Data Provided: None

The University Of Sheffield.

DEPARTMENT OF ELECTRONIC AND ELECTRICAL ENGINEERING

Spring Semester 2014-2015 (2 hours)

Principles of Communications

Answer **THREE** questions. **No marks will be awarded for solutions to a fourth question.** Solutions will be considered in the order that they are presented in the answer book. Trial answers will be ignored if they are clearly crossed out. **The numbers given after each section of a question indicate the relative weighting of that section.**

1. a. Explain briefly what is meant by encryption. **(3)**

b. Explain briefly the difference between source and channel encoding schemes. **(3)**

c. Find the Huffman codes for the following set of messages

Message	S_1	S_2	S_3	S_4
Probability	0.3	0.2	0.15	0.35

What is the percentage efficiency of this coding scheme? **(6)**

d. Derive an expression for the signal to noise ratio at the output of the envelope detector demodulator in AM DSB LC systems. **(8)**

2. a. List the disadvantages of run length encoding. **(2)**

b. Explain how linear block encoding can be used to detect and correct errors in digital communications. **(6)**

c. A non-symmetric binary channel is shown in Figure 1

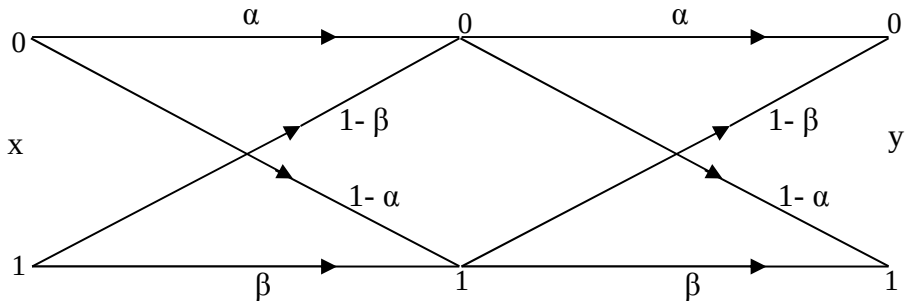

Figure 1

Find $P_{(y=0)}$ and $P_{(y=1)}$ when $P_{(x=0)} = 0.3$, $P_{(x=1)} = 0.7$, $\alpha = 0.6$ and $\beta = 0.7$ **(6)**

d. Explain with the aid of diagrams what is meant by Reed-Solomon codes and Forney interleaving. **(6)**

3. **a.** Explain, with the aid of a waveform diagrams, how an integrate and dump filter gives the same maximum output as a matched filter for a binary waveform. **(2)**

b. Using diagrams as necessary, explain the difference between signal regeneration in analogue and digital communication systems. **(6)**

c. Explain with the aid of diagrams how noise suppression and jamming rejection can be achieved in spread spectrum systems. **(6)**

d. Draw a block diagram of a transversal filter with 5 taps and calculate the tap weights to implement a matched filter for the following input waveform,

$$g(t)=\begin{cases}10\cos(500\pi t) & 0\le t\le 2\text{ms}\\ 0 & \text{elsewhere}\end{cases}$$

You should assume that the delay in the transversal filter is $\Delta\tau$=500μs and t_o = 2ms. **(6)**

4. **a.** List some of the advantages of spread spectrum systems. **(4)**

b. Explain with the aid of an example what is meant by a maximal length PN sequence and how it can be generated. **(5)**

c. The circuit shown in Figure 2 is used to produce a PN code.

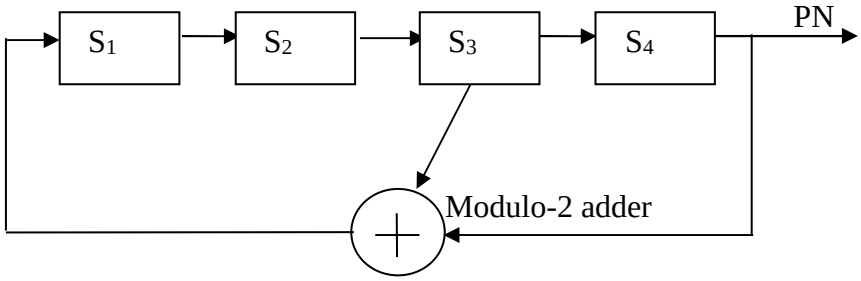

Figure 2

Assume the shift register is initialised with S_1=1, S_2=0, S_3=0, S_4=0. What is the output PN code sequence after 16 pulse cycles? Is this an example of a good PN code? **(5)**

d. Explain, with the aid of a diagram, how a trade-off solution can be achieved between various non-orthogonal M-Ary signalling schemes. **(6)**

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