

Assignment of Chapter 5

1. Given an 8-state $(15, 13)_8$ convolutional code,
 - (a) Please show its shift register encoder structure, state table and trellis.
 - (b) Please determine the codeword of a message vector $\mathbf{u} = (1, 0, 1, 1, 1, 0, 1)$.
2. Given a 4-state $(7, 5)_8$ convolutional code and a received word

$$\mathbf{r} = (1, 1, 0, 1, 1, 1, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 1, 0),$$

please use the Viterbi trellis shown in Fig. 1 to decode the received word. (The decoding computation can be performed using Fig. 1)

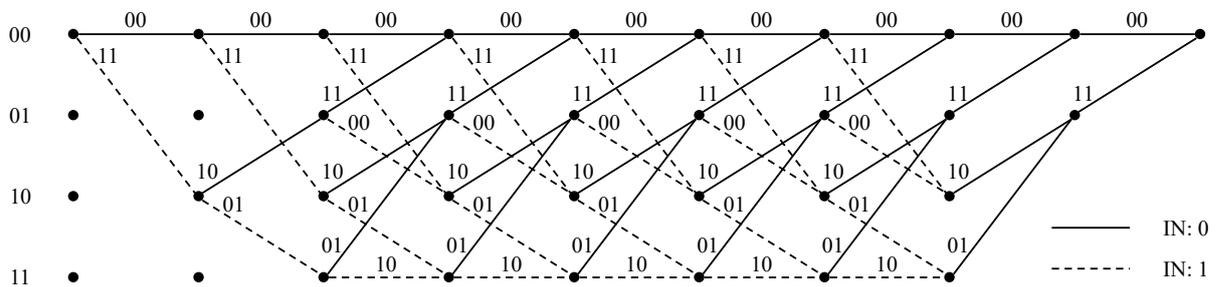


Fig. 1: Viterbi trellis of the $(7, 5)_8$ convolutional code

3. Given a $2/3$ TCM code whose encoder structure and mapping scheme are shown in Fig. 2,
 - (a) Please determine the trellis of the TCM code.
 - (b) Please determine the free distance of the TCM code.
 - (c) Please determine the codeword of a message vector $\mathbf{u} = (0, 1, 1, 0, 1, 1, 0, 1)$, where each pair of bits is in the order (a_2, a_1) , and tailing bits are in the form $(a_2, a_1) = (0, 0)$. The codeword should follow the order (c_3, c_2, c_1) , and so on.
 - (d) Please determine the asymptotic coding gain (in dB) that the TCM coded system is able to achieve over an uncoded QPSK system.

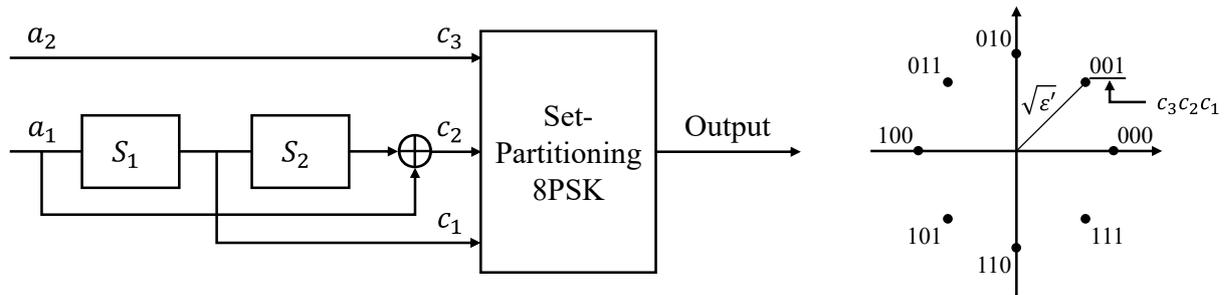


Fig. 2: Rate 2/3 TCM encoder and the 8-PSK mapping scheme