

ELEX 7860 : Wireless System Design
2024 Winter Term

Quiz 4

13:30 – 14:20

Thursday, Feb 29, 2024

SW01-2016

This exam has two (2) questions on one (1) pages. The marks for each question are as indicated. There are a total of seven (7) marks. Answer all questions. Write your answers and all rough work in this paper and nowhere else. Show your work. Underline or draw a box around your final answer. Numerical answers must include units. Books and notes are allowed. No electronic devices other than calculators are allowed. **Show your work.**

This exam paper is for:

Paper, Test 1 A00123456

Each exam is equally difficult.

Answer your own exam.

Do not start until you are told to do so.

Name: _____

BCIT ID: _____

Signature: _____

Question 1

4 marks

Using the convention shown in the lectures, a block code has the following generator matrix:

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

- (a) What is the parity check matrix (H)?
- (b) The codeword 101000 is received. What is the syndrome?
- (c) If the codeword above was received, which bit was in error and what codeword was transmitted? (*Hint: find the possible syndromes.*)

Question 2

3 marks

LTE uses OFDM with a (complex) sampling rate of $f_s = 30.72$ MHz. There are $N = 2048$ samples per OFDM block.

- (a) What is the subcarrier spacing?
- (b) If a cyclic prefix of 144 samples is used, what is the duration of each OFDM block, including the cyclic prefix? Give your answer in microseconds.
- (c) What is the bandwidth of the signal if 1201 contiguous subcarriers, including the one at DC (zero frequency), are used?