

Problem Set # 6

Convolutional Codes

10.15 A convolutional encoder has a single-shift register with two stages, (i.e., constraint length $K = 3$), three modulo-2 adders, and an output multiplexer. The generator sequences of the encoder are as follows:

$$g^{(1)} = (1, 0, 1)$$

$$g^{(2)} = (1, 1, 0)$$

$$g^{(3)} = (1, 1, 1)$$

Draw the block diagram of the encoder.

Note: For Problems 10.16–10.23, the same message sequence 10111 . . . is used so that we may compare the outputs of different encoders for the same input.

10.16 Consider the rate $r = 1/2$, constraint length $K = 2$ convolutional encoder of Fig. P10.16. The code is systematic. Find the encoder output produced by the message sequence 10111 . . .

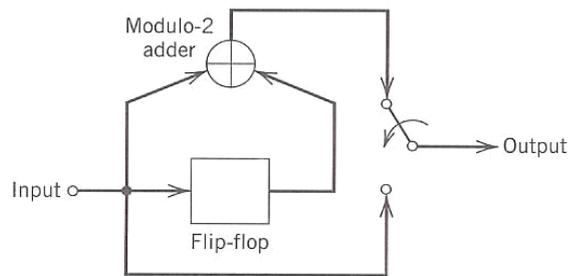


FIGURE P10.16

10.17 Figure P10.17 shows the encoder for a rate $r = 1/2$, constraint length $K = 4$ convolutional code. Determine the encoder output produced by the message sequence 10111 . . .

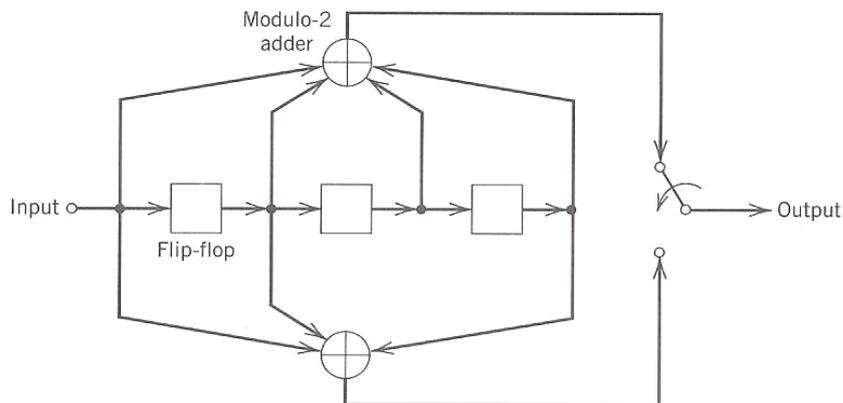


FIGURE P10.17

- 10.19 Construct the code tree for the convolutional encoder of Fig. P10.16. Trace the path through the tree that corresponds to the message sequence 10111 . . . , and compare the encoder output with that determined in Problem 10.16.
- 10.20 Construct the code tree for the encoder of Fig. P10.17. Trace the path through the tree that corresponds to the message sequence 10111. . . . Compare the resulting encoder output with that found in Problem 10.17.
- 10.21 Construct the trellis diagram for the encoder of Fig. P10.17, assuming a message sequence of length 5. Trace the path through the trellis corresponding to the message sequence 10111. . . . Compare the resulting encoder output with that found in Problem 10.17.

- 10.25 The trellis diagram of a rate-1/2, constraint length-3 convolutional code is shown in Figure P10.25. The all-zero sequence is transmitted, and the received sequence is 100010000. . . . Using the Viterbi algorithm, compute the decoded sequence.

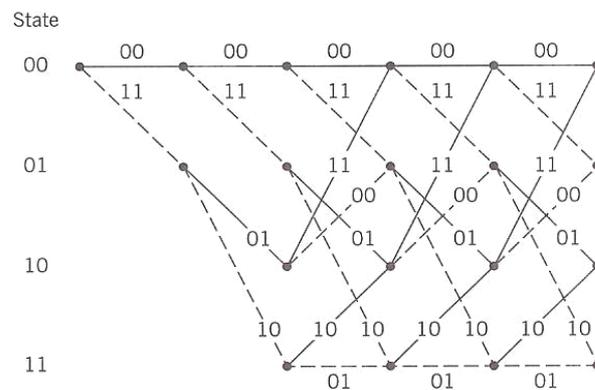


FIGURE P10.25

These problems are extracted from *Communication Systems* by Simon Haykin

Try problems from the textbook by Richard B. Wells.

Note: answers will not be posted. If you have any question you may visit in the office hours or by an appointment.

Doing a mistake in the HW is better than doing it in the exam! **Best regards, Dr. Ali Muqaibel**