Two MATLAB assignments will be given. Students are allowed to work in pairs. Each of the assignments will give 5 extra points to your final score. Thus, you can earn 10 extra points from these two assignments.

Deadline for MATLAB Assignment-1: 11 March 2002
Deadline for MATLAB Assignment-2: 25 March 2002

Your report should include the following:

1. Brief explanation of your algorithm
2. The outputs and
3. Your codes.

You must submit your code via e-mail to the course assistant. Remember to make your m-files using your student number, so that I can recognise them easily.

MATLAB Assignment-1 Deadline 11 March 2002

Perform a Monte Carlo simulation of a 16-QAM-communication system using a rectangular signal constellation. The block diagram of the system to be simulated is shown in figure 1.1

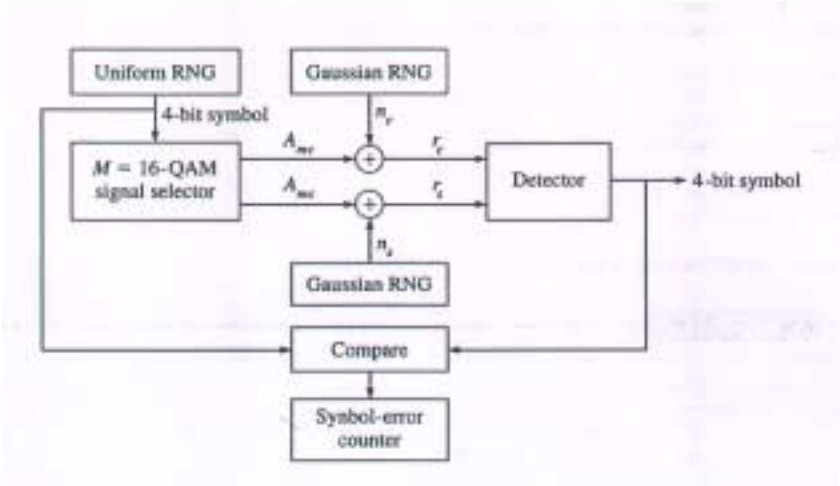

Figure 1.1 Simulation block diagram for 16-QAM

1. Perform the simulation for transmission of at least N=10,000 symbols at different values of SNR parameter, i.e. E_b/N_o.
2. Show the performance of the system by plotting E_b/N_o in dB Vs symbol error probability, P_e.
3. Also the plot the theoretical value of symbol-error probability in the same graph so that a comparison can be made.

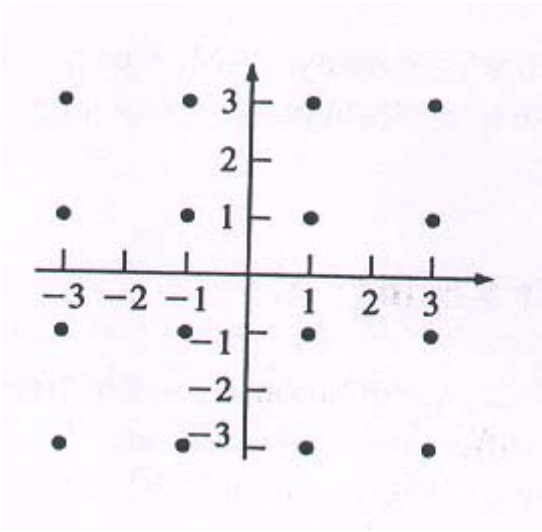

Figure 1.2 Constellation points for 16-QAM

Hints:

1. The uniform random number generator (RNG) is used to generate the sequence of information symbols corresponding to the 16-possible 4-bit combinations.
2. The information symbols are mapped into the corresponding signal points, as shown in figure 1.2, which have the co-ordinates $[A_{mc},A_{ms}]$.
3. Two gaussian RNG are used to generate the noise components $[n_c,n_s]$.
4. The channel phase shift ϕ is set to 0 for convenience. Consequently, the received signal plus noise vector is $r=[A_{mc}+n_c\ A_{ms}+n_s]$.
5. The detector computes the distance metrics given by

$$D(r,s_m)=|r-s_m|^2, \qquad m=1,2,.....,M$$

6. The decoder chooses the closest distance to be the correct decision.