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)
> **-It is one of the four USB types. They provide periodic streams of continuous communication between a host and a device. This type of bus is used when delivery timing is important since it has the ability to be received at the same rate that it is being delivered. This comes in handy with things like voice deliveries and software that cannot withstand transient losses. This loss in the data stream could become detrimental to this software and thus isochronous transfers are necessary to ensure proper delivery and receipt.**

What is a **Bulk Transfer**? (Section 5.8)
> **-Per the name, bulk transfers deal with large amounts of data in a sequential manor. It utilizes hardware for error detection with limited retries. Some devices that use this are printers and scanners. This transfer is non-periodic but flows in bursts. Is not time sensitive and can use any available bandwidth. Because of this time insensitivity, bulk transfers can build up as they wait for bus time. This build up is cause for more programming and requires the need for a fair access policy that can manage when these transfers are allowed onto a bus. Because of this, USB's with larger available bandwidths are favorable for these transfers to ensure succinct data exchanges.**

How many **microframes** are there in a **frame**? (Section 8.4.3.1)
> **-A frame time is defined as 1 ms with a microframe lasting 125 us. This results in a classic eight to one ratio between frames and microframes. Eight microframes fit into one frame.**

What is **Bus Enumeration**? (Section 9.1.2)
> **-This is the action taken when a USB device is connected or detached. This is done by the host as a device cannot interfere with a host's operations. This precaution was to ensure that connecting a USB would not crash a system that is operating correctly; the host will commence enumeration when it is available.**

What is **Dynamic Attachment and Removal**? (Section 9.2.1)
> **-Dynamic attachment and removal are attributed to the nature of the port host. Ports are responsible for pinging the host and alerting it to the nature of the port; this includes changes in state of the port. These states involve being inactive, whether enumeration is needed, or if it is active. This check in allows the hub to disable and reenable the ports without system crashes. Detaches can be dangerous if the hub is not notified because the power flowing through the port isn't shut off. When detached this way, cables can build up a large inductance and create a large flyback voltage on the open end of the device.**