UNIVERSITY OF
**WATERLOO**

# Department of Electrical and Computer Engineering

## ECE-493-T20 ECE 659: IOT Signal Processing and Intelligent Sensor Networks

**Instructor: Dr. Otman A. Basir**

## Assignment 1
## Due Date: June 6, 2022 11:59PM

- **Instructions**

    - The assignment can be done individually/in-group . In all cases, collaboration is encouraged.
    - You should upload your answers as a PDF file on learn before 11:59pm of the deadline date. Make sure to write the names fo the group members and ID's.
    - Attach any codes used for the assignment separately as a compressed file to the same dropbox
    - Communicate any issues or concerns with the TAs.

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**Problem 1** (10 points). For each one of the following IoT protocols determine to what layer of the IoT stack it belongs to, and describe its characteristics wrt: standard, data rate, range, frequency band, topology, and power requirements.

- IEEE 802.15.4,

- IEEE 802.11 AH,

- WirelessHART,

- Bluetooth Low Energy BLE,

- LTE-A,

- WiFi

**Problem 2** (3 points). Can the MAC protocols of the IEEE802.11 standard be used in IoT network that run on very constrained devices. Justify your answer.

**Problem 3** (7 points). In a data link layer the flow control is performed using the Stop and Wait protocol, if you are to define the minimum frame size to ensure 50% channel utilization show how to define this number. For the data rate use 8Kbps and the propagation delay is 100 msec.

**Problem 4** (15 points ). For this question, use the OMNET++ simulation. Carry out a simulation for a an IoT network made of 25 hosts deployed in a simulation area of 500m * 500 m rectangular region for 900s simulation time using the AODV routing algorithm. Use the IEEE 802.11 as the MAC Layer in the simulation with the data rate 11Mbps. The traffic source is CBR source, the sending rate is 3 packets/sec and the packet size is 512 bytes. Perform number of simulations using the listed scenarios:

- Use at least two different mobility models (e.g. Random Walk, Random Waypoint)

- Use mobility node speed that changes from 1m/s to 20m/s

Measure and plot the following parameters (Packet delivery ratio, latency, throughput) vs. the node(s) speed for each mobility model.