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

20/20

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)

4/4 Isochronous transfer provides periodic, continuous communication between host and type. It is delivered at the rate it is received "latin, iso: same, + chronous: time." Voice is an example of isochronous transfers, because it needs to be transmitted continuously to the receiver of the voice at the same rate as the speaker speaks it, else distortion occurs. One side effect of isochronous transfers is that retries are impossible and data is rather dropped than slowed down. In USB, a portion of the bandwidth is allocated to ensure the desired rate of data transfer.

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

4/4 Bulk transfer is a sequential transfer type used for large amount of data, with hardware level error detection and some retry ability to ensure accurate data transfer. Bandwidth can vary with other bus activity, since the delivery rate and consistency is not critical to success. Non-periodic, large-packet communication that tends to be done in bursts and can be delayed.

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

4/4 A frame in USB is a 1 ms time base, with a microframe on a high speed bus taking 125 microseconds. This means 8 microframes can be sent per frame.

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

4/4 Bus enumeration is the process of detecting and identifying USB devices connected. Devices attached to a bus are assigned an address to uniquely identify it, and since what is plugged in varies from moment to moment, this is a continuous process. This process also includes detecting and processing the removal of devices.

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

4/4 In USB, plugging in or unplugging a hub or function must not affect the functionality of another segment of the network. The transaction between that function and the host can be affected, but the hub will recover and the host will be alerted to the disconnect