Sample Term 3 2023 Cover Sheet - Engineering

COMP4336/COMP9336 – Mobile Data Networking

Sample Final Exam – Term 3 2023

INSTRUCTIONS:

1. Time allowed – 2 hours, plus 15 minutes.
2. Total number of questions to be answered – 15 (answer all questions)
3. Total marks available – 40 marks, worth 40% of the total marks for the course.
4. Marks available for each question are shown in the exam.
5. Students are advised to read all of the examination questions before attempting to answer the questions.
6. This exam cannot be copied, forwarded, or shared in any way.
7. Students are reminded of the UNSW rules regarding Academic Integrity and Plagiarism.
8. Your work will be saved periodically throughout the exam and will be automatically submitted when the test ends provided you are connected to the internet.
9. You must upload all of your work within the exam time. There is no extra time to upload. No late submissions will be accepted.

1 MCQ9

For a CSI = $\sqrt{3} + j3$, the phase shift is
Select one alternative:

- 90 degree
- 60 degree
- 45 degree
- 10 degree
- 30 degree

Maximum marks: 2

2 MCQ7

With SF = 10, LoRa symbols for 500 kHz channels would be
Select one alternative:

- exactly 3 ms
- longer than 2 ms
- exactly 2 ms
- longer than 3 ms
- shorter than 2 ms

Maximum marks: 2

3 MCQ3

The original OFDM for 802.11a-1999 has a 3200 ns data pulse, but the effective symbol interval is extended by another 800 ns guard interval (GI) to cater for multi-path delay spread. If a low-spread environment reduces the GI by half, what will be the increase in symbol rate?

Select one alternative:

- About 5%
- About 50%
- About 12%
- None of these
- About 100%

Maximum marks: 3

4 MCQ6

For cattle monitoring, you have decided to attach LoRa devices around the neck of your farm animals. What type of LoRa device would be most appropriate for this purpose?

Select one alternative:

- Class A
- Class B
- Either Class A or Class C
- Class C
- Either Class B or Class C

Maximum marks: 1

5 MCQ4

A cellular operator wants to reuse its spectrum every 1.2km. If user densities in the area dictates cells of 200m radius, what would be the cluster size of the cellular design?

Select one alternative:

- 16
- None of these
- 13
- 19
- 9

Maximum marks: 3

6 MCQ8

Which of the following statements is true?

Select one alternative:

- FMCW radars estimate range by transmitting a mix of up and down chirps
- FMCW radars estimate range by transmitting modulated pulse
- FMCW radars estimate range by transmitting chirps
- Pulse radars transmit signals continuously
- Pulse radars are widely used in small-form factor IoT devices

Maximum marks: 1

7 MCQ1

The following table shows the 8-bit codewords to transmit 2-bit symbols. What would be an acceptable codeword for the missing codeword (last row in the table) if 2-bit errors are to be corrected?

Data	Codeword
00	00010000
01	10101100
10	11011111
11	?

Select one alternative:

- 01100010
- 00100111
- 01100111
- 01110011
- 01100011

Maximum marks: 3

8 MCQ2

Which Bluetooth LE channel will have less likelihood of interference with wireless LAN?

Select one alternative:

- 17
- 16
- 5
- 27
- 37

Maximum marks: 3

9 MCQ5

If you are deploying sensors on a train carriage to monitor real-time status of the train, which of the following wireless networking technologies would be the most appropriate candidate for connecting these sensors to the Internet?

Select one alternative:

- HaLoW
- BLE
- WiFi 5
- LTE-M
- LoRaWAN

Maximum marks: 1

10 Essay2

Table 1 traces the congestion window (CW) variable for 10 successive packet transmissions by a specific station in a wireless LAN. The initial value for CW was 15 (CW_{min} = 15). Answer the following questions (explain your answer):

1. Out of 10 packet transmissions, how many were *retransmissions*?
2. What was the value of CW_{max}?

Table 1 CW Trace

Packet Tx Time	CW	Packet Tx Time	CW
T1	15	T6	63
T2	15	T7	127
T3	31	T8	127
T4	15	T9	15
T5	31	T10	31

Fill in your answer here

Format

Words: 0

Maximum marks: 3

11 Essay1

The following paragraph attempts to describe the classic Bluetooth, but suffers from a number of *technical inaccuracies*. Identify and correct all *technical inaccuracies* in the description. [*Note: Try to highlight your corrections in some way, or list them one-by-one.*].

“Bluetooth (BT) provides relatively low data rates for supporting short-range (<10m), wireless personal area network (WPANs) applications in the 5 GHz ISM band using frequency-hopping spread spectrum techniques. The BT radio hops at a nominal rate of 1600 hops/ms in a pseudo-random manner through a set of 79 2-MHz-wide channels available in 5 GHz band. The basic architectural unit in a BT system is the scatternet, consisting of a master device and a maximum of eight active slave devices, which only communicate with the master. The master device determines the hopping sequence, the timing and the scheduling of all packets in the scatternet. Time is divided into slots of 625 ms. The master starts its transmissions in odd-numbered time slots only, and the slave in even-numbered slots only. For single-slot-packet transmission, the hop frequency changes every slot. Multi-slot-packets are restricted to 3 or 4 consecutive slots in which the hop frequency follows that of the first slot throughout the transmission.”

Fill in your answer here

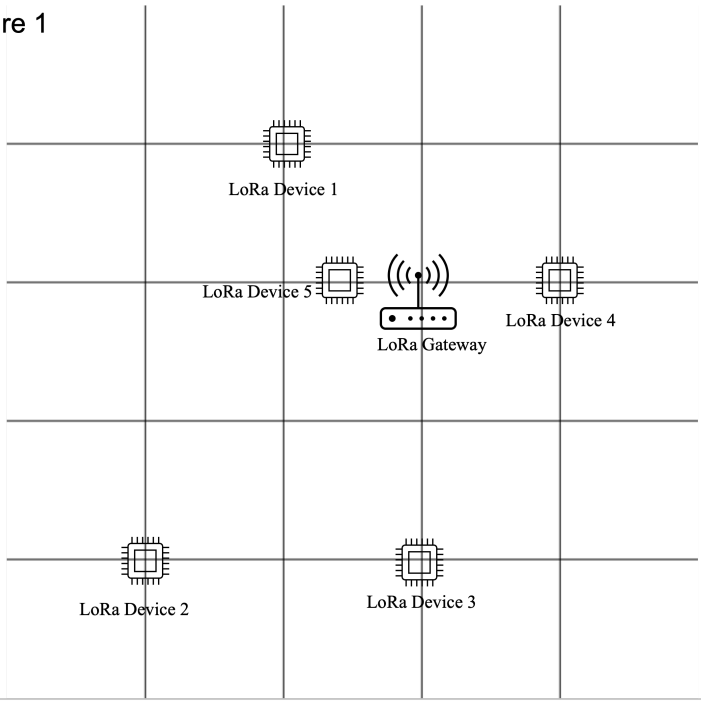
Format

Words: 0

Maximum marks: 4

12 Essay6

Figure 1



Using a square grid template, Figure 1 shows the locations of a LoRa gateway and 5 LoRa devices connected to the gateway on a flat ground surface. Discuss and justify potential SF (spreading factor) allocations for the five LoRa devices.

Fill in your answer here

Format

Words: 0

Maximum marks: 4

13 Essay3

To realise interference-free communications, a LoRa operator decides not to allocate the same SF to multiple devices, i.e., different devices use different SFs when communicating to the LoRa gateway over the same channel. However, this severely restricts the number of devices that can be connected to the gateway. To increase the maximum number of devices in the network, the operator enforces a duty cycle limit of 1%, i.e., no devices are allowed to be active more than 1% on average. What would the maximum number of devices that could be connected to this LoRa network?

Fill in your answer here

Format

Words: 0

Maximum marks: 3

14 Essay4

FMCW radars usually employ linear chirps, where the frequency increases linearly. Would non-linear chirps, e.g., where the frequency increases exponentially, also work? Justify your answer.

Fill in your answer here

Format

Words: 0

Maximum marks: 3

15 Essay5

A current wireless network version has a maximum data rate of 10Mbps, which is achieved using a 16-QAM modulation. To reach a maximum data rate of 25 Mbps, what level/order of QAM is required given that all other parameters remain the same? Show your work.

Fill in your answer here

Format

Words: 0

Maximum marks: 4

Document 1
Attached

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Do not panic. Your answers are saved in the browser cache you are using.

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BEWARE!

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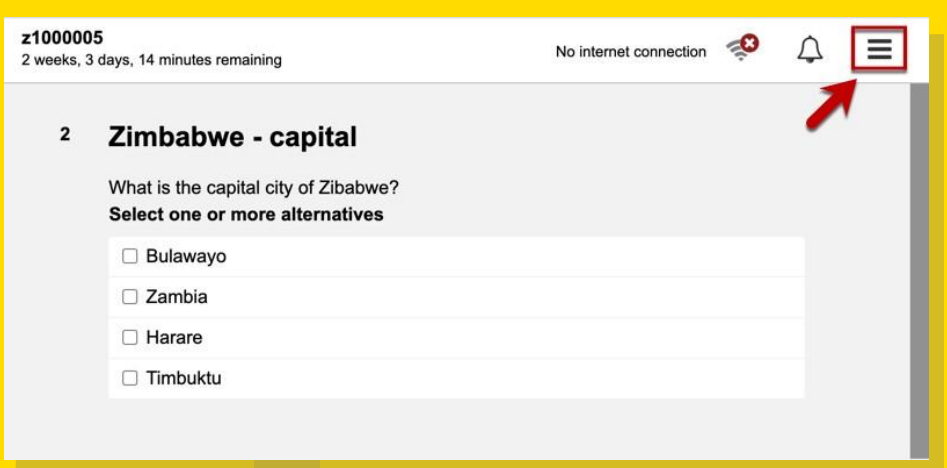
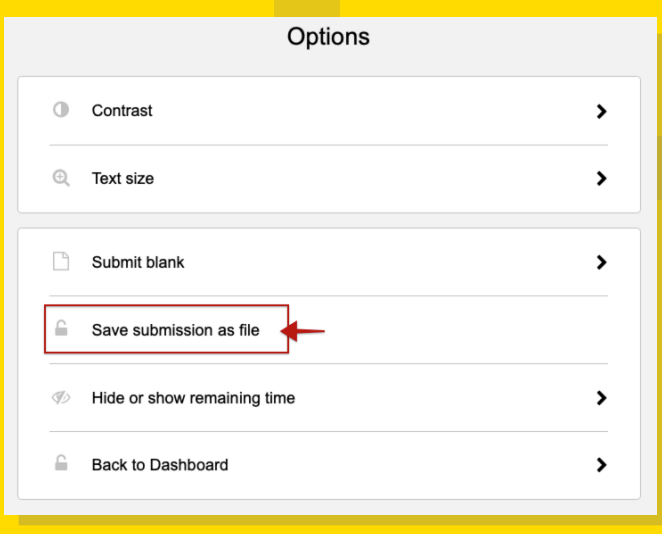
1. SAVE YOUR SUBMISSION AS A FILE

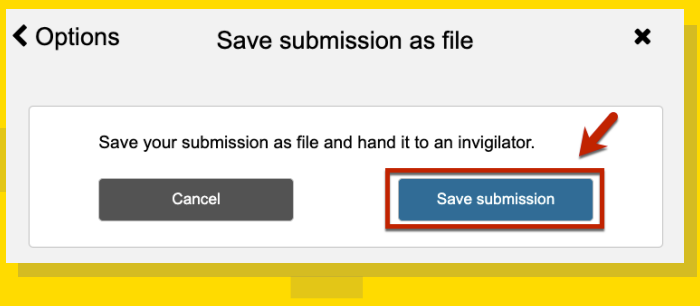
a You can do this by clicking the hamburger icon on the top right corner of your test page.



b Click "Save submission as file"



c Click "Save submission".



Clicking "Save submission" will pack your answers in a submission file. Check in your browser download folder to find the file.

Great! Your submission file will look like this with .ia extension.

Cand_z1000006-Test_61384634.ia

Your submission file is an encrypted file. You won't be able to read it and you must not tamper with the file nor change the file name. Inspera will look for your specific submission file when it is needed to be uploaded back to the Inspera system.

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