

Digital Communication Lab3

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Questions:

1-We multiply by $(\log_2(\text{ModulationOrder}))$ because it is the number of bits per symbol.

2-For MASK

$$Eb = \frac{Eav}{\log_2 M}$$

By substituting for Eav we get that:

$$Eb = \frac{(M^2 - 1)}{3\log_2 M}$$

For MPSK As the Eav equals 1

$$Eb = \frac{1}{\log_2 M}$$

For QPSK

$$Eav = \frac{2(M - 1)}{3}$$

So, we get that:

$$Eb = \frac{2(M - 1)}{3\log_2 M}$$

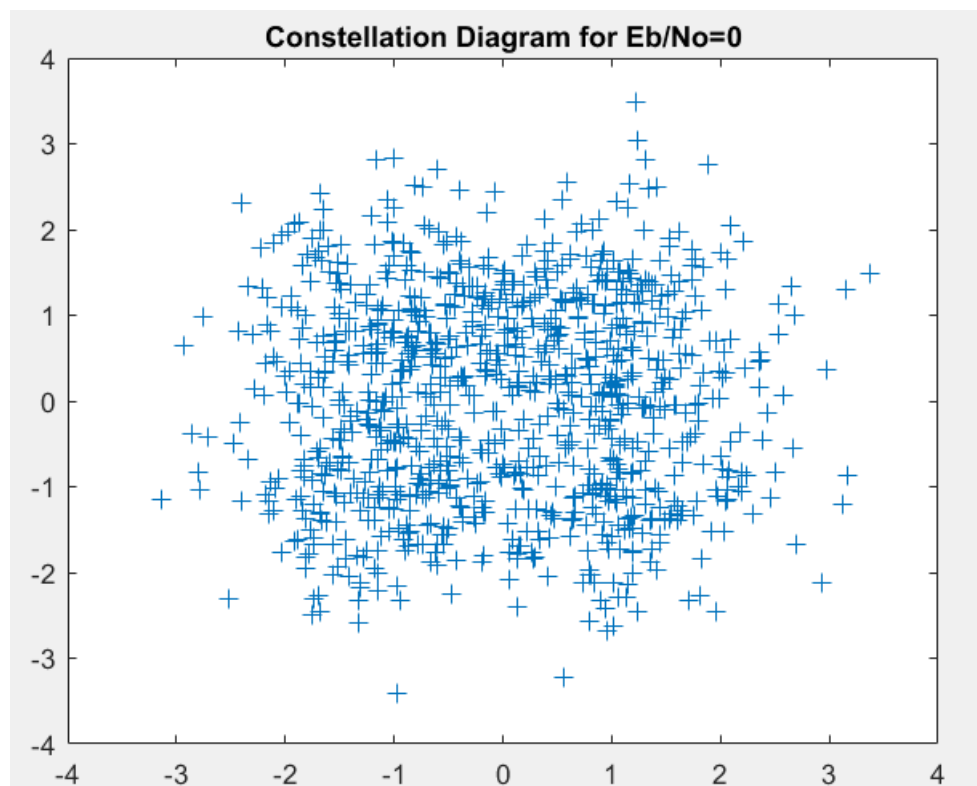
3- Reshapes the vector Bits into a matrix with a number of rows equal to $\log_2(\text{ModulationOrder})$ and a number of columns equal to $\text{NumberBitsPerFrame}/\log_2(\text{ModulationOrder})$ where each row corresponds to a symbol.

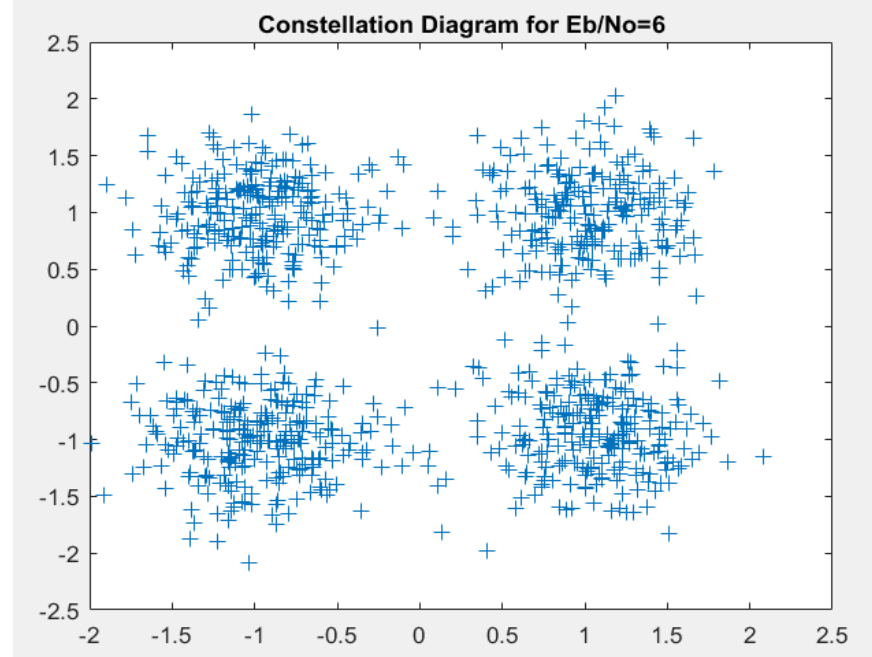
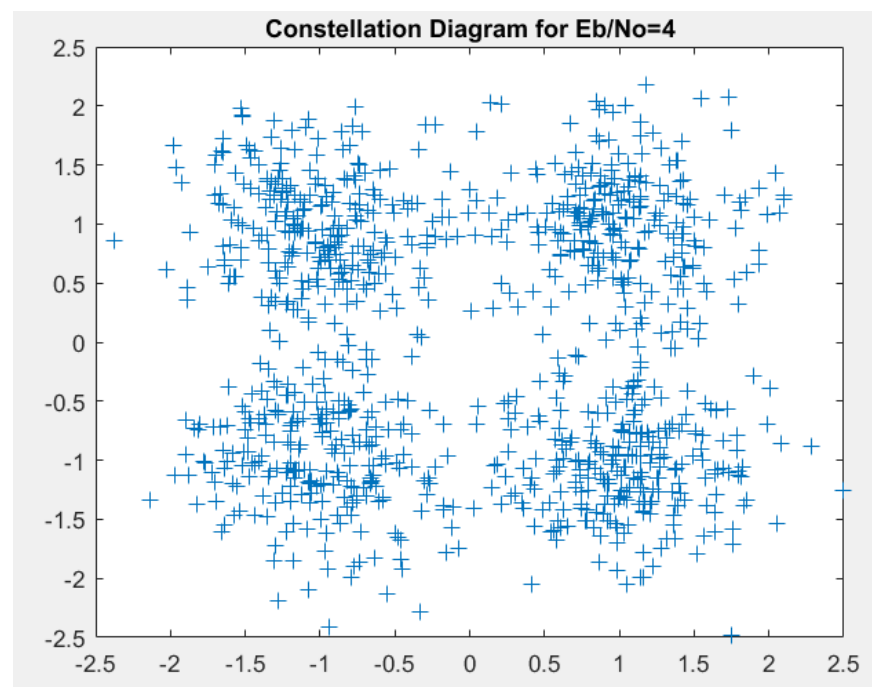
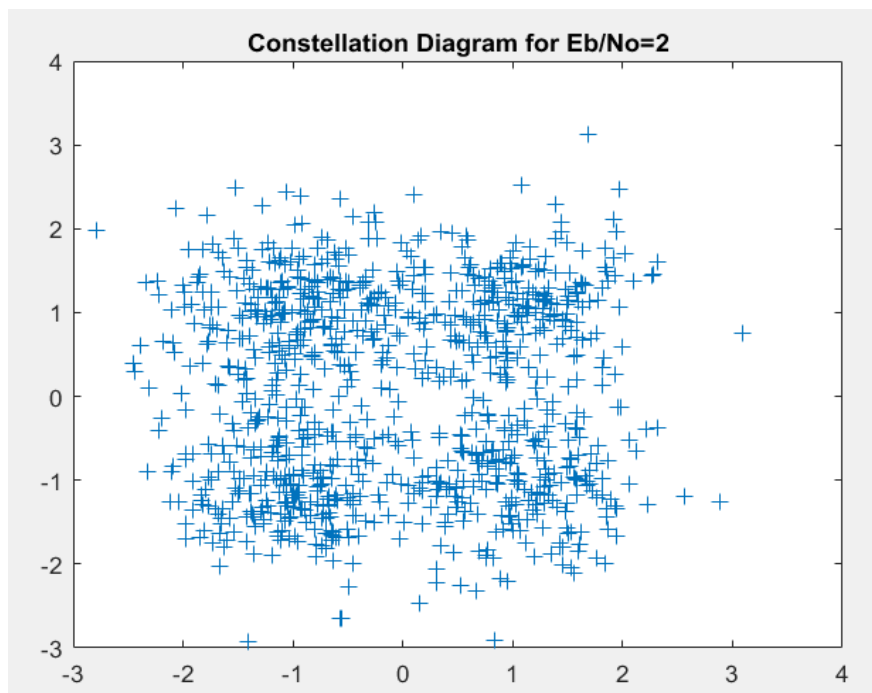
4-Because we have two components which are the in phase component and the quadrature component.

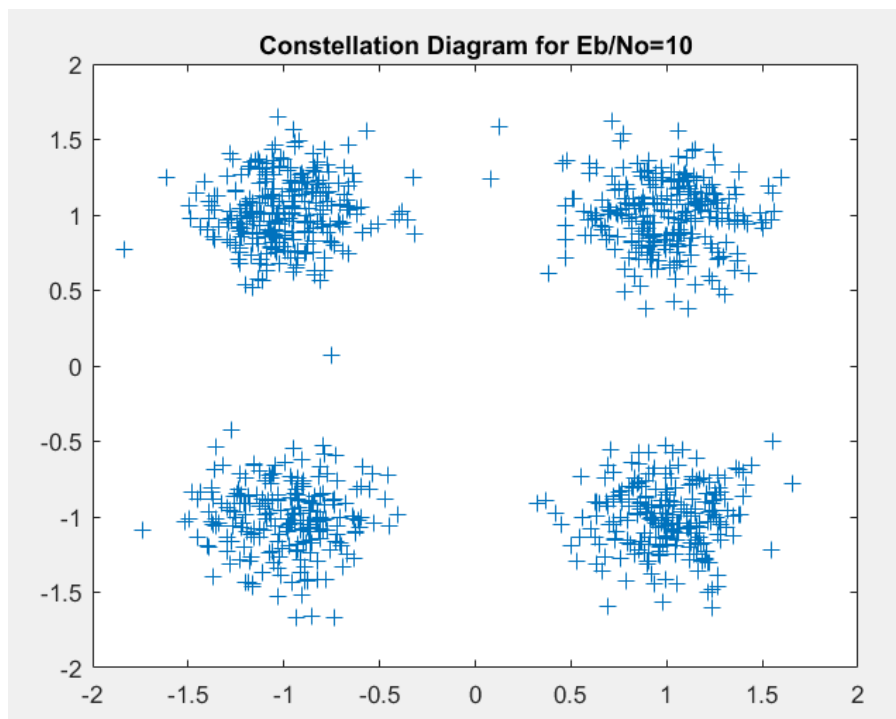
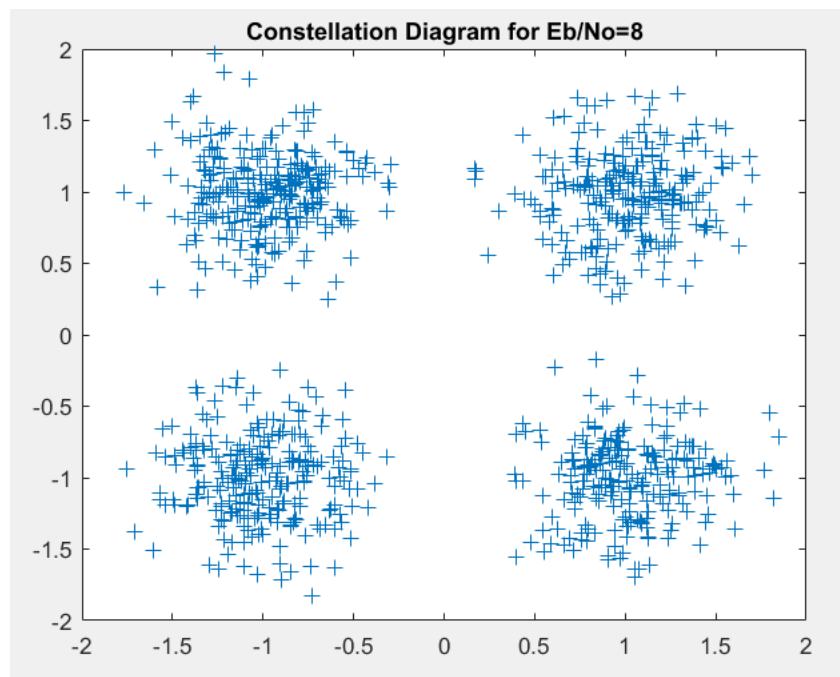
5-To adjust the indices to start from 1 as MATLAB's 1st index is 1 not 0.

6-We multiply by $\sqrt{\frac{N_0}{2}}$ because we are trying to acquire noise signal not power of noise

7-

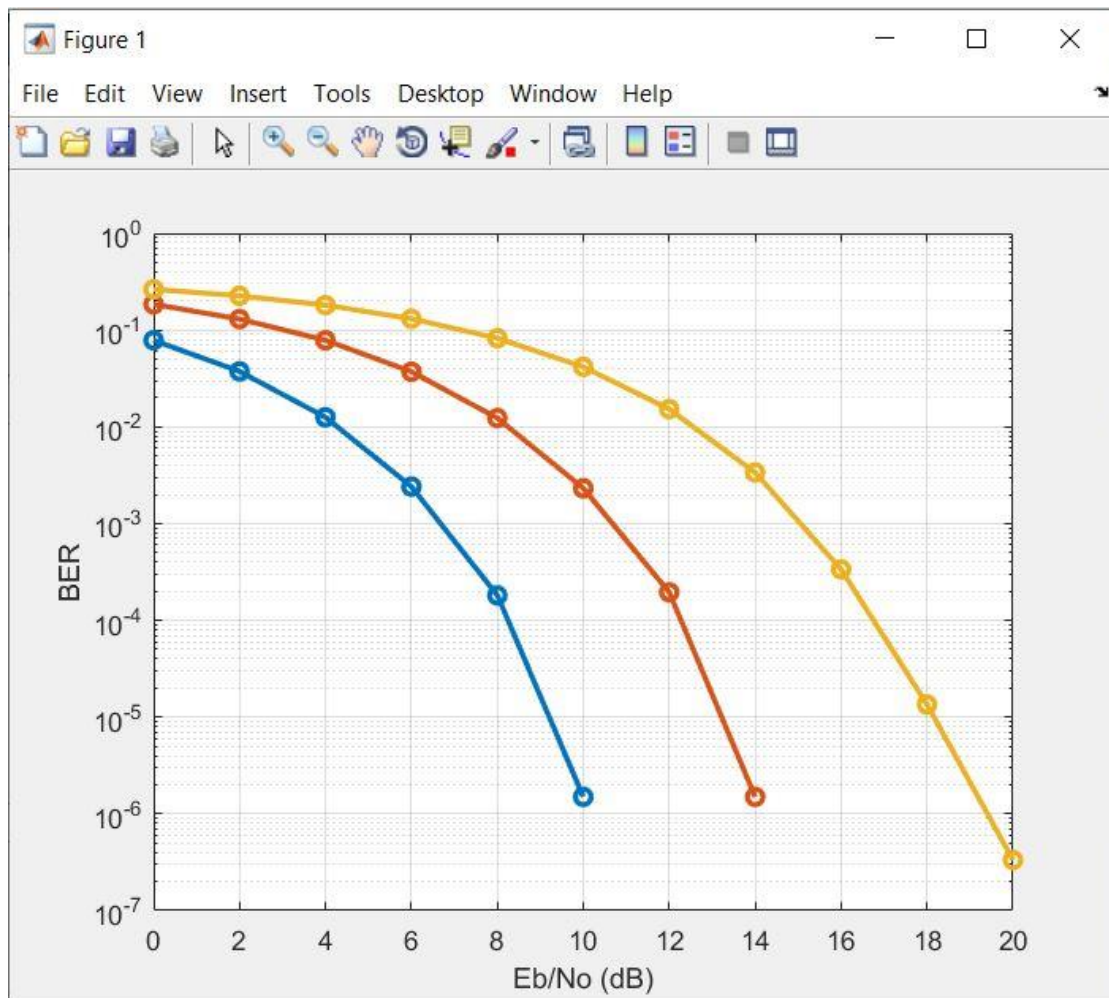






8-it breaks the loop and ends the plotting when Probability of error reaches 0 which means that the additional increase in E_b/N_0 won't affect the diagram

When sketching the QPSK, 16QAM, and 64QAM we get the following graph:



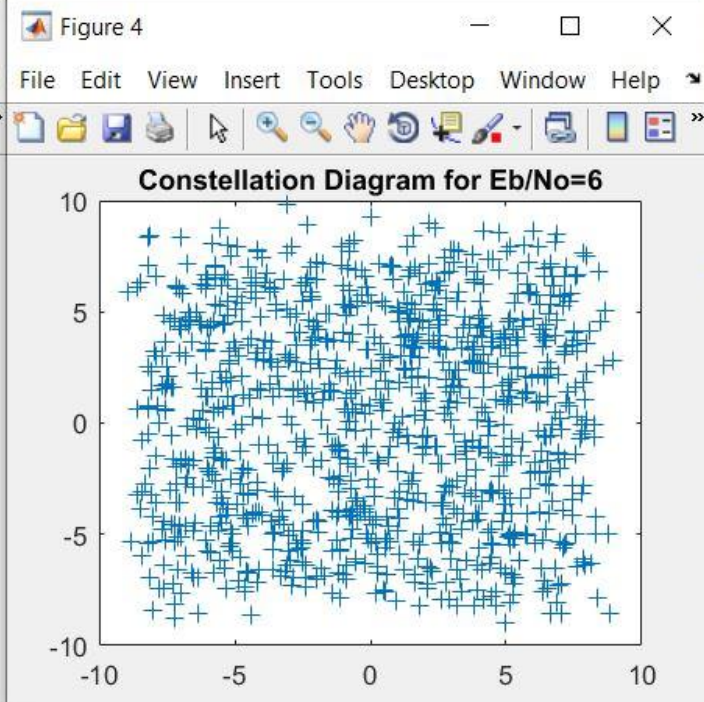
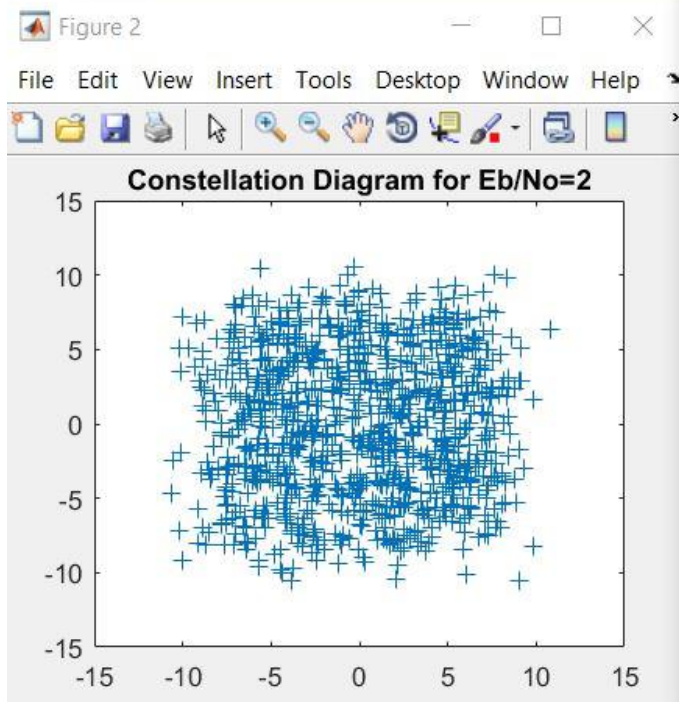
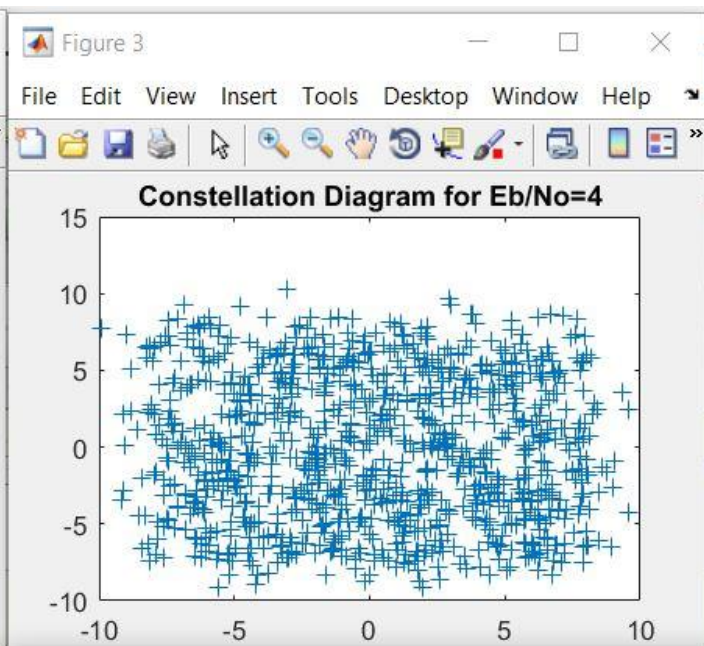
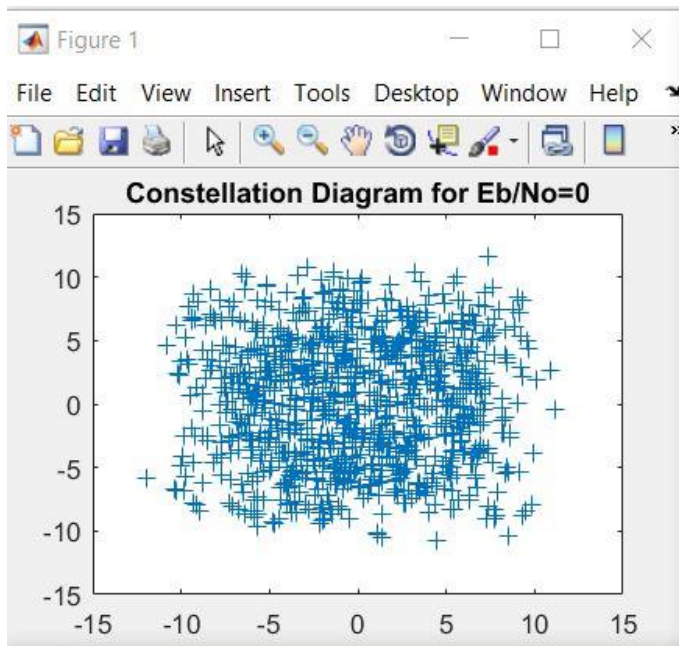


Figure 5

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Constellation Diagram for Eb/No=8

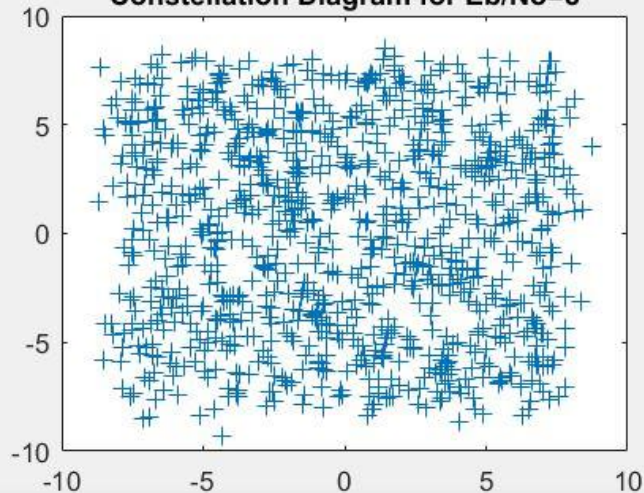


Figure 7

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Constellation Diagram for Eb/No=12

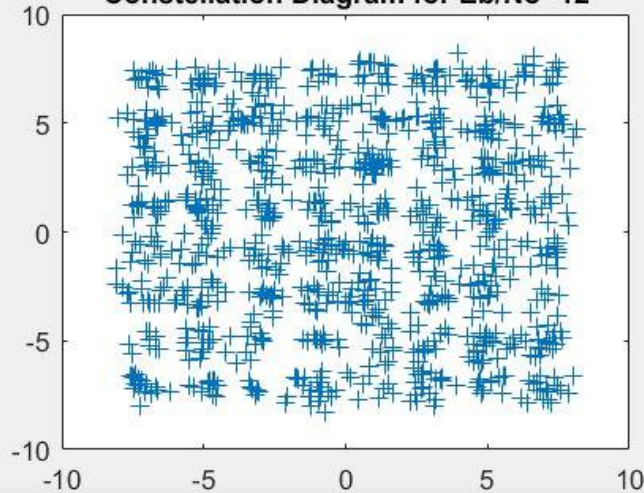


Figure 6

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Constellation Diagram for Eb/No=10

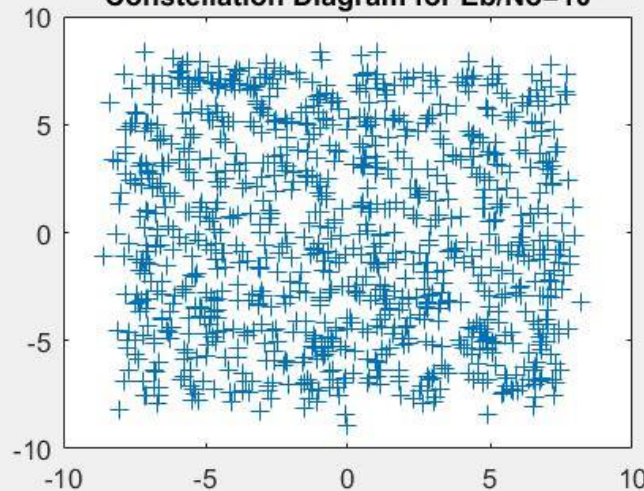
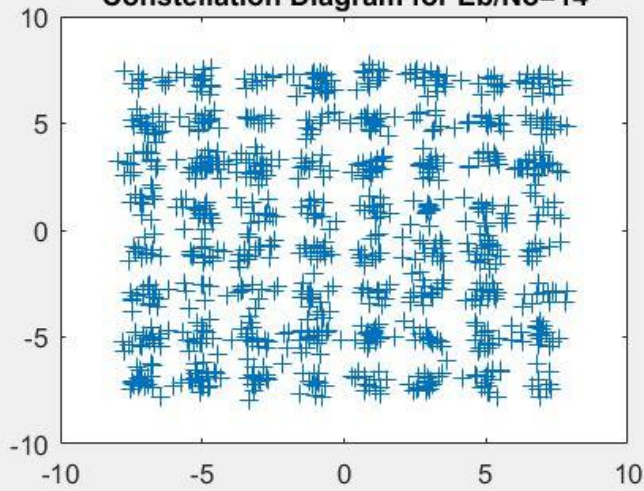


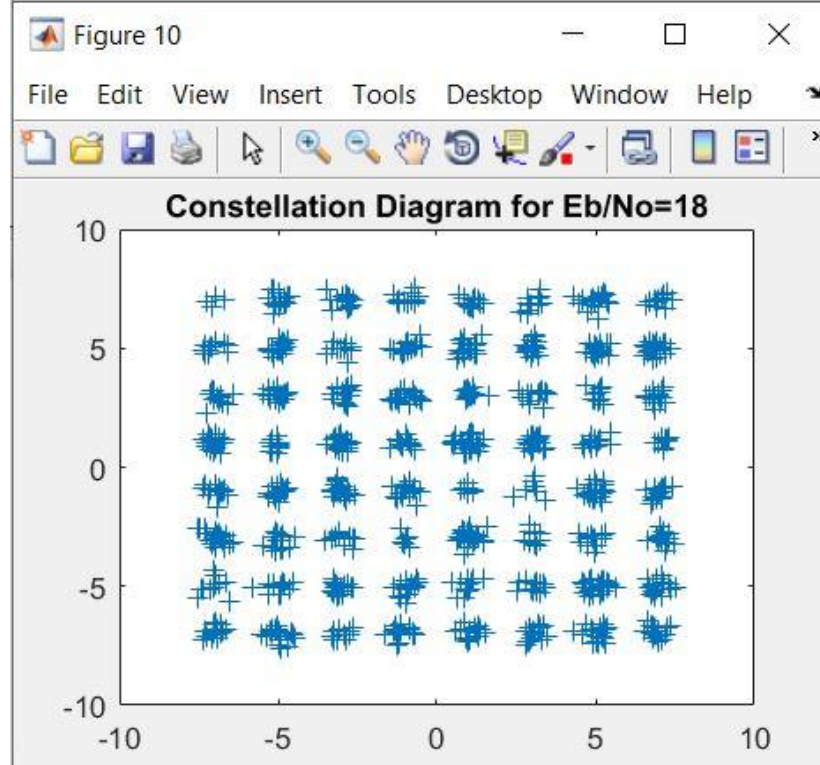
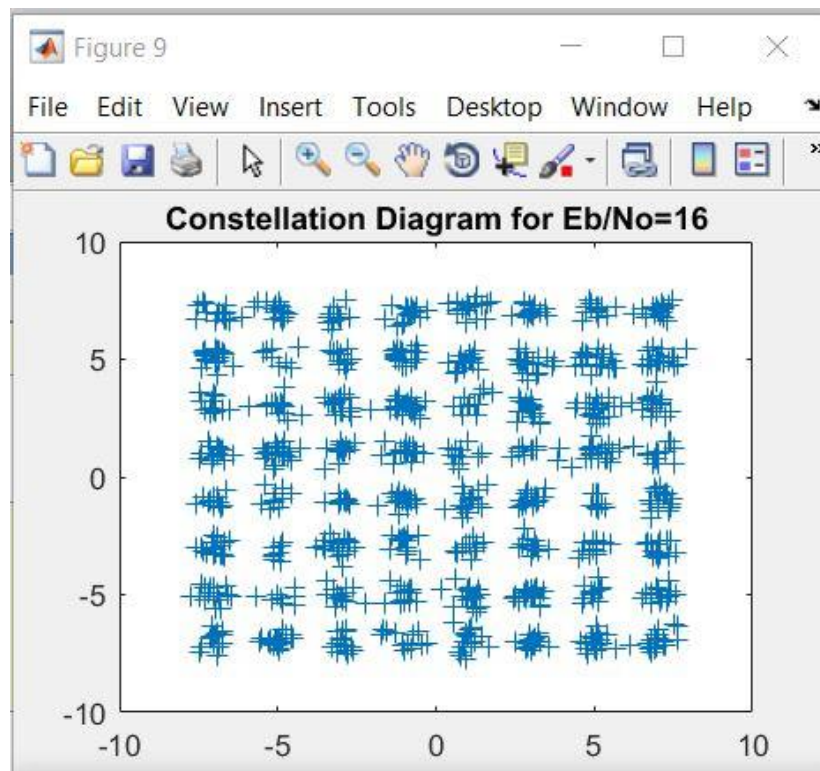
Figure 8

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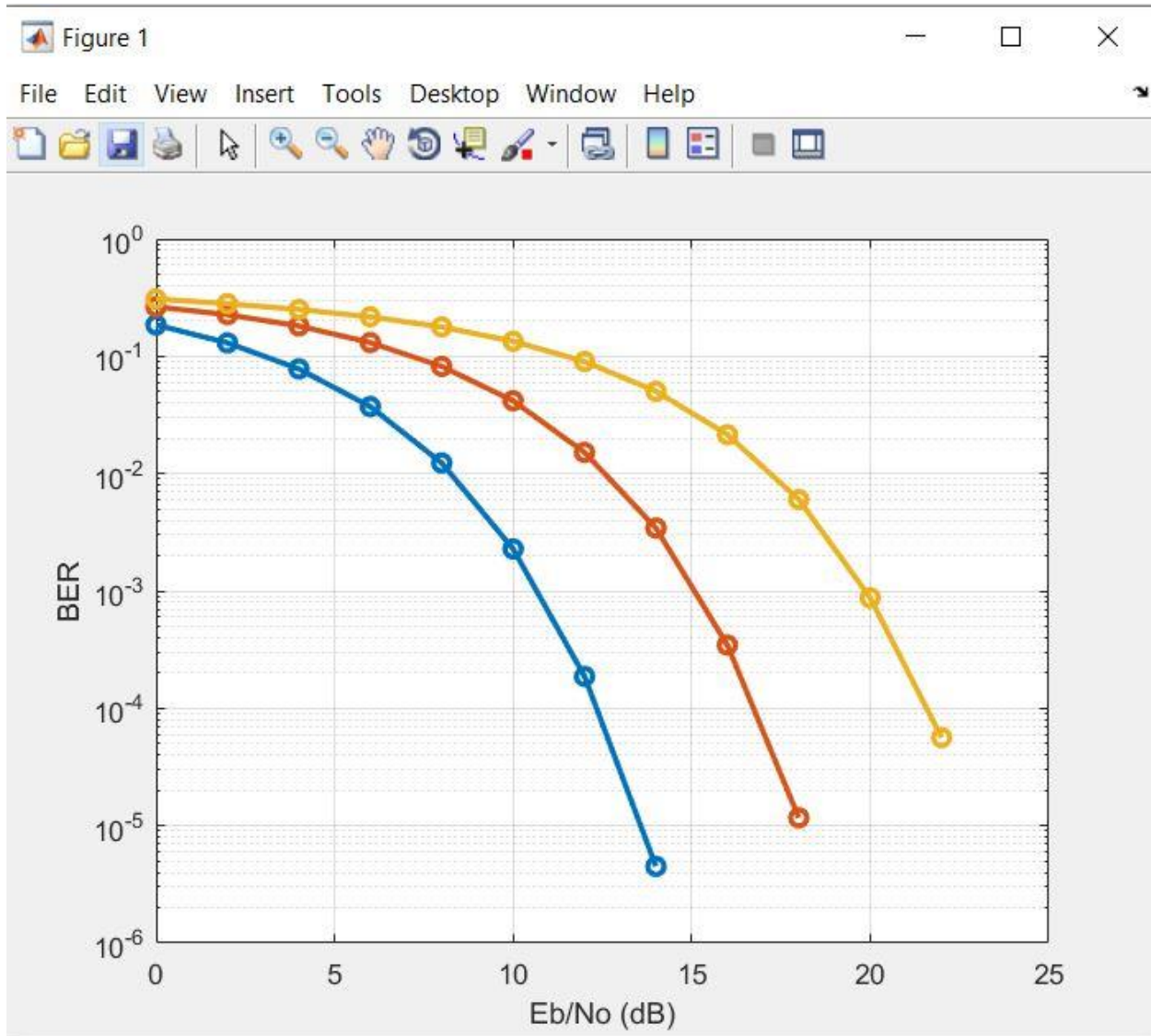
Constellation Diagram for Eb/No=14

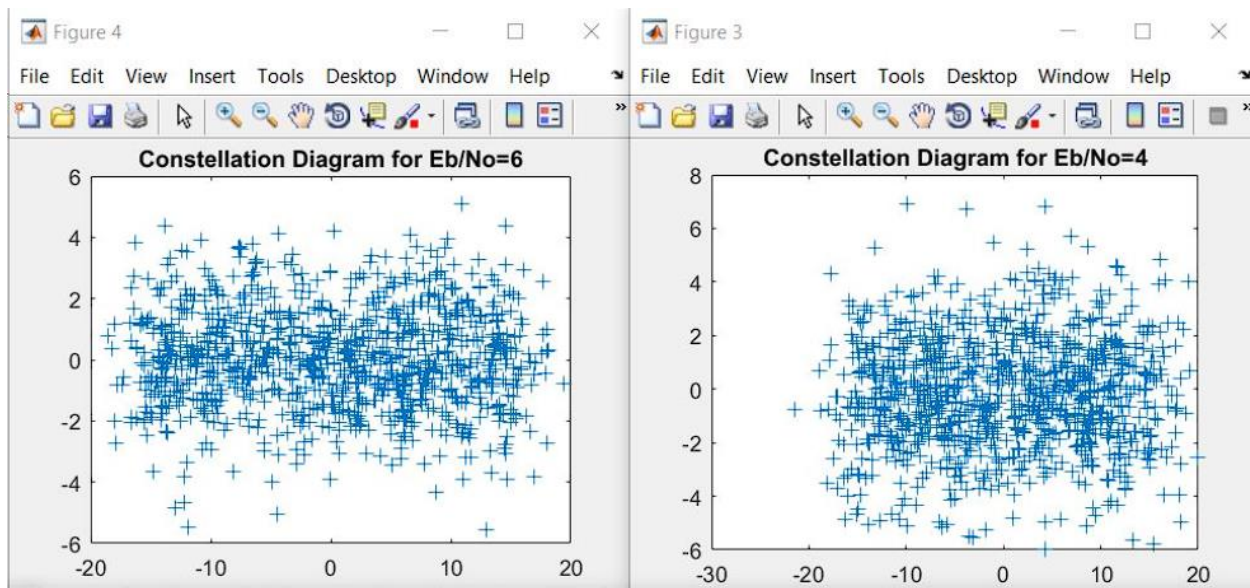
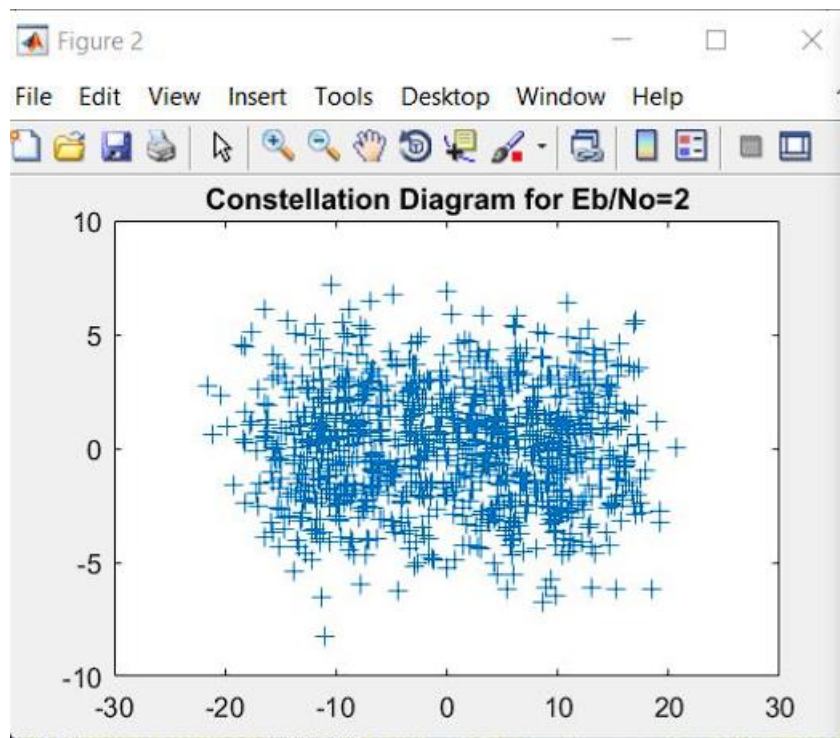
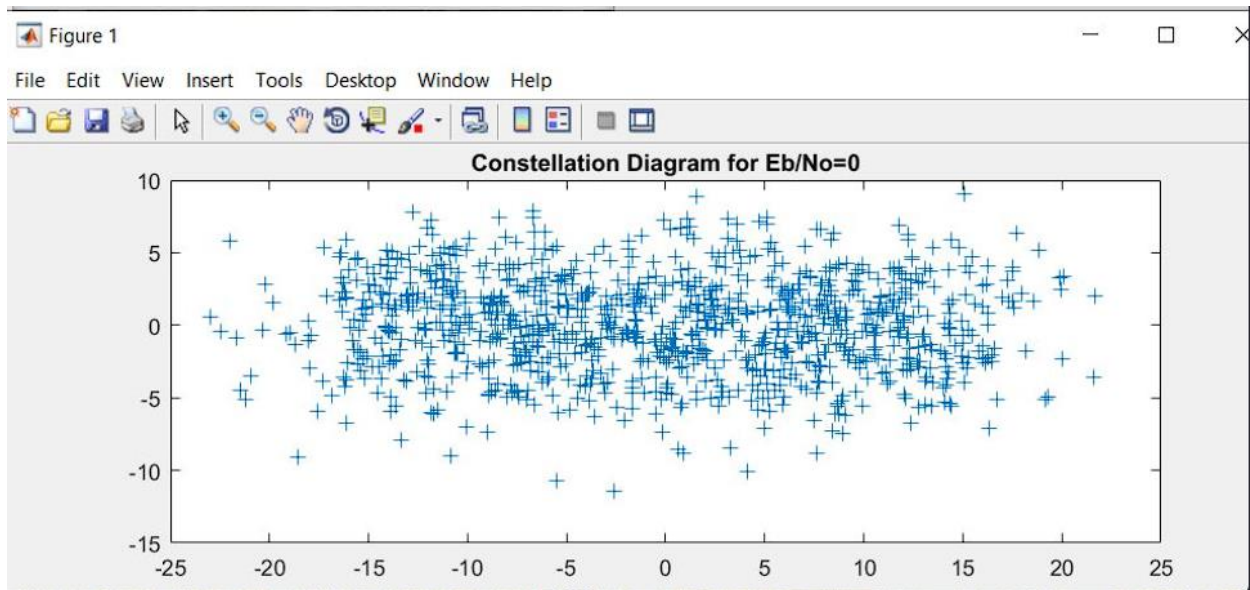


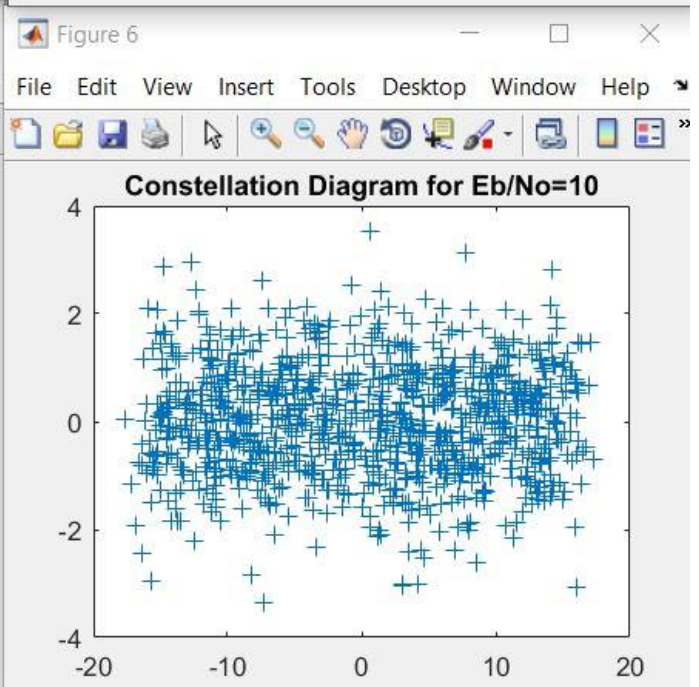
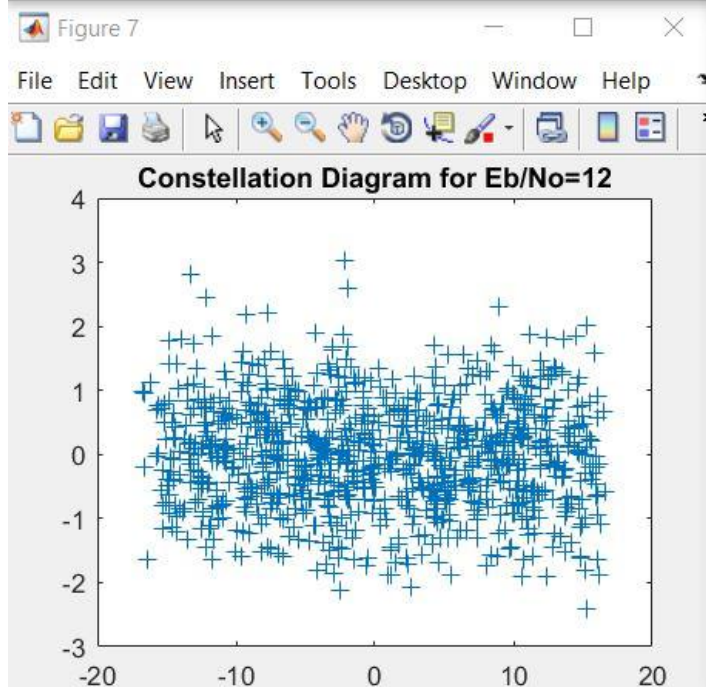
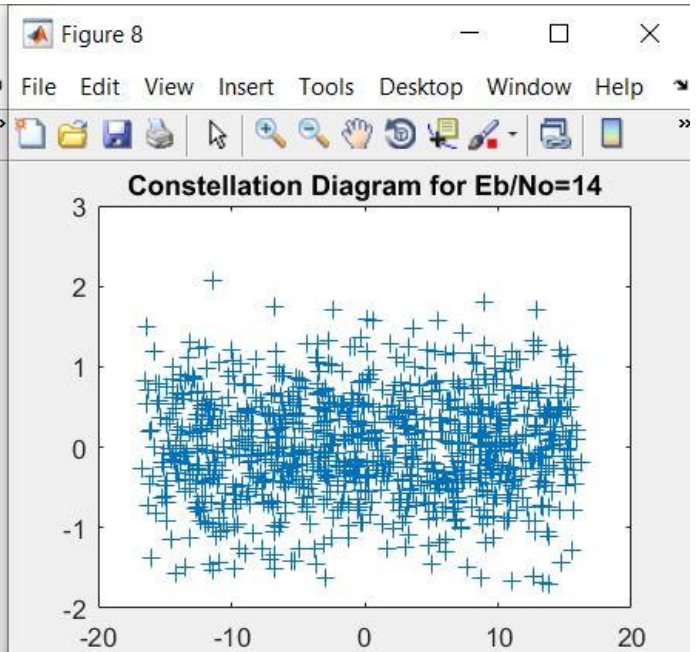
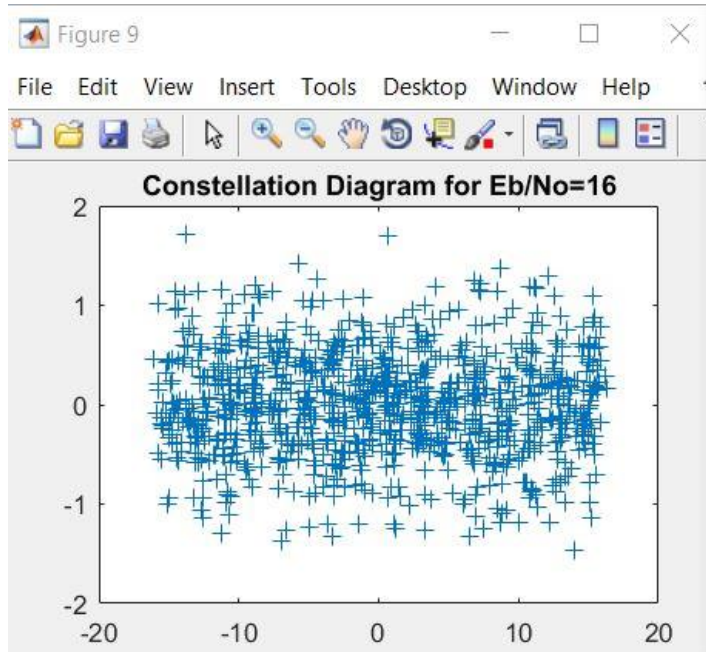
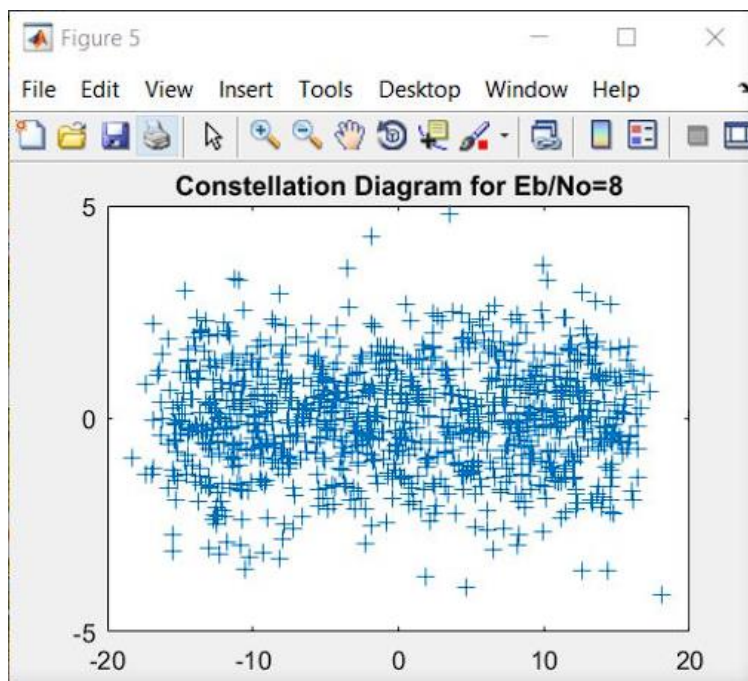


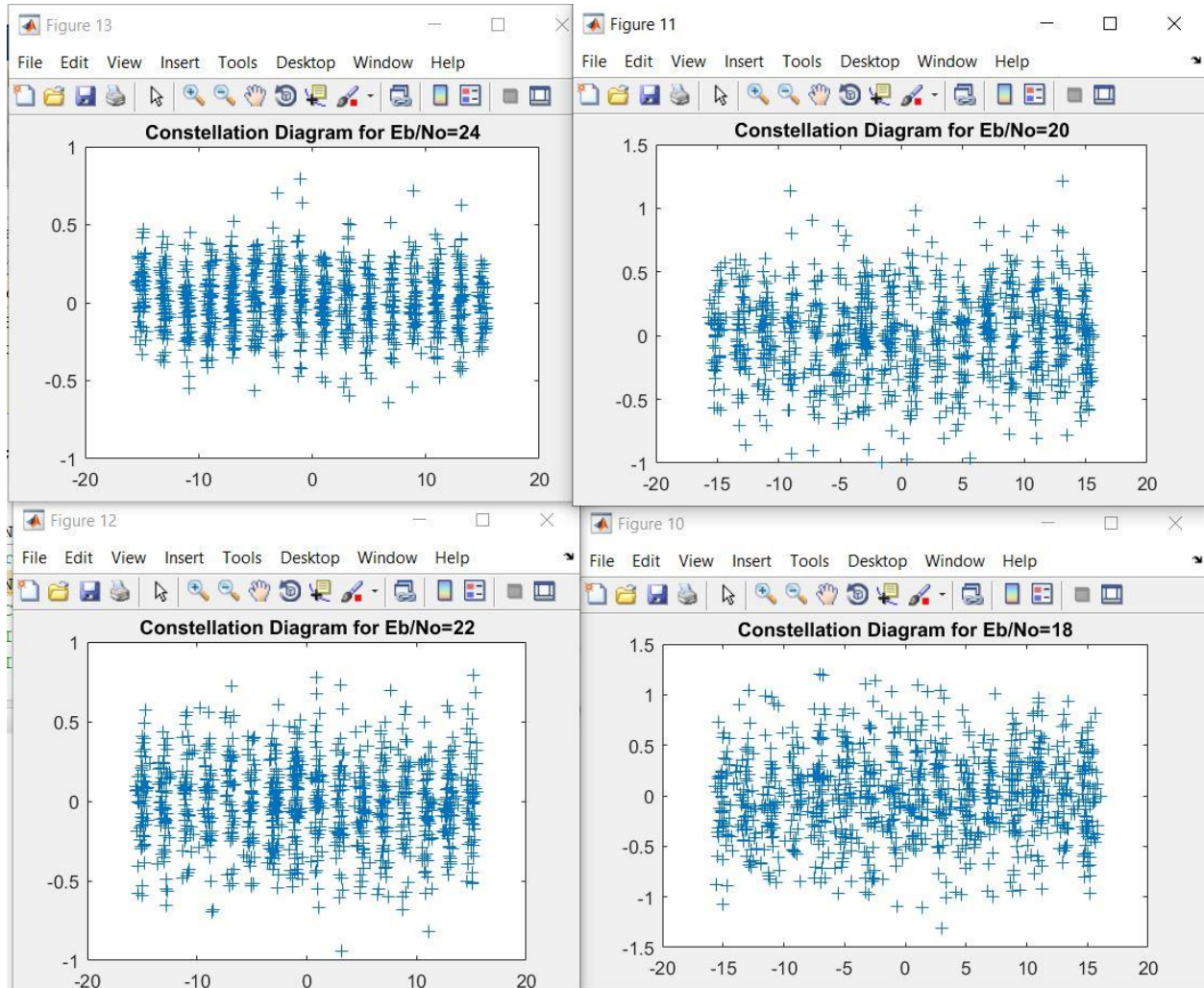
We notice that the probability of error in making decisions decreases as the E_b/N_0

When sketching the 4ASK, 8ASK, and 16ASK we get the following graph:



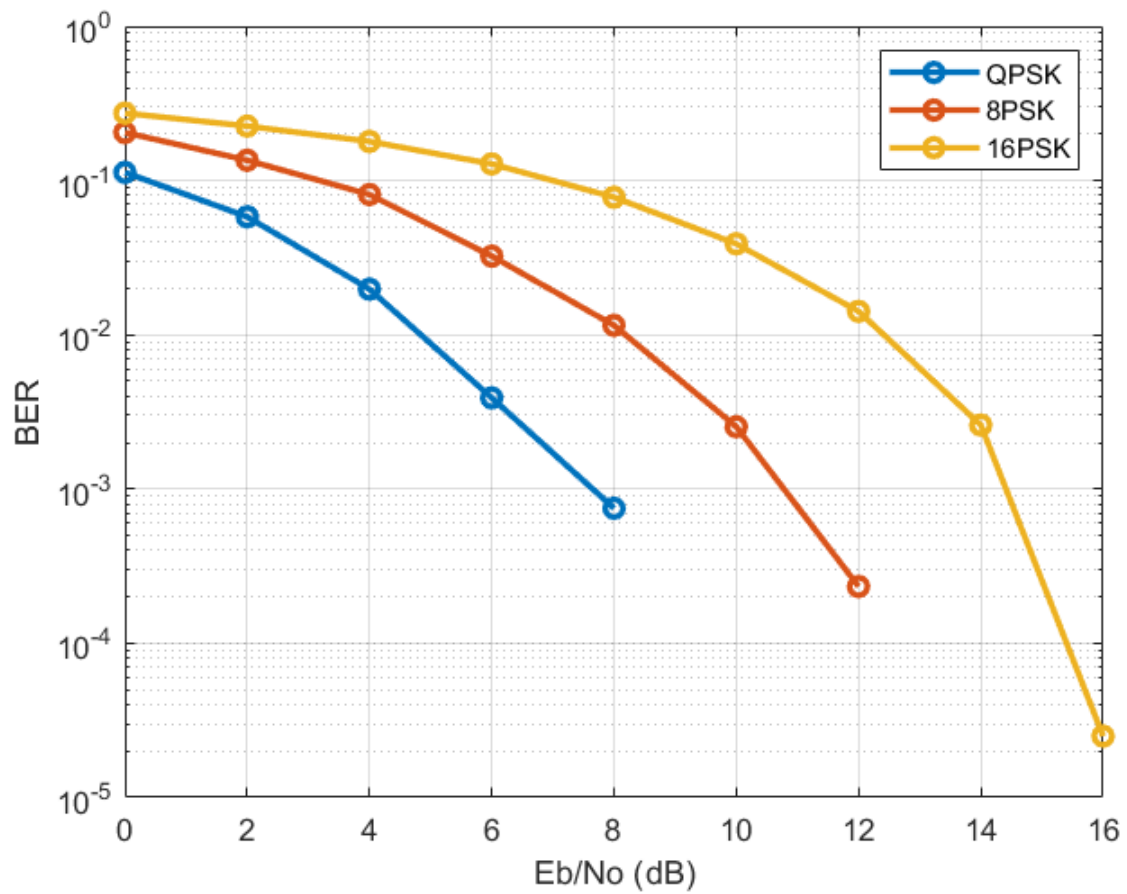


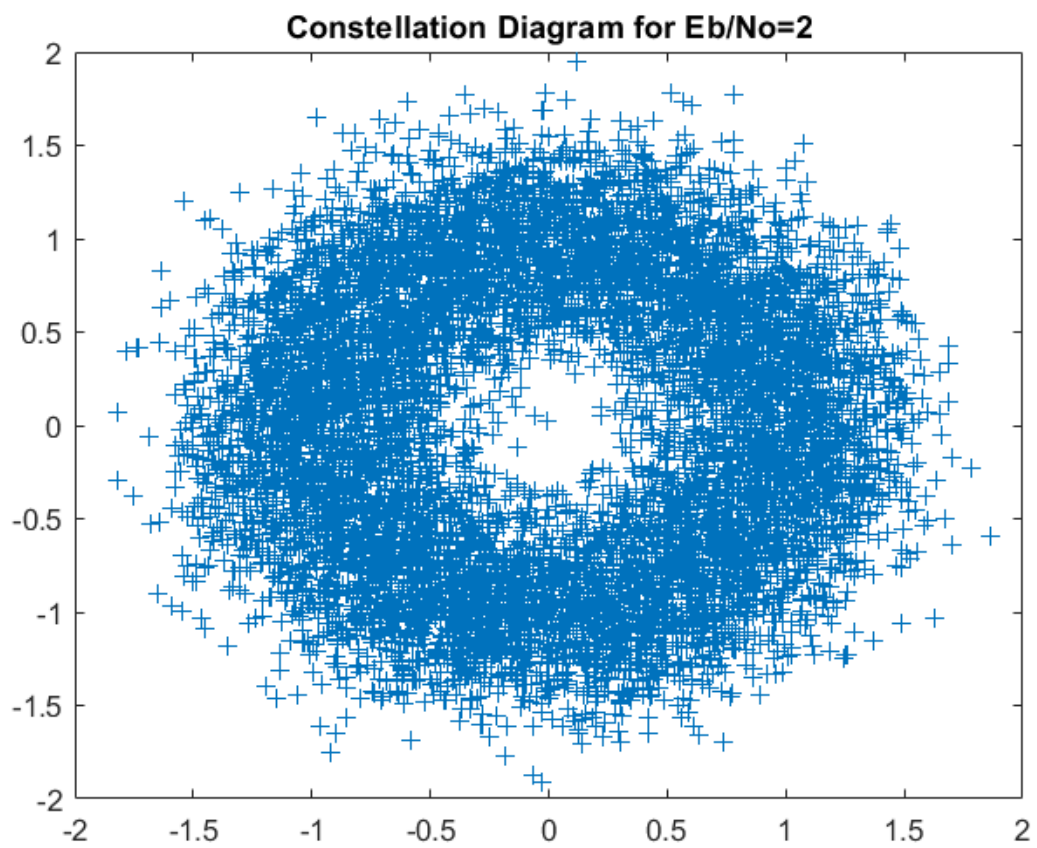
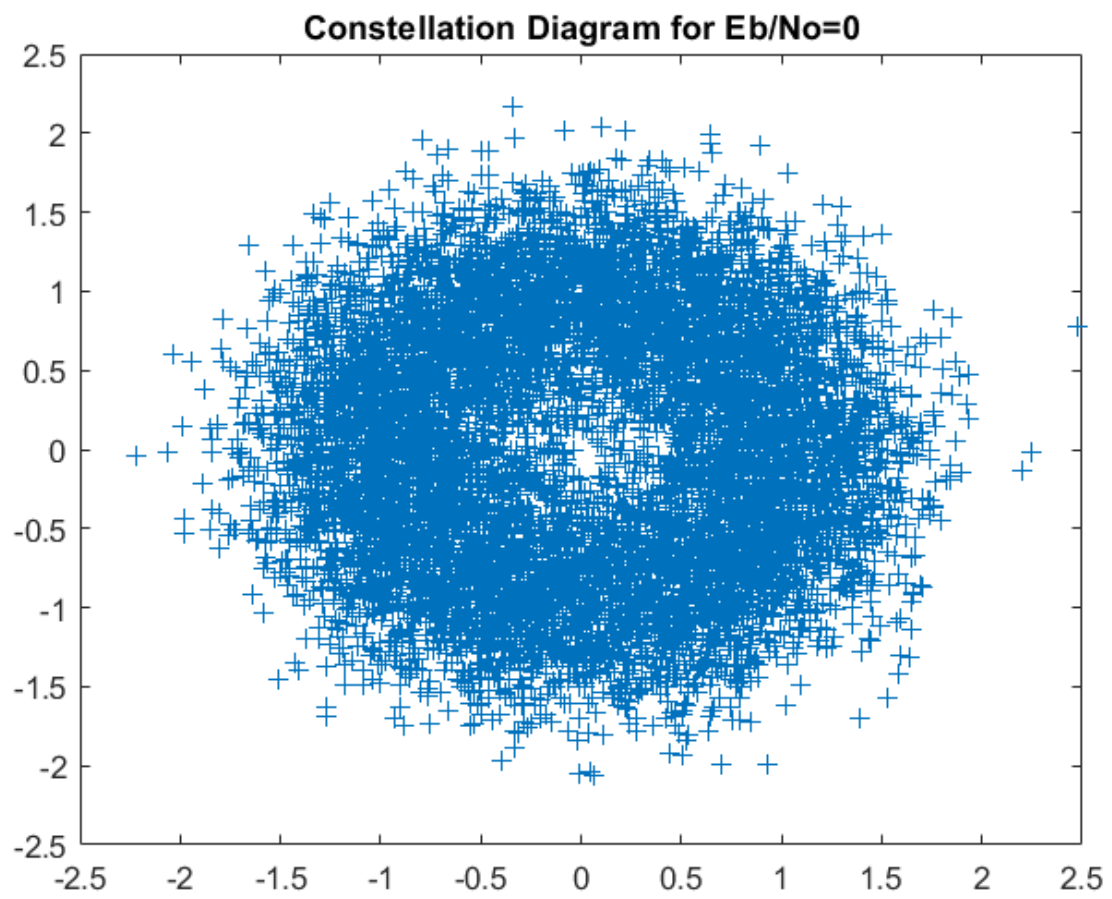


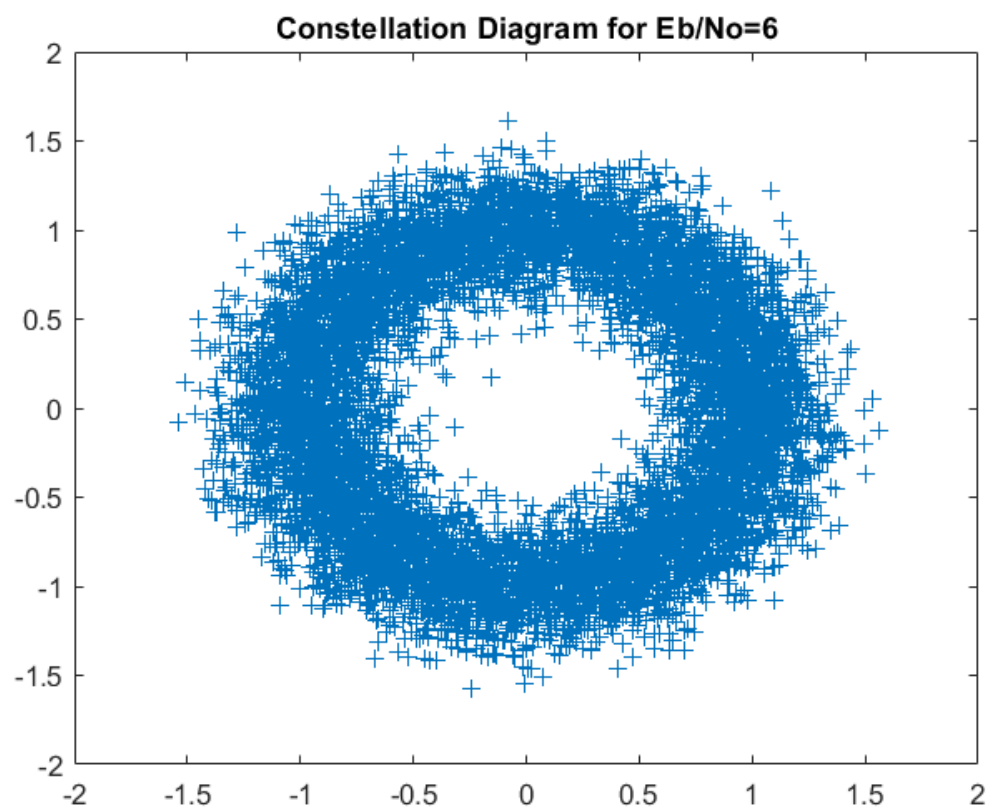
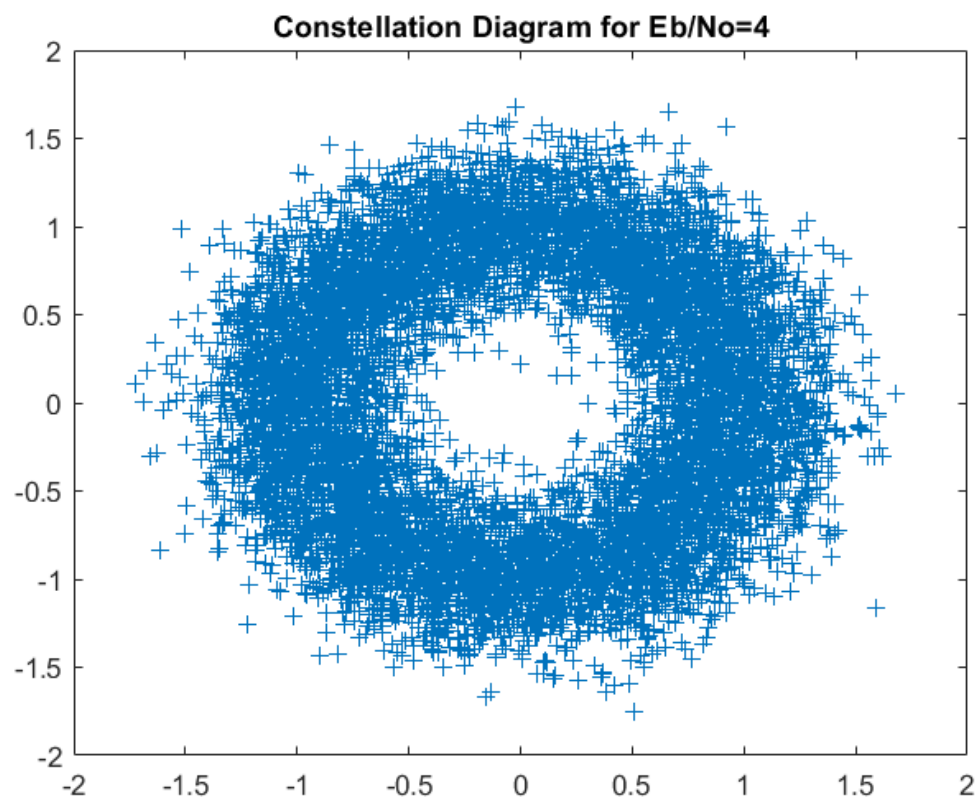


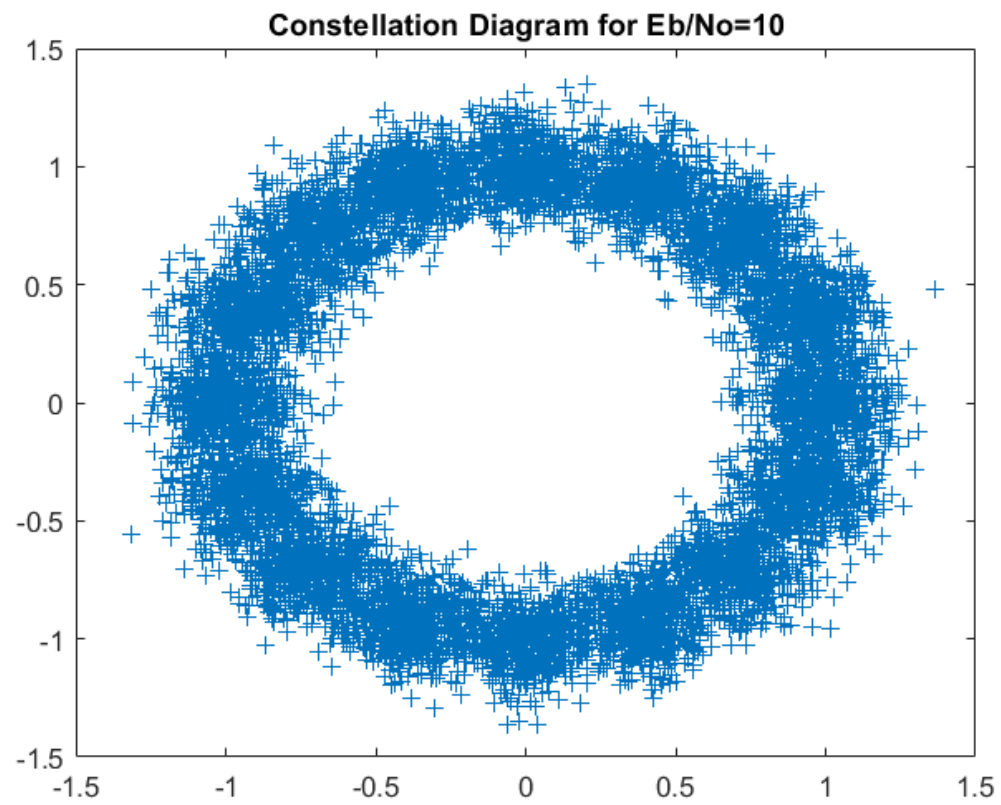
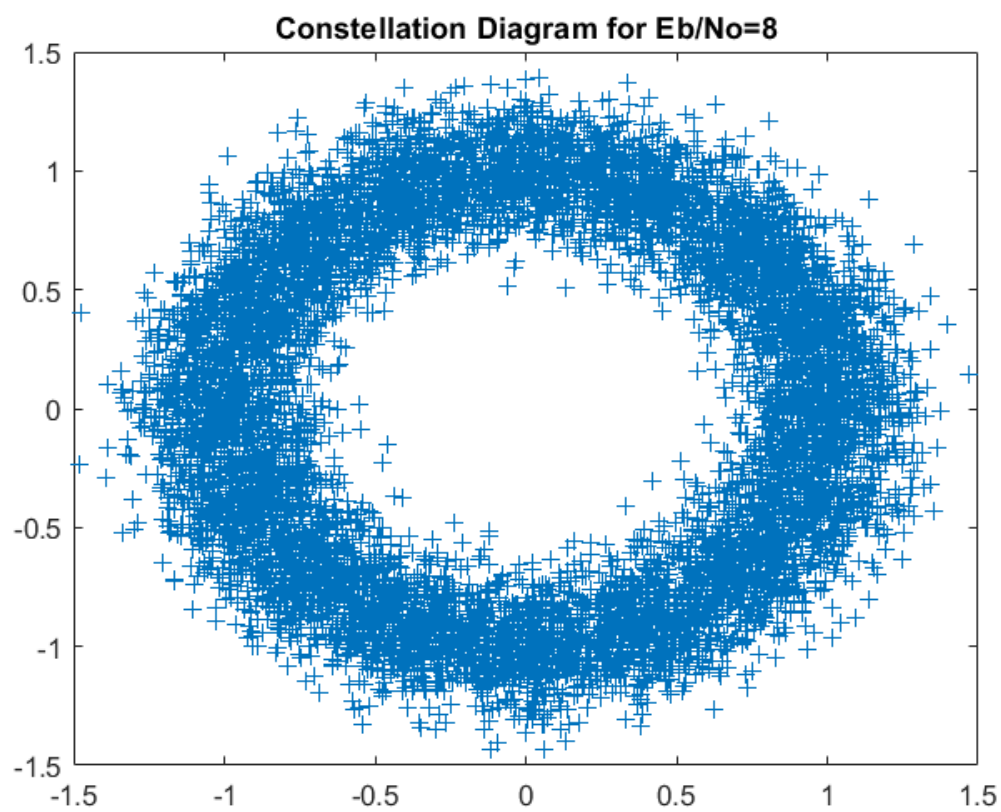
By increasing the E_b/N_0 the decision regions become clearer and the noise between them decreases

When sketching the QPSK, 8PSK, and 16PSK we get the following graph:

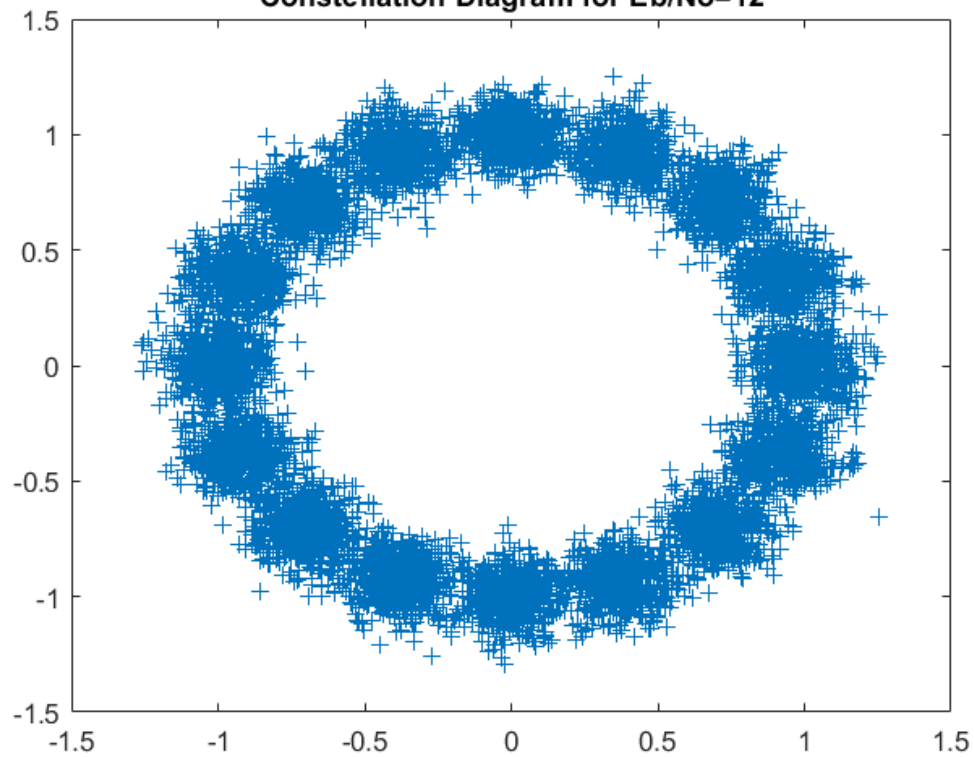




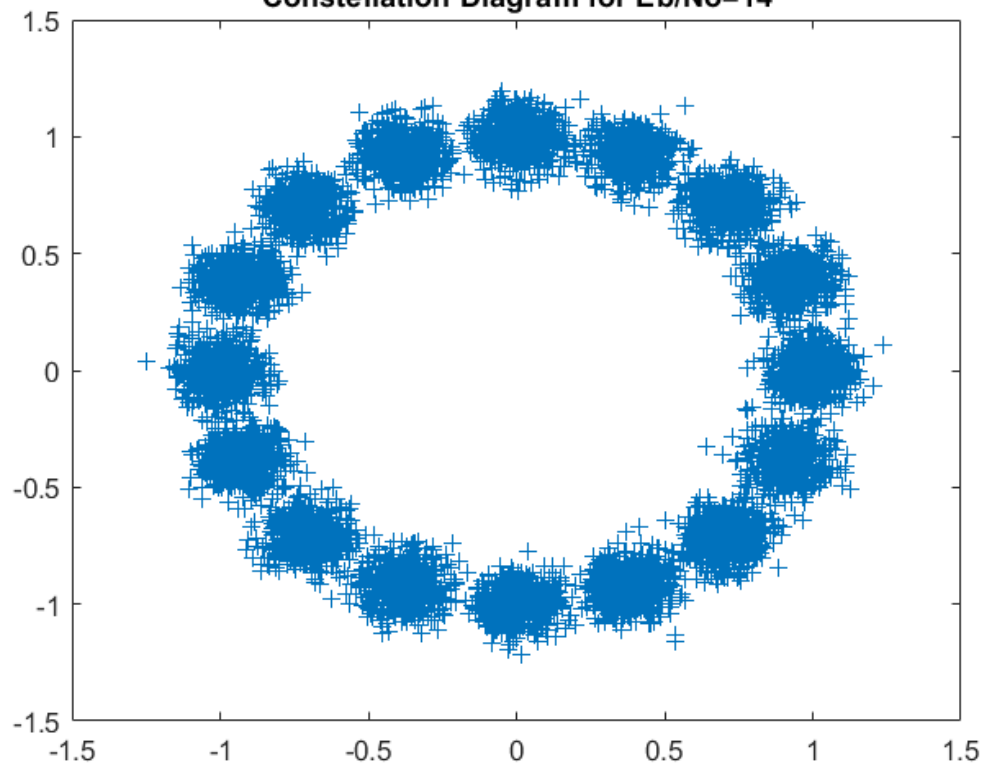


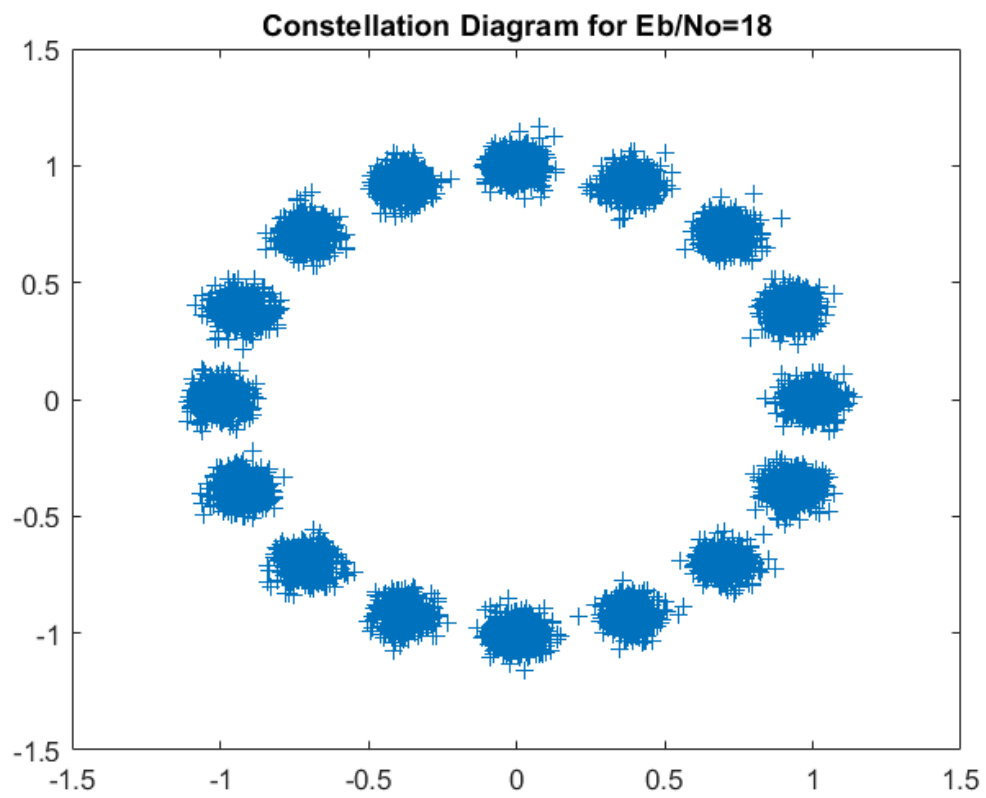
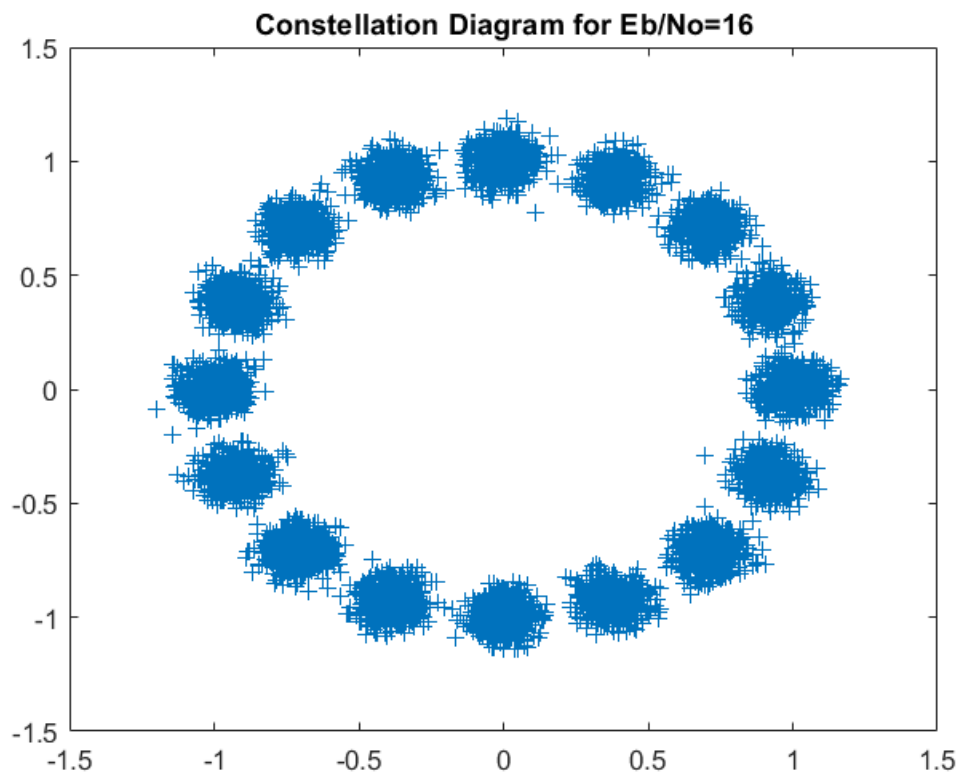


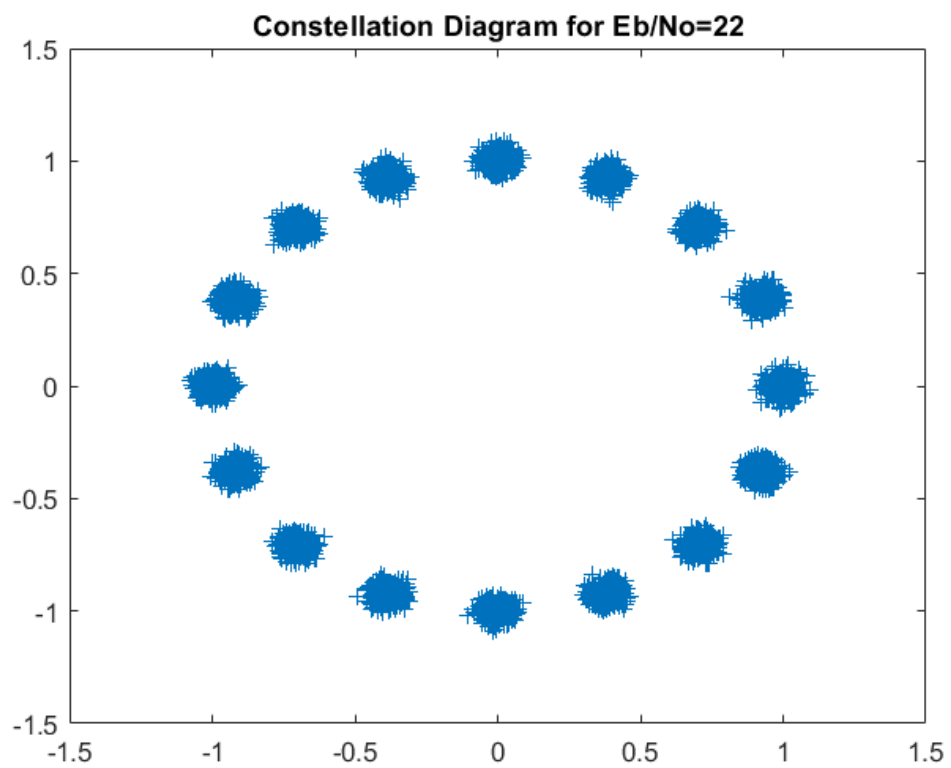
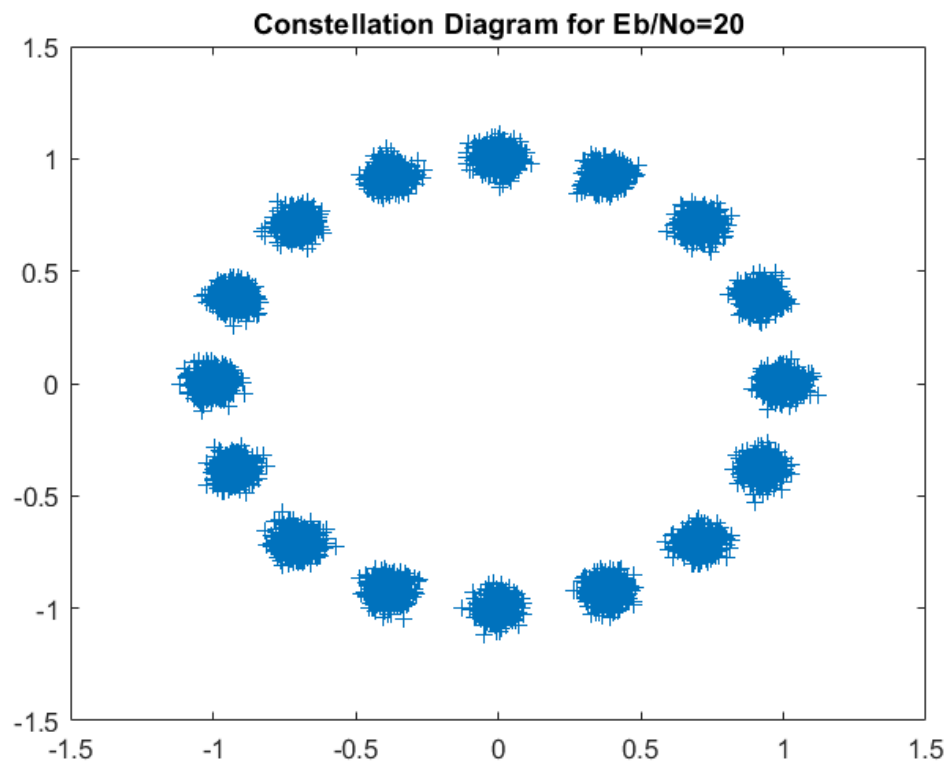
Constellation Diagram for $E_b/N_0=12$

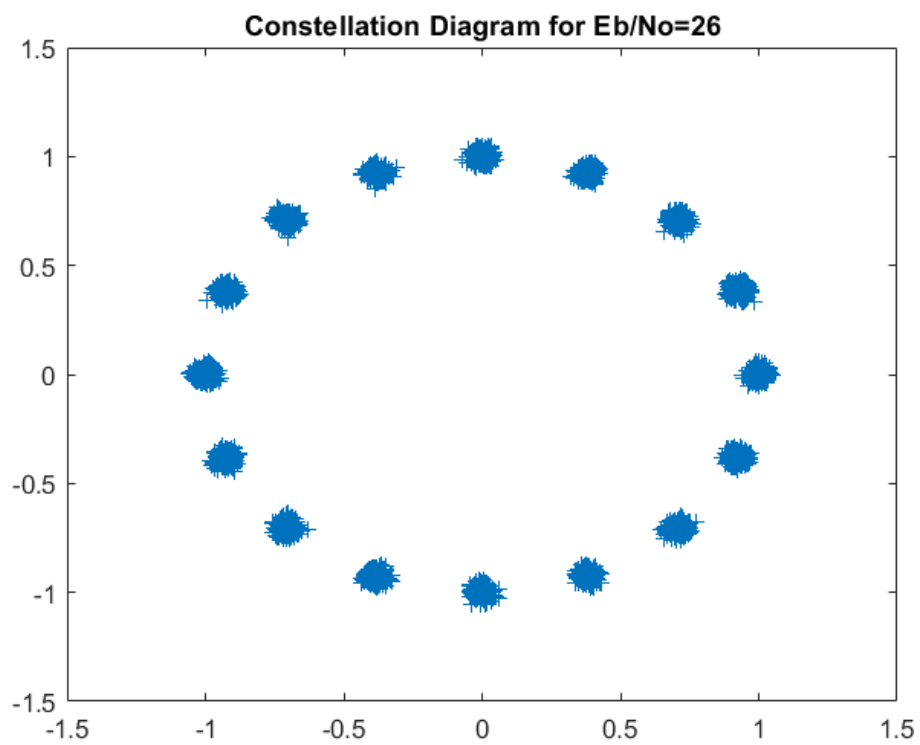
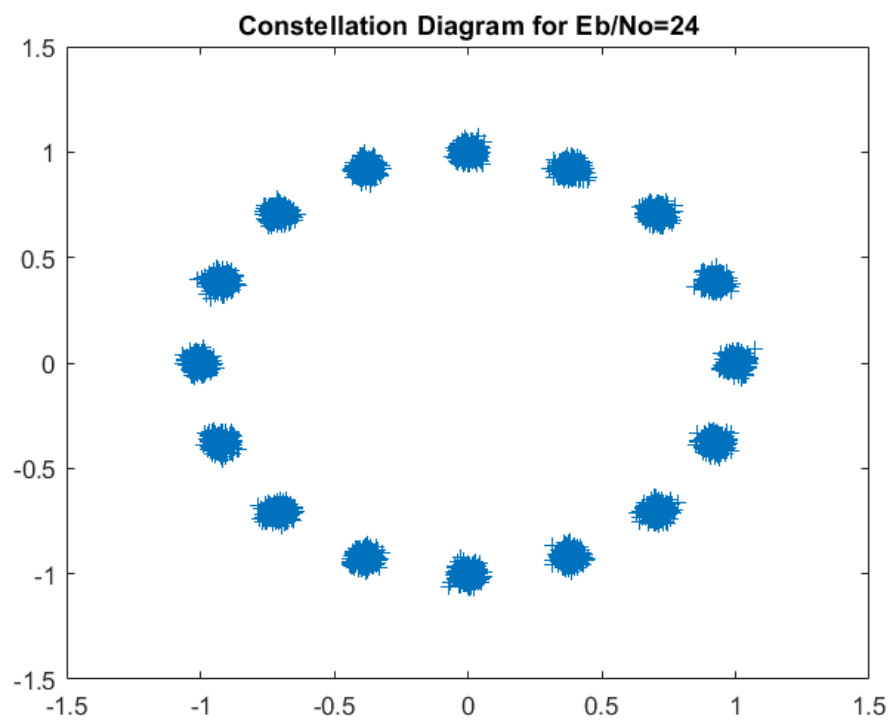


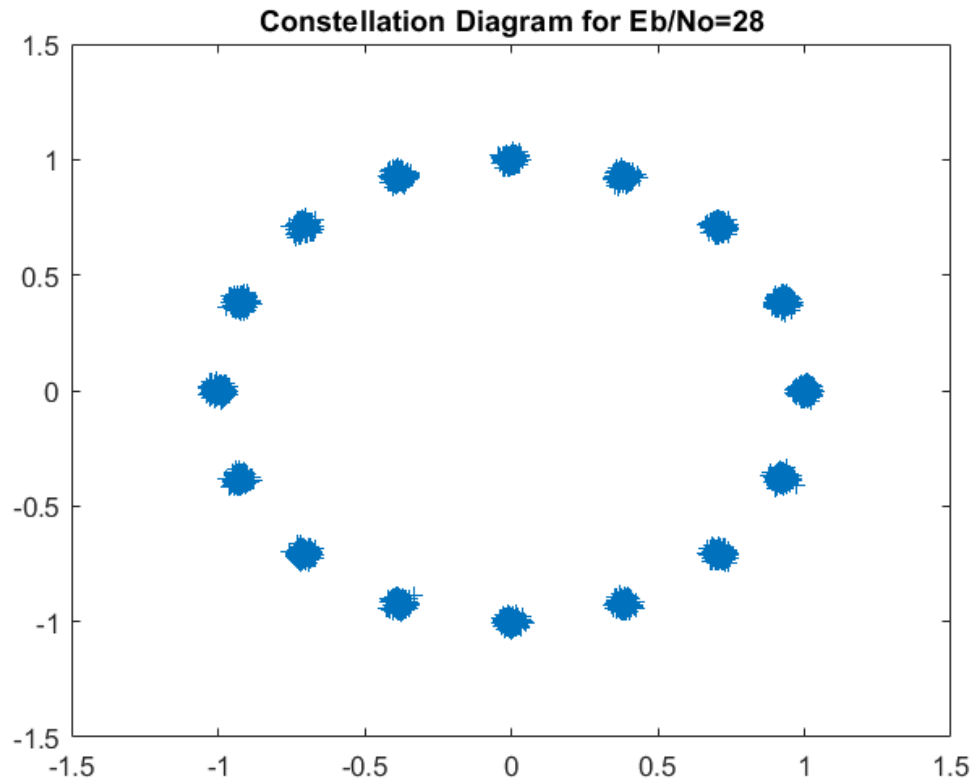
Constellation Diagram for $E_b/N_0=14$











By increasing the Eb/No the decision regions become clearer and the noise between them decreases

to simulate the passband modulation and not is baseband equivalent.

$$Re \times (\cos Wct + \emptyset c) - Im \times (\sin Wct + \emptyset c)$$