Course Activity

16QAM Rx implementation

Target

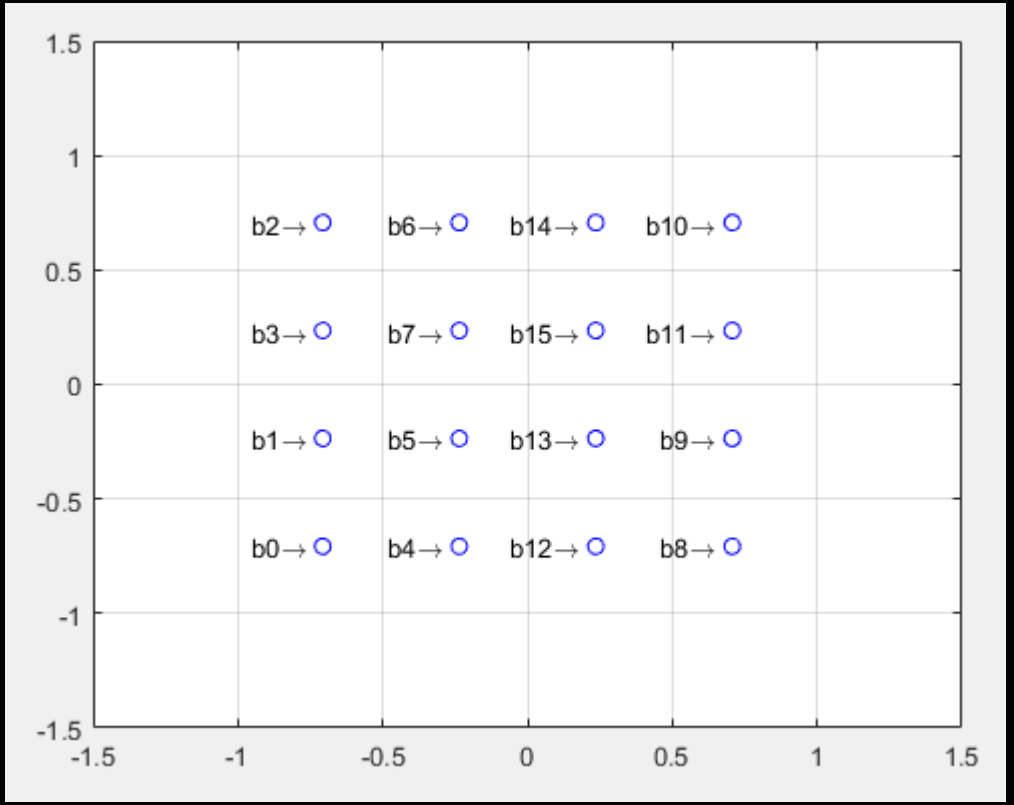
- Design 16-QAM Tx
  - Bit to symbol mapping
- Pass through a given simulated channel and AWGN
- Decode and report
  - SNR
  - Symbol error rate
  - Bit error rate
  - Throughput

Template code

- BPSK, channel included
  - https://drive.google.com/open?id=0B4Qc-NfoSFXsNmJzaDlodVdKalk
- Parameters
  - Tx_amp in line 54
  - Path_loss_exp in line 62
  - noisedB in line 63
  - d in line 64
  - phase_shift in line 82

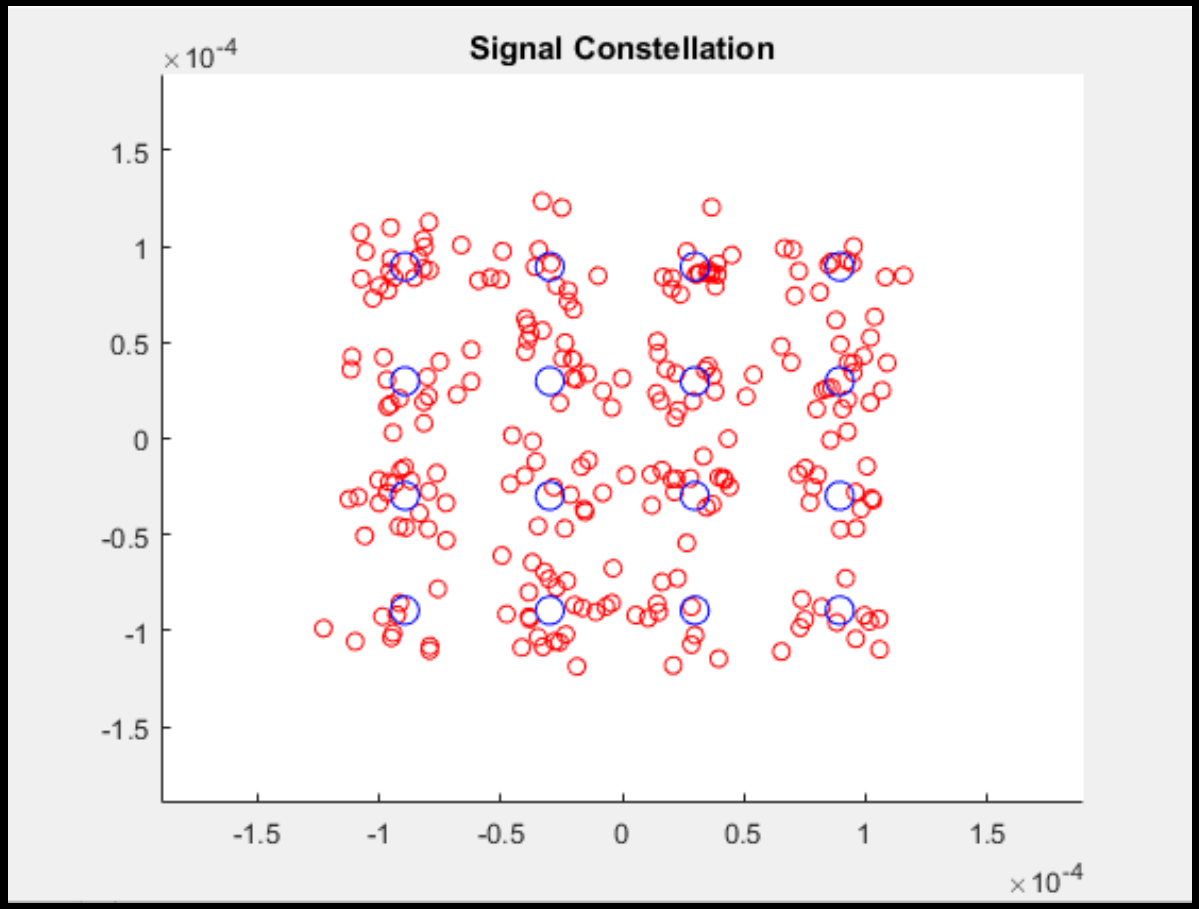
Requirement – bitmapping

1. Random mapping
2. Gray-code



https://www.mathworks.com/help/comm/gs/compute-ber-for-a-qam-system-with-awgn-using-matlab.html
https://www.gaussianwaves.com/2012/10/constructing-a-rectangular-constellation-for-16-qam/

Requirement – signal constellation



Requirement – decode

Noise level from -30:10:-50

- SNR (dB)
- Symbol error rate
- Bit error rate

Submit

- courses.dlc.ntu.edu.tw
  - Exercise > Rx_implementation
  - .zip containing
    - qam_implement.m
    - bitmapping_random.png – 15%
    - bitmapping_gray.png – 15%
    - constellation.png – 40%
    - report.pdf reporting SNR, symbol error rate, bit error rate, and explanation. – 30%

Appendix – SNR calculation

- Signal per symbol = $\sqrt{\left(\frac{\sum_{i=1}^{N} |S_i|^2}{N}\right)}$
- High sample/symbol -> SNR high
- Low bit/symbol -> SNR high