5. When the channel is AWGN, but not fading, the relation between the two coding schemes are as following:

From the plot, it can be easily seen that when \( \gamma \leq 4.341 \text{ or } 6.376 \text{ dB} \), the performance of (15,11) Hamming coding is worse than (7,4) Hamming coding. The result is reasonable since (15,11) coding has less redundancy than (7,4) coding, thus (15,11) coding has less ability to compensate the noise.

While if the SNR is pretty high or when \( \gamma > 4.341 \text{ or } 6.376 \text{ dB} \), then we don’t need to use too much redundancy to compensate the noise, so the performance of (15,11) coding will become better than (7,4) coding since it’s more efficient.

But when the channel is fading, or quite commonly Rayleigh fading, the performance comparison of the two coding scheme is on the next page.
It can be clearly seen that the (15,11) coding is always worse than the (7,4) coding, that is because the Rayleigh fading channel will cause deep fade now and then, and during such periods, the instant SNR is literally much lower than the threshold got from former page, thus the performance of (15,11) coding is dragged down dramatically.
6.
In this problem we need to compare five situations:
1. nonfading AWGN channel with no coding or diversity in use.
2. rayleigh fading channel with no coding or diversity in use.
3. rayleigh fading channel with SC diversity scheme but no coding in use.
4. rayleigh fading channel with MRC diversity scheme but no coding in use.
5. rayleigh fading channel with EGC diversity scheme but no coding in use.

The transmitted signal is assumed to be BPSK. For simplicity, I assume the signal to be +1 or −1, thus the signal power is 1, and the SNR is the inverse of the noise power.

When the Monte Carlo trial number exceeds 100000, the simulation results are quite close to the theoretical result. All five plots are shown from next page.

The last plot is a summary of the simulations for all five situations.
1. nonfading AWGN channel with no coding or diversity in use.
2. rayleigh fading channel with no coding or diversity in use
3. rayleigh fading channel with SC diversity scheme but no coding in use.
4. Rayleigh fading channel with MRC diversity scheme but no coding in use.
5. Rayleigh fading channel with EGC diversity scheme but no coding in use.
Summary

Comparison of BER by Monte Carlo Simulation

- AWGN nonfading channel
- Rayleigh fading channel
- Selective Combining
- Maximum Ratio Combining
- Equal Gain Combining

BER vs. SNR in dB