

MATLAB ASSIGNMENT 1

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Part-1

1.)

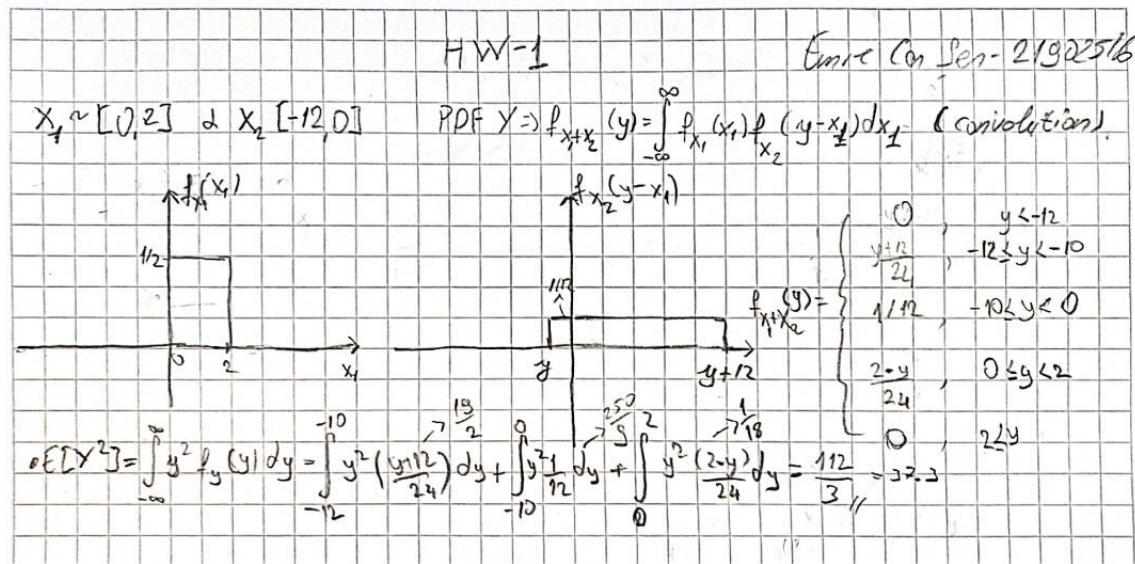


Figure 1- Theoretical Results

2, 3.)

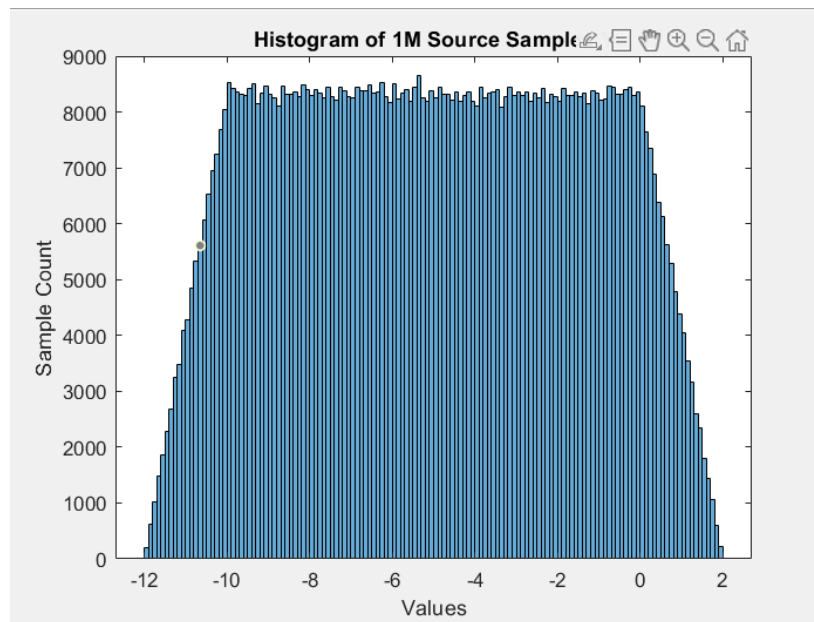


Figure 2- Histogram of Y

The theoretical average value of squares: 37.34

The MATLAB average value of squares: 37.31

The obtained values are very close, since our sample count is quite large the effect of chance is negated and, if with a further increase in sample count the obtained MATLAB result would even get closer to theoretical value.

4.)

In order to construct a uniform quantizer with $N=4$, first the interval $[-12,2]$ is divided to 4 uniform sub-intervals. Second, the midpoints of these sub-intervals are taken as reconstruction levels. For this case,

- Quantization Levels: $[-2 \ 1.5 \ 5 \ 8.5 \ 12]$
- Reconstruction Levels: $[-0.25 \ 3.25 \ 6.75 \ 10.25]$

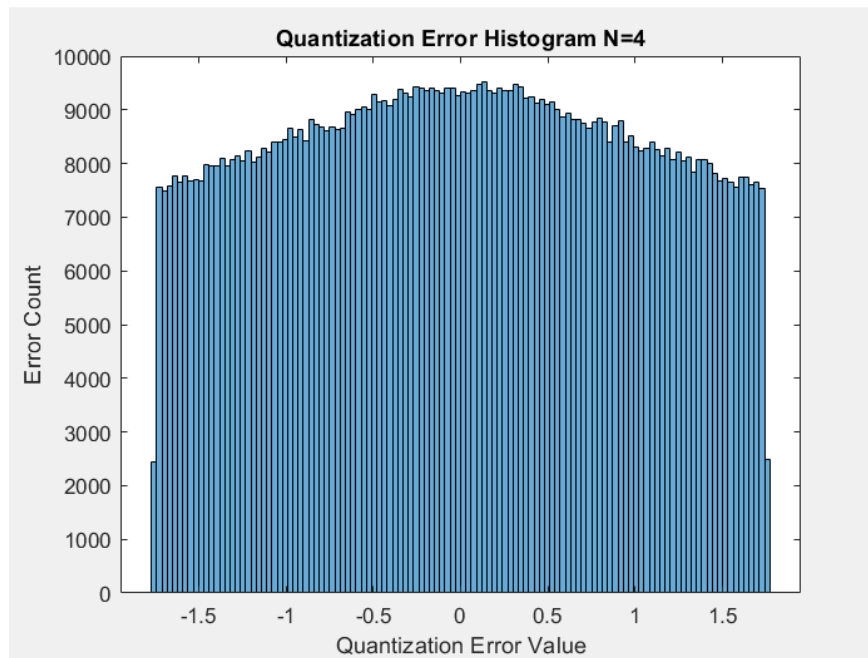


Figure 3- Quantization Error N=4

- Average power of quantization error for $N=4$: -0.1901 dB
- SQNR for $N=4$: 15.9190 dB

5.)

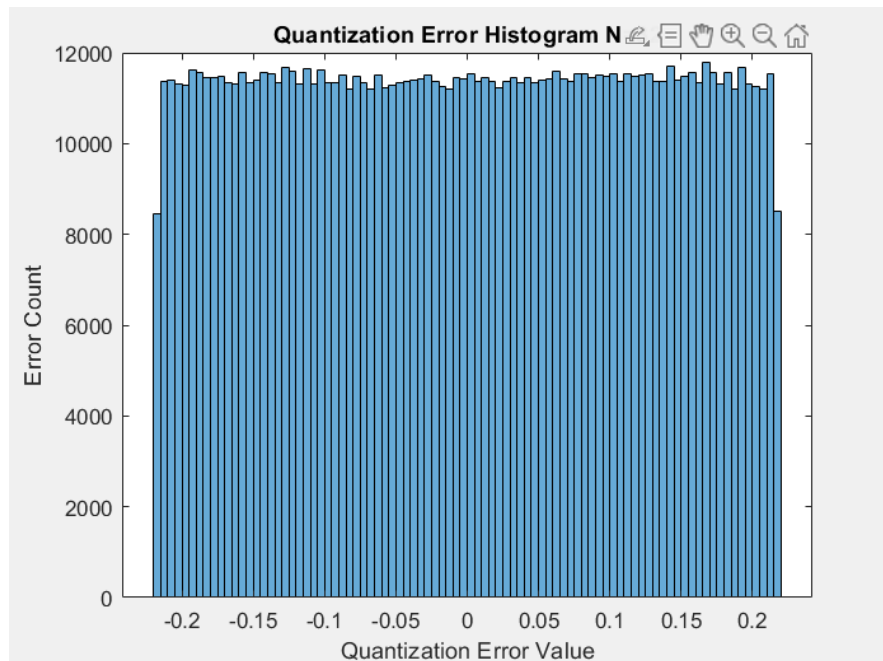


Figure 4- Quantization Error N=32

- Average power of quantization error for N=32: -17.9697 dB
- SQNR for N=32: 33.6986 dB

With higher N, the quantized version of the original distribution is closer to the original version. Hence, the error obtained with higher N is significantly lower and as a result, the SQNR value is also significantly greater.

6, 7.)

For this part, the Lloyd-Max algorithm was performed with N=4 and it is expected that the error for this part will be lower than the previous parts. The reason being that the Lloyd-Max algorithm accounts better for the variations in the distribution by taking the mean between intervals. As opposed to just assigning reconstruction levels uniformly.

- Quantization Levels: -12.0000 -8.0558 -4.9970 -1.9395 2.0000
- Reconstruction levels: -9.5857 -6.5260 -3.4680 -0.4109

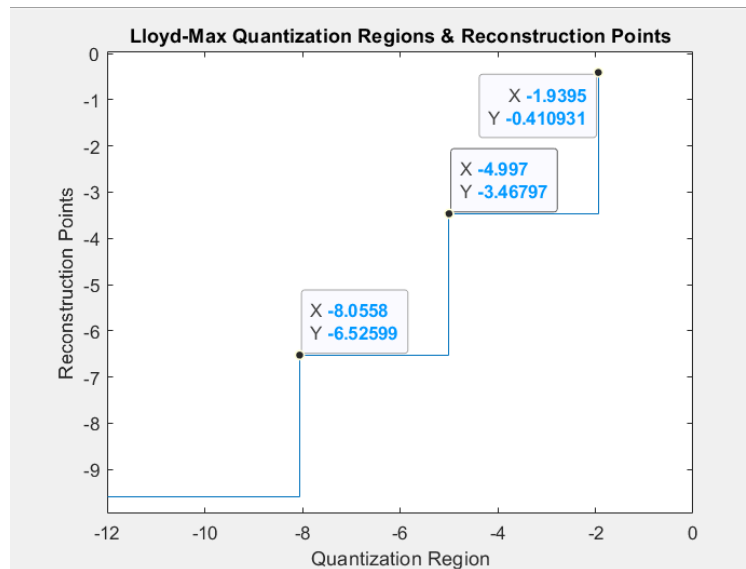


Figure 5- Lloyd-Max Quantization Regions and Reconstruction Points

Rather than uniform points like part 4, we have the mean points of the distribution for each sub-interval and, the quantization levels are the mid-points of 2 successive reconstruction levels.

8.)

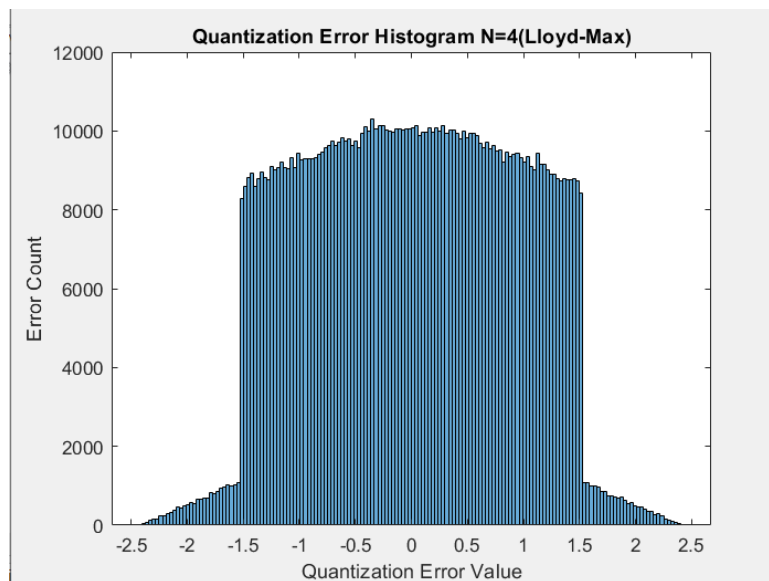


Figure 6- Quantization Error N=4 with Lloyd-Max

- Average power of quantization error for N=4: -0.8062 dB
- SQNR for N=4: 16.5351 dB

The results obtained in this part show that this is an improvement over the results in part 4. The reconstruction of the original distribution is done with less error. So it's expected that for the N=32 case, the Lloyd-Max will perform better than uniform quantizer case.

9.)

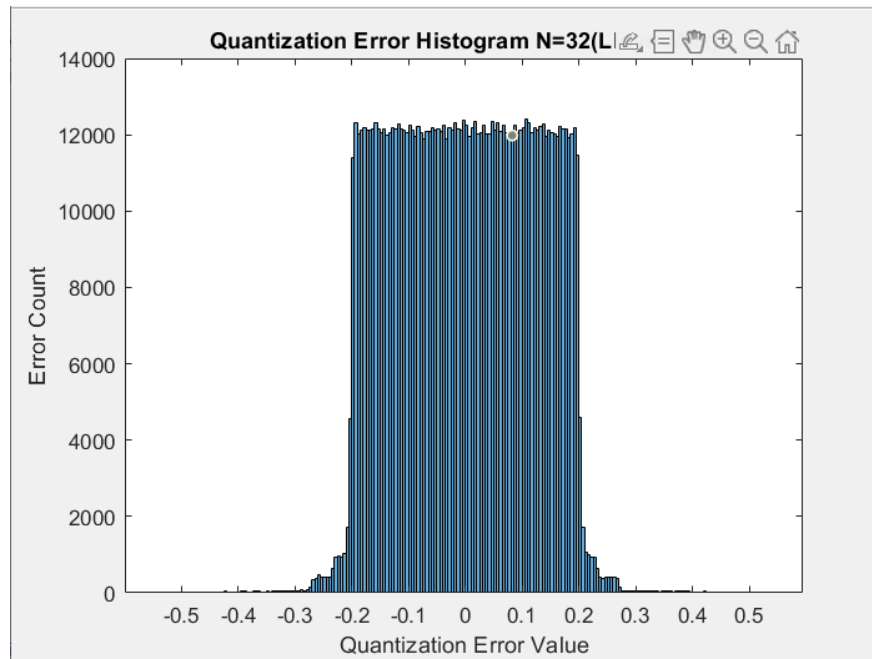


Figure 7- Quantization Error N=32 with Lloyd-Max

- Average power of quantization error for N=32: -18.3402 dB
- SQNR for N=32: 34.0629 dB

These results are an improvement over both the results obtained in part 5 and 8. As expected, the Lloyd-Max algorithm was able to deal with varying distributions more effectively. If the distribution were to be uniform, there would be no difference between part 5 and this part. Also the increase in N further reduced the error and increased the SQNR.

Part-2

1, 2.)

Since every character before coding is 5 bit, the average codeword length will be 5 bits before coding.

After coding, 4.20475 bits.

3.)

For this part, an online character remover was utilized to remove characters that were not in the dictionary.

Text Used:

Born in Tokyo City in the Empire of Japan Miyazaki expressed interest in manga and animation from an early age and he joined Toei Animation During his early years at Toei Animation he worked as an inbetween artist and later collaborated with director Isao Takahata Notable films to which Miyazaki contributed at Toei include Doggie March and Gulliver s Travels Beyond the Moon He provided key animation to other films at Toei such as Puss in Boots and Animal Treasure Island before moving to A Pro where he codirected Lupin the Third Part I alongside Takahata After moving to Zuiyo Eizo later known as Nippon Animation Miyazaki worked as an animator on World Masterpiece Theater and directed the television series Future Boy Conan He joined Tokyo Movie Shinsha to direct his first feature film The Castle of Cagliostro as well as the television series Sherlock Hound In the same period he also began writing and illustrating the manga Nausicaa of the Valley of the Wind and he also directed the film adaptation produced by Topcraft Miyazaki co founded Studio Ghibli He directed numerous films with Ghibli including Laputa Castle in the Sky My Neighbor Totoro Kiki s Delivery Service and Porco Rosso The films were met with critical and commercial success in Japan Miyazaki s film Princess Mononoke was the first animated film ever to win the Japan Academy Prize for Picture of the Year and briefly became the highest grossing film in Japan following its release its distribution to the Western world greatly increased Ghibli s popularity and influence outside Japan His film Spirited Away became the highestgrossing film in Japanese history winning the Academy Award for Best Animated Feature and is frequently ranked among the greatest films of the century Miyazaki s later filmHowl s Moving Castle Ponyo and The Wind Rises also enjoyed critical and commercial success Following the release of The Wind Rises Miyazaki announced his retirement from feature films though he later returned to write and direct his twlfth feature film The Boy and the Heron Miyazaki s works are characterized by the recurrence of themes such as humanity s relationship with nature and technology the wholesomeness of natural and traditional patterns of living the importance of art and craftsmanship and the difficulty of maintaining a pacifist ethic in a violent world The protagonists of his films are often strong girls or young women and several of his films present morally ambiguous antagonists with redeeming qualities Miyazaki s works have been highly praised and awarded he was named a Person of Cultural Merit for outstanding cultural contributions and received the Academy Honorary Award for his impact on animation and cinema Miyazaki has frequently been cited as an inspiration for numerous animators directors and writers

Text Received:

born in tokyo city in the empire of japan miyazaki expressed interest in manga and animation from an early age and he joined toei animation during his early years at toei animation he worked as an inbetween artist and later collaborated with director isao takahata notable films to which miyazaki contributed at toei include doggie march and gulliver s travels beyond the moon he provided key animation to other films at toei such as puss in boots and animal treasure island before moving to a pro where he codirected lupin the third part i alongside

takahata after moving to zuiyo eizo later known as nippon animation miyazaki worked as an animator on world masterpiece theater and directed the television series future boy conan he joined tokyo movie shinsha to direct his first feature film the castle of cagliostro as well as the television series sherlock hound in the same period he also began writing and illustrating the manga nausicaa of the valley of the wind and he also directed the film adaptation produced by topcraft miyazaki co founded studio ghibli he directed numerous films with ghibli including laputa castle in the sky my neighbor totoro kiki s delivery service and porco rosso the films were met with critical and commercial success in japan miyazaki s film princess mononoke was the first animated film ever to win the japan academy prize for picture of the year and briefly became the highest grossing film in japan following its release its distribution to the western world greatly increased ghibli s popularity and influence outside japan his film spirited away became the highestgrossing film in japanese history winning the academy award for best animated feature and is frequently ranked among the greatest films of the century miyazaki s later film howl s moving castle ponyo and the wind rises also enjoyed critical and commercial success following the release of the wind rises miyazaki announced his retirement from feature films though he later returned to write and direct his twelfth feature film the boy and the heron miyazaki s works are characterized by the recurrence of themes such as humanity s relationship with nature and technology the wholesomeness of natural and traditional patterns of living the importance of art and craftsmanship and the difficulty of maintaining a pacifist ethic in a violent world the protagonists of his films are often strong girls or young women and several of his films present morally ambiguous antagonists with redeeming qualities miyazaki s works have been highly praised and awarded he was named a person of cultural merit for outstanding cultural contributions and received the academy honorary award for his impact on animation and cinema miyazaki has frequently been cited as an inspiration for numerous animators directors and writers

4.)

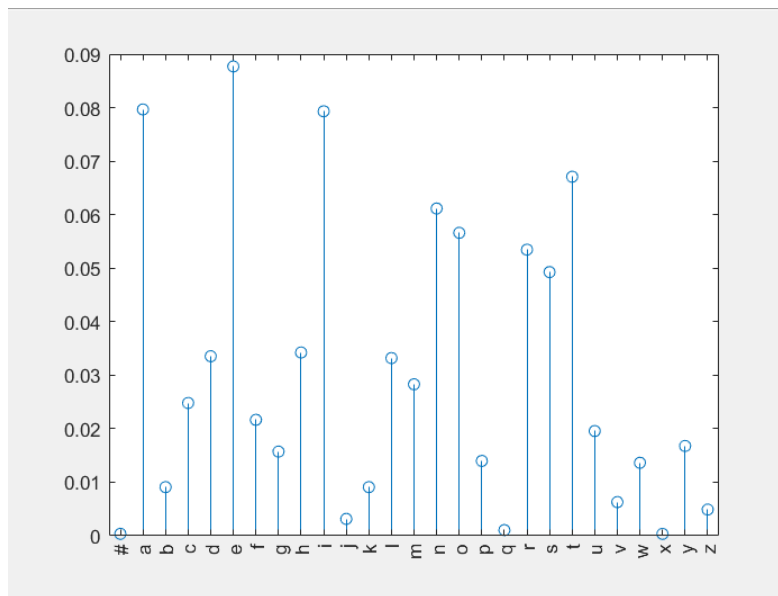


Figure 8- PMF of Characters

Then, entropy was found to be: 4.130. With Lempel-Ziv coding the average codeword was reduced from 5 to 4.20475 bits and entropy should be the lower bound. There is still room for improvement but the algorithm was successful. With more characters the disorder or randomness in the text would increase and so would the entropy, there would be more room for potential knowledge to be learnt. In this case the coding would be more of a challenge. With less characters, the opposite would be the case.