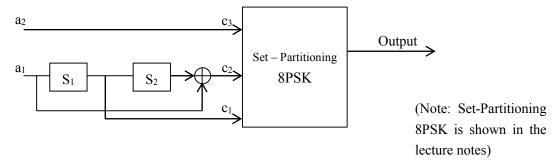1. Given the 8-state $(15, 13)_8$ conv. code.

   1) Please determine its encoder structure and trellis.

   2) Please determine the codeword that corresponds to an input message sequence of $\bar{m} = [\,1 \quad 0 \quad 0 \quad 1 \quad 0 \quad 1 \quad 0 \quad 0 \quad 0\,]$.

   3) Use the Viterbi trellis to determine the free distance of the code.

2. Given a rate 2/3 TCM encoder structure as

(Note: Set-Partitioning 8PSK is shown in the lecture notes)

   1) Please determine the trellis of the TCM code.

   2) Please determine the free distance of the TCM code.

   3) Please determine the asymptotic coding gain (in dB) that the TCM coded system can achieve over the uncoded QPSK system.