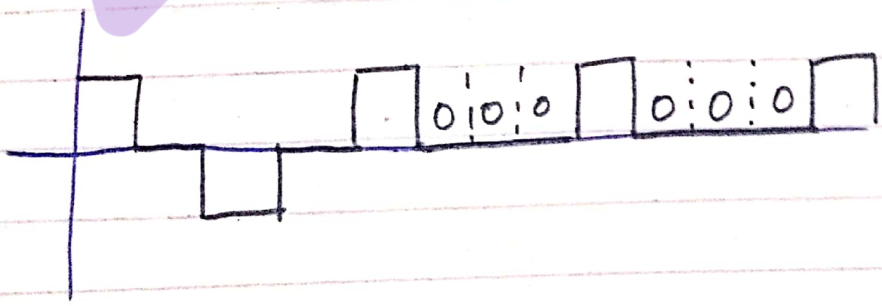
(a) B8ZZ

polarity of next pulse	no. of bipolar odd.	even
−	000 −	+00+
+	000 +	−00−

So, resulting pulse is



(b)



ACELOCALE PLACE OF EXPERTS

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(Question 6)

ⓐ NRZ-L

$S = N \div 2$

$W = \text{Signal} \times 2$

$= 2 \times 10 \times 10^6$

$= 20\ Mbps$

ⓑ Manchester

$S = N$

So,

Data Rate = 10Mbps

ⓒ MLT-3

$S = N \div 3$

$W = S \times 3$

$= 3 \times 10 \times 10^6$ bps

$= 30\ Mps$

d) 2B1Q

$N = S \times 4$

$= 10 \times 10^6 \times 4$ bps

$= 40\ Mbps$

ACELOCALE PLACE OF EXPERTS

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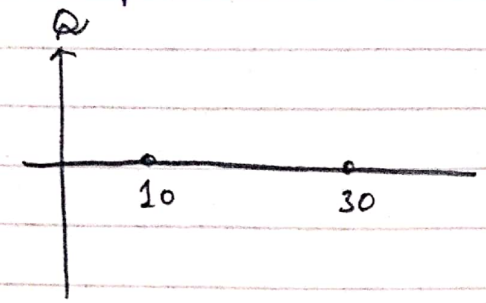
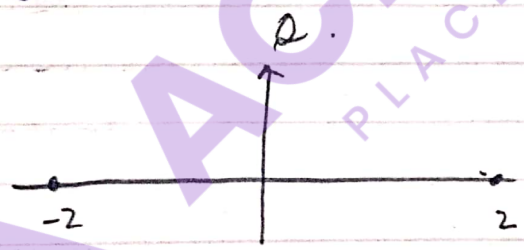
(Question 7)

(a) Phase Assumption = 0

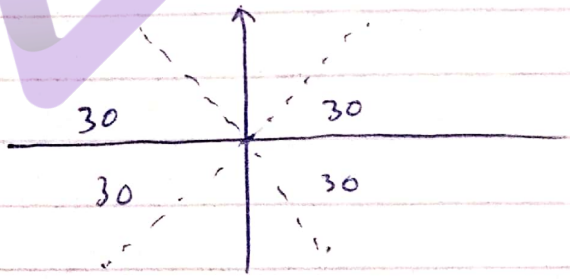


(b) BPSK

So, we have ~~two~~ one values (20)
so, there has to be a phase difference of 180 degrees



(c) QPSK, with peak value 30



d) 8-QAM with 10 & 30, from diff phases.

ACELOCALE PLACE OF EXPERTS

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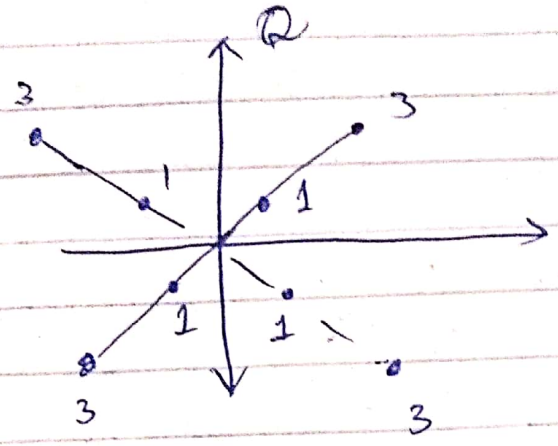

(Question 8)

Bits per band $= \frac{10 MBbs}{10}$

$= 1 Mbps.$

per channel $= \frac{10}{10} MHz$

$= 1000 kHz$

(a) $B = (1+d)\frac{N}{r}$

$= (1) \times \frac{1000 kHz}{1000 kHz}$

$= 1$

(b) $r = \log_2 L$

$L = 2^r$

$= 2^1 = 2 \rightarrow$ points of constellation on diagram

ACELOCALE PLACE OF EXPERTS

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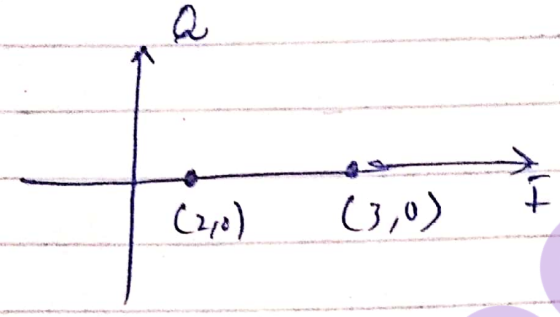
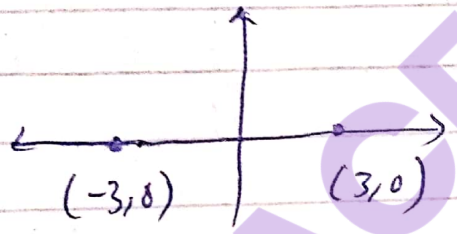
(Question 9)

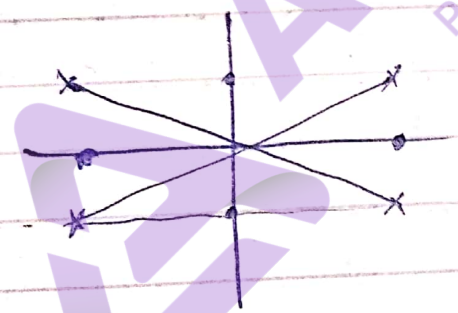
ⓐ Two points at (2,0) and (3,0).



ⓑ (-3,0), (3,0)

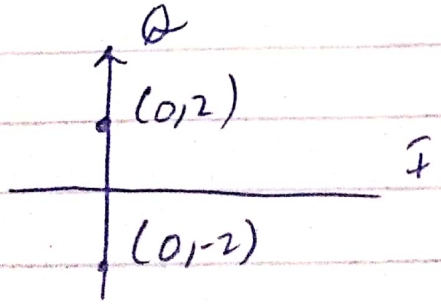


c)



Amplitude = $\sqrt{2^2+2^2} = 2\sqrt{3}$.

d) (0,2) and (0,-2)



ACELOCALE PLACE OF EXPERTS

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(Question 10)

Go-back N & Selective Repeat Protocol

Link Bandwidth Utilization.

Go Back N retransmits all the frames after the frame that's damaged or not.
While SRP only retransmits the frame lost.
So, Link Bandwidth Utilization for GBN is greater.

Complexity of Algorithms:

The space & time complexity of SRP is greater than GBN
Because GBN doesn't store frames received after the damaged one unless retransmission comes.
While, SRP stores them in buffer until the damaged frame is received.
Sorting is required in SRP because it needs to maintain frame sequence.

(Question 11)

pseudocode for Go Back N ARQ protocol..

```
Rn = 0
Sw = 2^m - 1 // (total buff / window size)
Sn = 0
Sf = 0
```

ACELOCALE PLACE OF EXPERTS

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```
while (true)
 {
   WaitforMsg();
   If (Msg (Needs to Be Sent))
   { If ( Sn - Sf >= Sw ), then Hibernate();

     if not
       Get Data()
     Make Frame (Sn, Rn)
      Store Frame( Sn, Rn)
      Transmit Frame (Sn, Rn)
      Sn = Sn + 1
      If (timer == 0); Start The Timer();

     }

   If (Message (Needs To Arrive))
    {
      Receive (Frame);
      If Damaged (Frame))
      Hibernate();
    if ((ack_n > Sf and ack_n <= Sn))
     {
        while ( Sf < ack_n )
        {
          Purge Frame (Sf);
          Sf = Sf + 1
        }
```

ACELOCALE PLACE OF EXPERTS

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```
StopTheTimer();
}
if (seq_r == R_n)
{
DeliverReqData();
R_n = R_n + 1;
SendTheAck(R_n);
}

}

If (MsgTimeOut))

{
StartTheTimer();
Frametemp = S_f;
while (Frametemp < S_n)
{
SendThisFrame(S_f);
S_f = S_f + 1;
}

}
```

ACELOCALE PLACE OF EXPERTS

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