Write a turbo encoding/decoding program using systematic recursive convolutional codes as constituent codes. It is sufficient to have a rate 1/3 encoder (no puncturing) and a rate 1/2 encoder (with a puncturing pattern described as in (16.9), page 774 of the textbook. The generator polynomials should be general.)

1. Verify the correctness of your program using Example 16.14 of the textbook (page 827). This is for a rate 1/3 code without puncturing.

2. Simulate the performance of the rate 1/2, (7, 5) turbo code with $G_{fb} = [111]$ and $G_{ff} = [101]$. Assume that the input sequence has a length of 5000 bits. Compare it with the performance of the (37, 21) non-systematic non-recursive convolutional code of the same length. You are supposed to generate a figure similar to that of Fig. 16.3 on page 771 of the textbook. The simulation setup is similar to that of hw4.