**Worksheet 4**

**Preparation for Midterm**

**CPSC 3555 - Spring 2018**

Section 1: Introduction to IoT - Review worksheet one. You will need to be able to answer those questions on the exam.

Section 2: Resistors, Circuits, and Sensors - Review worksheet two. You will need to be able to identify simple circuits components (i.e. power, resistors, LEDs). You will need to say the resistance of a resistor based on the color bands for both 4 and 5 band resistors. I will provide the color chart during the midterm. You should also be able to clear communicate the difference between an analog and a digital sensor.

Section 3: IoT Applications - Review worksheet three.

Section 4: Networking Technologies. Read <http://www.intelligenttechchannels.com/overview-of-networking-technologies-used-to-build-iot-solutions/> and <https://www.ibm.com/developerworks/library/iot-lp101-connectivity-network-protocols/index.html>. Answer the following questions:

1. What is Bluetooth Low Energy? What is the communication range? What is the frequency? What is the data rates?

Bluetooth is a short-range communications technology importantly used in computing and consumer products. Bluetooth Low Energy has less power consumption; it has a Frequency of 2.4GHz, range of up to 150m and a data rate of 1Mbps.

1. What is ZigBee? What is the communication range? What is the frequency? What is the data rates?

Zigbee is an industry standard wireless networking technology. It is meant for applications requiring limited data transfers at low transfer rates within 100m range. ZigBee has a frequency of 2.5GHz, a range of up to 100m and a data rate of 250kbps.

1. What is 6LowPAN? What is the communication range? What is the frequency? What is the data rates?

A 6LowPAN is a networking protocol and can be used across Ethernet, Wi-Fi, 802.15.4 and sub-1GHz industrial, scientific and medical bands.

1. What is WiFi? What is the communication range? What is the frequency? What is the data rates?

WiFi provides fast data transfer and can handle high quantities of data. It has a frequency of 2.4GHz and 5GHz bands, a range of approximately 50m and data rates of 150-200Mbps.

1. What is cellular? What is the communication range? What is the frequency? What is the data rates?

Cellular is suitable for high volumes of data, but the cost and power consumption for managing high volumes of data transfer are likely to be too high for most IoT applications. Cellular is suitable for sensor driven, low data projects, transferred over the internet. Cellular uses 900, 1800, 1900, 2100MHz frequencies, has a range of 35km max for GSM, 200km max for HSPA, and has data rates less than 170kps GPRS, 384kbps EDGE, les than 2Mbps UMTS, less than 10Mbps HSP, and 3-10Mbps LTE.

1. What is MQTT?

Message Queue Telemetry Transport is a publish/subscribe-based messaging protocol that was designed for use in low bandwidth situations, particularly for sensors and mobile devices on unreliable networks.

1. What is AMQP?

Advanced Message Queuing Protocol is an open standard messaging protocol that is used for message-oriented middleware.

1. What is XMP?

Extensible Messaging and Presence Protocol was originally designed for real-time human-to-human communication including instant messaging. This protocol has been adapted for machine-to-machine communication to implement lightweight middleware and for routing XML data. XMPP is primarily used with smart appliances.

Section 5: IoT Networking Architectures. Read <https://www.authorea.com/users/54983/articles/65461-internet-of-things-iot-communication-architecture-standards-and-protocol-stacks/_show_article> and answer the following questions.

1. What is a point to point network?

A point-to-point connection refers to a communications connection between two nodes or endpoints.

1. What is a mesh network?

A mesh network is a local network topology is which the infrastructure nodes connect directly, dynamically and non-hierarchically to as many other nodes as possible and cooperate with one another to efficiently route data form/to clients.

1. What is a star network?

A star network is a local area network (LAN) in which all nodes are directly connected toa common central computer. Every workstation is indirectly connected to every other through the central computer.

Section 6: IoT System Components: Edge devices, Gateways, and the Cloud - Using the Internet and textbook, search for answer to the following questions. You must cite at least 2 reputable sources for each answer. Consider using Google Scholar or information from larger companies (i.e. IBM, Intel, Dell, NVIDIA, etc.). I also added a article entitled A Survey of Internet of Things Architectures to CougarView that can help.

1. What is an IoT Gateway?

One of the most critical components to an IoT device is the device known as the *Gateway.* An IoT gateway aggregates sensor data, translates between sensor protocols processes sensor data before sending it onward and more.

Sources:

<http://internetofthingsagenda.techtarget.com/feature/Using-an-IoT-gateway-to-connect-the-Things-to-the-cloud>

<https://www.techopedia.com/definition/2184/default-gateway>

1. What is an IoT Edge device?

An IoT Edge device is any piece of hardware that controls data flow at the boundary between two networks. Edge devices are used for a variety of task, but they essentially wok as data entry and exit between networks. These devices can include sensors and routers which both take in or transmit data.

Sources:

<https://www.techopedia.com/definition/6978/edge-device>   
<https://www.oreilly.com/ideas/the-edge-of-the-iot>

1. What is Fog computing?

Fog computing is a decentralized computing infrastructure in which data, compute, storage and applications are distributed in the most logical, efficient place between the data source and the cloud.

Sources:

<http://internetofthingsagenda.techtarget.com/definition/fog-computing-fogging>

<https://www.openfogconsortium.org/resources/>

1. What is Edge computing?

In an edge computing model, sensors and connected devices transmit data to a nearby edge computing device, such as a gateway device that processes or analyzes the data, instead of sending it back to the cloud or a remote data center.

Sources:

<http://www.businessinsider.com/edge-computing-in-the-iot-forecasts-key-benefits-and-top-industries-adopting-an-analytics-model-that-improves-processing-and-cuts-costs-2016-7>

<http://searchdatacenter.techtarget.com/definition/edge-computing>

1. What is the Cloud?

The Cloud is a network of servers in which each server has a different function. Data stored in the cloud can be accessed remotely over the Internet, making it accessible from any device that has access to the Internet.

Sources:

<http://mashable.com/2013/08/26/what-is-the-cloud/#EUrN3ke6Rgqu>

<https://www.gcflearnfree.org/computerbasics/understanding-the-cloud/1/>