Question-1

Design a two bits optimal quantizer for the following data:

1, 7, 8, 14, 2, 22, 14, 21, 3, 9, 20

(i)Write down the quantization table and define ranges and Q^{-1} for each range

(ii) Compress then decompress the above data and calculate the Mean Square Error

(iii) Compress then decompress the above data using the following uniform quantizer and calculate the mean square error, compare with the result of optimal quantizer and comment on your results

Code	Range	Q-1
00	1-->6	3
01	7-->12	9
10	13-->18	15
11	19-->24	21

Question-2

Design a 2 bits Lloyd-Max Quantizer for the following data stream
-16,1,-8,10,11,-9,2,-15,-18,-19,4,13,14,5,-5,-6 what will be the MSE after quantization-dequantization of the stream.

Question-3

It is required to compress the following image using Vector Quantization Algorithm.
- Design a code book with vector size 2x1 (2 horizontal and one vertical) and the number of vectors =4 (final code book must be integer values only)
- Calculate the accurate compression ratio achieved (assume original pixels are stored in 5 bits)
- Reconstruct the original image from the compressed one
- Calculate the MSE between the original and the decompressed images.

1	1	6	6	12	14
8	8	13	15	15	17
10	12	3	3	3	3
1	1	12	14	8	8

Question-4

Given the following Vector quantizers:-
> (1) vector size (2X2) and codebook size = 32 vectors
> (2) Vector size (3X3) and codebook size = 64 vectors
> (3) vector size (4X4) and codebook size = 256 vectors

  (i) compare between the compression ratios achieved using each quantizer (image size is 120 X 120, **do not neglect** overhead)

  (ii) compare between the compression ratios achieved using each quantizer (image size is 1200 X 1200, **do not neglect** overhead)

  comment on your results