Dordt University
Engineering 304, Microprocessor Interfacing
Problem Set #9, Spring 2020

Answers for the questions below can be found in the *Universal Serial Bus Specification* Revision 2.0 (also known as the "USB Standard"). The standard is available in hard-copy via the reserve collection at the Dordt Library. It is also available for free downloading from the Web. (A link is given on the Canvas homework page for this course.)

For each question below, provide an answer that is as complete as possible subject to the constraint that it is **less than 100 words.**

What is an **Isochronous Transfer**? (Section 5.6)

- Isochronous Transfer is a constant-irate, error-tolerant transfer of data. They are often used for real-time information like audio or video. Isochronous data streams are given a special portion of the bandwidth to ensure it gets delivered at a certain rate. It has no error detection, so the data sends regardless if it's successful or not.

What is a **Bulk Transfer**? (Section 5.8)

- Bulk Transfer is a high speed communication with relatively large amounts of data. It will repeat transmission until it gets a 100% transfer success. It may take a while for it to send, but it will send eventually when the bus is free. It requires a large amount of free bandwidth to push the data through quickly.

How many **microframes** are there in a **frame**? (Section 8.4.3.1)

- Within a 1ms frame, there are 8 microframes. Each microframe is 125 μs.

What is **Bus Enumeration**? (Section 9.1.2)

- Bus enumeration is a process to identify and manage the device state changes necessary. When a USB device is first plugged in, it gives power and determines the nature of the change by querying the hub. Then it resets, assigns unique address, and transfers different settings of the device. Finally, it is determined how the USB device will be used with class drivers, and is ready for use.

What is **Dynamic Attachment and Removal**? (Section 9.2.1)

- Dynamic Attachment and Removal (aka Hot-Plugging) is a special feature of USB that allows the user to unplug and plug in USB devices without causing the Operating System to crash. This is significantly convenient in the modern age. It allows the ports to be used easily without too much extra care and knowledge.