ELEX 7860 : Wireless System Design
2021 Winter Term

Quiz 2
10:30 − 11:20 AM
Friday, February 19, 2021

This quiz has three (3) questions on four (4) pages. The marks for each question are as indicated. There are a total of nine (9) marks.

Download this quiz and write your answers in the space provided. You may print the quiz and write the answers by hand, mark up this document using a tablet, or edit the file with a word processor. Books and notes are allowed but you may not communicate with anyone else during the quiz. Please sign the following declaration to confirm your understanding of this:

> This work is solely my own effort and I understand the consequences of plagiarism and other offences described in BCIT Policy 5104.

Signed: _____

Answer all questions. *Show your work.* Draw a box around your final answer. Numerical answers must include units.

When you are done, export your document to a **PDF** file. Submit the PDF file to the Quiz 2 Assignment folder on the course web site before the submission deadline, 11:20 AM . If you submit multiple times only the most recent submission will be marked.
Only PDF files will be marked.
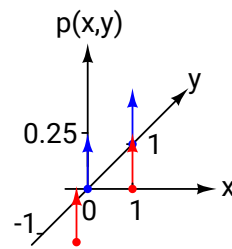
Name: _____

BCIT ID: _____

Question	Mark	Max.
1		4
2		2
3		3
Total		9

The input to a channel can have the value 0 or 1. The output can have the values -1, 0 or 1. The joint probability density is shown in the following table and diagram:

X	Y		
	-1	0	1
0	1/4	1/4	0
1	0	1/4	1/4

p(x,y)

For example the joint probability $p(x = 0, y = 1) = 0$ and $p(x = 1, y = 1) = 0.25$ and the marginal probability $p(x = 0) = 0.5$.

What is the mutual information between the input and output of this channel in bits per channel use?

The input to (another) channel can be 0 or 1 and the output can be 0 or 1. The probability of error (that a 0 is received as a 1 or vice-versa) is 0.1. What is the capacity of this channel in "information bits per bit transmitted over the channel"?

A message is transmitted together with a CRC computed using the simplified algorithm described in the lecture notes. The generator polynomial is $x^3 + 1$. The message received, including the CRC, is `10101111`. Does the CRC indicate the received message has an error? Show your work.